

## Attachment 26

# WACC Attachment SFG Consulting: The required return on equity for regulated gas and electricity network businesses

May 2014



# The required return on equity for regulated gas and electricity network businesses

*Report for Jemena Gas Networks, ActewAGL Distribution, Ergon, and Transend*

27 May 2014

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## 1. Background and conclusions

### Overview and instructions

1. SFG Consulting (**SFG**) has been retained by Jemena Gas Networks, ActewAGL Distribution, Ergon, and Transend to provide our views on the estimation of the overall return on equity under the National Electricity Rules and National Gas Rules (**Rules**). In particular, we have been asked to provide an opinion that:
  - a) describes each of the methods and models that are identified by the Australian Energy Regulator (**AER**) as being relevant to estimating the return on equity, including how they were developed, the theoretical and empirical basis for their development, and how they relate to each other if at all;
  - b) provides our opinion on whether each model is relevant to estimating the return on equity, insofar as we consider that the models provide information that is useful in undertaking the task of estimating the cost of equity;
  - c) compares the merits of the methods and models, in terms of their ability to estimate the return on equity that is:
    - i) commensurate with the efficient financing costs and degree of risk of a benchmark efficient entity with a similar degree of risk as that which applies to a regulated gas or electricity network in respect of the provision of reference services;<sup>1</sup> and
    - ii) reflective of prevailing conditions in the market for equity funds; and
  - d) recommends a method or model, or combination of methods and models, to be used in estimating the return on equity, having regard to the relative merits of the available methods and models, and the requirements of the National Gas Law and Rules and National Electricity Law and Rules for the return on equity to be:
    - i) commensurate with the efficient financing costs and degree of risk of a benchmark efficient entity with a similar degree of risk as that which applies to a regulated gas or electricity network in respect of the provision of reference services; and
    - ii) reflective of prevailing conditions in the market for equity funds.
  - e) estimates the return on equity using this method, model or combination of methods and models that is:
    - i) commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to a regulated gas or electricity network in respect of the provision of reference services; and
    - ii) reflective of prevailing conditions in the market for equity funds.
2. In preparing the report, we have been asked to:

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<sup>1</sup> In this report, we consider gas and electricity transmission and distribution businesses in general. We do not consider whether a specific business, or group of businesses, might differ in a material way from the average firm in the broader set.

- a) consider different approaches to applying each of the financial models, including any theoretical restrictions on empirical estimates;
  - b) consider the theoretical and empirical support for each of the financial models;
  - c) consider any comments raised by the AER and other regulators including on (but not limited to) (a) whether each of the financial models applies in Australia and (b) the statistical reliability of the parameter estimates produced by those models; and to
  - d) use the sample averaging period of the 20 business days to 12 February 2014 (inclusive) to estimate any prevailing parameter estimates needed to estimate the return on equity.
3. Our instructions are set out in Appendix 1 to this report.
  4. This report has been authored by Professor Stephen Gray and Dr Jason Hall. Stephen Gray is Professor of Finance at the UQ Business School, University of Queensland and Director of SFG Consulting, a specialist 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, has published widely in high-level academic journals, and has more than 15 years' experience advising regulators, government agencies and regulated businesses on cost of capital issues. 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 their curriculum vitas are attached as Appendix 2 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*.

### **Summary of conclusions**

7. Our primary conclusions in relation to the estimation of the allowed return on equity are set out below.

#### **Relevant financial models**

8. We consider four financial models that are relevant for the purpose of estimating the required return on equity for the benchmark efficient entity:
  - a) The Sharpe-Lintner capital asset pricing model (**CAPM**);
  - b) The Black CAPM;
  - c) The Fama-French three factor model; and
  - d) The dividend discount model.

9. In our view, these four models all provide evidence that is relevant to the estimation of the required return on equity for the benchmark efficient entity. We reach this conclusion for the following reasons:
- a) **All four models have a sound theoretical basis.** The Sharpe-Lintner CAPM, Black CAPM and Fama-French model are all based on the notion that the expected return on any asset is equal to a linear combination of the returns on an efficient portfolio and its zero covariance portfolio. This basic theoretical framework is the same for all three models, which differ only according to the way the efficient portfolio and the zero-covariance portfolio are determined. For example, under the Fama-French model the efficient portfolio is formed by combining three factor portfolios, whereas under the Sharpe-Lintner CAPM and Black CAPM the market portfolio (proxied by a stock market index) is assumed to be efficient. The Sharpe-Lintner CAPM further assumes that investors can borrow and lend as much as they like at the risk-free rate. The dividend discount model is based on the notion that the current stock price is equal to the present value of expected future cash flows (dividends).
  - b) **All four models have the purpose of estimating the required return on equity as part of the estimation of the cost of capital.** This point is not weakened by the fact that the models can be used to inform other decisions as well. For example, the Sharpe-Lintner CAPM and the Fama-French model can also be used to compute “alpha” for the purpose of mutual fund performance evaluation.
  - c) **All four models can be implemented in practice.** For all four models, there is a long history and rich literature concerning the estimation of model parameters. This literature has developed empirical techniques, constructed relevant data sets, and considered issues such as the trade-off between comparability and statistical reliability.
  - d) **All four models are commonly used in practice.** Some form of CAPM is commonly used in corporate practice and by independent expert valuation practitioners. The Black CAPM is commonly used in rate of return regulation cases in other jurisdictions (where it is known as the “empirical CAPM”). The dividend discount model is also commonly used in rate of return regulation cases in other jurisdictions (where it is known as the “discounted cash flow” approach). The Fama-French model has become the standard method for estimating the required return on equity in peer-reviewed academic papers and its use to estimate the required return on equity is required knowledge in professional accreditation programs.

#### Market risk premium

10. The market risk premium (**MRP**), or, more properly, its two components – the required return on the market portfolio and the risk free rate – is one of the key parameters for a number of asset pricing models. Our main conclusions in relation to this important parameter are set out below.
11. In relation to historical excess returns evaluated using the Ibbotson approach:
- a) The arithmetic mean should be used and the geometric mean should not;
  - b) The data should be updated to include 2013 and the more accurate dividend yield adjustment provided by NERA (2013)<sup>2</sup>;

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<sup>2</sup> NERA, 2013, *The market, size and value premiums*, June.

- c) Historical mean excess returns produce an estimate of the MRP in *average* market conditions and could inform an estimate of the MRP in *prevailing* market conditions after consideration of the extent to which the prevailing conditions might differ from the average conditions;
- d) Government bond yields tend to fall during financial crises and have been at historical lows (relative to the last 50 years) since the onset of the GFC. Consequently, setting the MRP equal to a constant historical mean would imply that the onset of the GFC caused the cost of equity across the economy to also fall to record lows, which is clearly implausible. In our view, an estimate of the required return on equity that falls to historical lows during a severe financial crisis is neither commensurate with the prevailing conditions in the market nor reflective of the efficient financing costs of a benchmark efficient entity; and
- e) We adopt historical MRP estimates based on the entire available data set (noting that the estimates are not materially different if post-1958 data is used). The relevant estimates are as follows:

	<b>Theta=0.35</b>	<b>Theta=0.7</b>
Required return on the market <sup>a</sup>	10.75%	10.87%
Market risk premium	6.63%	6.76%

a: Based on a risk-free rate of 4.12%  
 Figures rounded to two decimal places.

12. In relation to historical market returns evaluated using the Wright approach:

- a) There are two approaches for estimating MRP from the historical data. The Ibbotson approach assumes that the MRP is constant across all market conditions and estimates the MRP as the mean historical excess return. At the other end of the spectrum, the Wright approach assumes that the required return on the market is constant and estimates the MRP by subtracting the contemporaneous risk-free rate.
- b) In our view, the Ibbotson and Wright approaches should both be used to inform the estimate of MRP for use in a Sharpe-Lintner CAPM foundation model.
- c) Moreover, Lally (2012 MRP, 2013 MRP) also recommends that the Ibbotson and Wright approaches should both be used to estimate MRP, and the Wright approach is also used extensively by UK regulators to estimate the required return on the market and the MRP.
- d) The Wright approach currently produces the following estimates:

	<b>Theta=0.35</b>	<b>Theta=0.7</b>
Required return on the market	11.71%	11.83%
Market risk premium	7.59%	7.71%

13. In relation to dividend discount models:

- a) It is our view that the SFG (2014 DDM) estimates are the most robust, reliable and up-to-date estimates that are currently available – they are commensurate with the prevailing conditions in the market for equity funds and best reflect the efficient financing costs of the benchmark efficient entity.

- b) Using up to date data, SFG (2014 DDM) report the following estimates:<sup>3</sup>

	<b>Theta=0.35</b>	<b>Theta=0.7</b>
Required return on the market	11.42%	12.53%
Market risk premium	7.31%	8.41%

14. In relation to the responses of survey participants:

- a) In our view, none of the surveys that have been proposed for use in the regulatory setting fare well against the criteria that have been set out by the Australian Competition Tribunal (**the Tribunal**), in which case we agree with the Tribunal's conclusion that "it is dangerous for the AER to place any determinative weight on the results;"<sup>4</sup> and
- b) If the AER is to have regard to the survey responses, it should not interpret (standard) ex-imputation estimates of MRP provided by survey respondents as (regulatory) with-imputation estimates of MRP. Rather, they should convert standard ex-imputation estimates into regulatory with-imputation estimates according to Officer (1994) and as implemented by the AER's post-tax revenue model (**PTRM**) and by IPART (2013).

15. In relation to independent expert valuation reports:

- a) We agree with the use of independent expert reports to inform the estimate of MRP. In our view, these reports provide relevant evidence which, if relegated to the final cross-check stage of the estimation process, is unlikely to ever receive any real weight.
- b) Our assessment of the relevant evidence is that independent expert valuation reports support higher estimates of the required return on equity than those that would be produced by a mechanistic application of the Sharpe-Lintner CAPM. In particular, SFG (2013 IE) and Incenta (2014) show that the return on equity estimates used in independent expert reports are materially higher than comparable regulatory estimates.
- c) Independent expert reports provide ex-imputation MRP estimates that would have to be routinely converted into the corresponding with-imputation estimate of MRP for use in the regulatory process. An ex-imputation estimate of MRP of 6% (which we consider to be conservative for the reasons set out above) implies the following with-imputation estimates of MRP and the required return on the market (where the risk-free rate is set to 4.12%):

	<b>Theta=0.35</b>	<b>Theta=0.7</b>
Required return on the market	11.20%	12.29%
Market risk premium	7.08%	8.17%

16. The MRP estimates from the various approaches are summarised in Table 1 below. The estimates that form the basis of our final estimate of MRP appear in bold face. Historical excess return estimates are based on the longest data set available. We note that the historical excess returns (Ibbotson approach) and historical market returns (Wright approach) are less sensitive to the estimate of theta because they are largely based on pre-imputation historical data.

<sup>3</sup> We recognise that the AER is still considering how the implied MRP estimates from this approach should be adjusted to incorporate the assumed value of imputation credits. See for example AER Appendix E, p. 125. Resolution of that issue is beyond the scope of this report. The current DDM estimate of 7.3% is an estimate that has been computed on the same basis as the 7.9% estimate included in the AER's Table D.1.

<sup>4</sup> Application by Envestra Ltd (No 2), ACompT 3, Paragraphs 162-163.



**Table 1**  
**Estimates of market risk premium**

Method	Theta=0	Theta=0.35	Theta=0.7
	Gamma=0	Gamma=0.25	Gamma=0.5
Historical excess returns	6.51%	<b>6.63%</b>	6.76%
Wright approach	7.46%	<b>7.59%</b>	7.71%
Dividend discount model	6.20%	<b>7.31%</b>	8.41%
Survey responses	6.00%	7.08%	8.17%
Independent expert valuation reports	6.00%	<b>7.08%</b>	8.17%

Estimates of regulatory MRP estimates with different assumptions about the value of distributed imputation credits.

17. For the reasons set out in our companion report, SFG (2014 Gamma),<sup>5</sup> we adopt an estimate of theta of 0.35, and an estimate of gamma of 0.25. These are the estimates that were adopted by the Tribunal.<sup>6</sup> Our recommended estimate of MRP is based on these estimates of theta and gamma. If theta and gamma are to be revised in accordance with the AER's Guideline, the estimate of MRP would be correspondingly higher.
18. In compiling a final estimate of MRP, we have regard to the following evidence:
- a) First, we note that historical returns can be processed in two ways – by assuming that MRP is constant in all market conditions (Ibbotson approach) or by assuming that real required returns are constant in all market conditions (Wright approach). We apply equal weight to each of these approaches, producing an estimate of MRP from historical returns of 7.11%<sup>7</sup>;
  - b) The estimate of MRP from dividend discount models of 7.31%; and
  - c) The estimate of MRP from independent expert reports of 7.08%.
19. The estimates of the required return on the market from what we consider to be the relevant evidence (given a risk-free rate of 4.12% and theta of 0.35) are set out in Table 2 below. Note that we place no weight on survey response data as we do not consider that approach to produce reliable estimates of the MRP.

**Table 2**  
**Estimates of the required return on the market**

Method	Theta=0.35
Historical excess returns	10.75%
Wright approach	11.71%
Dividend discount model	11.42%
Independent expert valuation reports	11.20%

20. In our view, the approaches set out in Table 2 have different relative strengths and weaknesses:
- a) The Wright and Ibbotson approaches each represent end points of a spectrum when using historical data to estimate the required return on the market. The Wright approach assumes that the real required return on equity is constant across different market conditions and the Ibbotson approach assumes that the MRP is constant so that the required return on equity

<sup>5</sup> SFG, 2014, *An appropriate regulatory estimate of gamma*, May.

<sup>6</sup> By contrast the AER's Guideline and its recent transitional decisions adopt a gamma of 0.50.

<sup>7</sup> 7.11% is the mean of 6.63% and 7.59%.

rises and falls directly with changes in the risk-free rate. We agree with the conclusion in the Guideline materials that there is no compelling statistical evidence to support one or the other of these assumptions pervasively across all market conditions and that regard should be had to both.<sup>8</sup> We also note that both approaches are used in practice, including regulatory practice. We also note that it is common in practice to have some regard to long-run historical data when estimating the required return on the market.

- b) We agree with the Guideline's assessment that dividend discount model evidence is relevant and should be considered when estimating the required return on the market. The dividend discount model is theoretically sound in that simply it equates the present value of future dividends to the current stock price and it is commonly used for the purpose of estimating the required return on the market. Among the four approaches to estimating the MRP that are considered in this report, this approach is the only approach that provides a forward-looking estimate of the MRP.
- c) Independent expert valuation reports provide an indication of the required return on equity that is being used in the market for equity funds. We agree with the Guideline's conclusion that this information is relevant and should be considered. However, we note that certain assumptions must be made when seeking to extract an appropriate MRP estimate from an independent expert report (in particular, the extent to which various uplift factors should be incorporated into the MRP estimate).<sup>9</sup> It is for this reason that we adopt a conservative ex-impudation MRP estimate of 6% in this report.

21. Taking account of the relevant strengths and weaknesses of the different estimation approaches, we propose the weighting scheme set out in Table 3 below. Our reasons for proposing this weighting scheme are as follows:

- a) We apply 50% weight to the forward-looking DDM estimate and 50% weight to the three approaches that are based on historical averages;
- b) We apply equal weight to the Ibbotson and Wright approaches for processing the historical market return data, those two approaches representing the two ends of the spectrum in relation to the processing of that data; and
- c) We apply some weight to our estimate from independent expert valuation reports, noting that this is a conservative estimate in that it is not influenced by any uplift factors or adjustments to the historically low risk-free rate.

22. We note that the final estimates are relatively insensitive to the proposed weighting scheme. For example, the final MRP estimate changes by less than 10 basis points if:

- a) If a weight of 25% was applied to each of the four estimates;
- b) Equal weight is applied to the Ibbotson and Wright approaches only; or

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<sup>8</sup> We note that this conclusion is made with reference to any specific information about why government bond yields are above or below historical average values at a particular point in time. If government bond yields are low because there is a high degree of risk aversion present amongst equity investors, as indicated by other indicators of market risk (for example, corporate bond yields amongst others) this is evidence that the MRP would be above the historical average. If equal consideration is given to the Wright and Ibbotson approaches, contemporaneous information of this type about market risk should be accounted for elsewhere in estimating the MRP.

<sup>9</sup> In particular, it is relatively common for independent experts to refer to a 6% estimate of MRP (apparently based on the long-run average of historical excess returns) but then to increase the estimate of the required return on equity by adding a margin to a CAPM estimate or by adopting a risk-free rate in excess of the contemporaneous government bond yield.

- c) Equal weight is applied to the Ibbotson, Wright and dividend discount approaches only.
23. We consider that the final estimates for MRP (7.21%) and the market return (11.33%) set out in the table below are commensurate with the prevailing conditions in the market for equity funds.

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

Method	MRP	Required return on the market	Weighting
Historical excess returns (Ibbotson)	6.63%	10.75%	20%
Historical market returns (Wright)	7.59%	11.71%	20%
Dividend discount model	7.31%	11.42%	50%
Independent expert valuation reports	7.08%	11.20%	10%
<b>Weighted average</b>	<b>7.21%</b>	<b>11.33%</b>	<b>100%</b>

The required return on equity for a benchmark efficient entity

24. Our estimates of the (with-imputation) required return of the benchmark firm<sup>10</sup> are as follows:
- a) The Sharpe-Lintner CAPM estimate is 10.01%;
  - b) The Black CAPM estimate is 10.62%;
  - c) The Fama-French model estimate is 10.87%; and
  - d) The dividend discount model estimate is 10.92%.
25. All of these approaches have different strengths and weaknesses. For example:
- a) The Sharpe-Lintner CAPM has the disadvantage of producing estimates of expected returns that have little or no relationship with actual returns – that is, it provides a poor fit to the observed data. However, the Sharpe-Lintner CAPM is commonly used in practice, albeit often in a modified form and we agree that systematic risk is a useful way to think about risks incorporated into market prices. Also, the Australian regulatory practice has been to use the Sharpe-Lintner CAPM exclusively, in which case it would be appropriate to at least continue to have regard to that approach. Consequently, our view is that the Sharpe-Lintner CAPM estimate of the required return is relevant evidence and some regard should be given to it. The limitations of the Sharpe-Lintner CAPM are that it does not account for all priced risks and its parameter estimates from standard empirical analysis have limited reliability.
  - b) The Black CAPM provides a better fit to the empirical data than the Sharpe-Lintner CAPM and it is commonly used in rate of return regulation cases in other jurisdictions (where it is known as the “empirical CAPM”). The Black CAPM is also more theoretically sound than the Sharpe-Lintner CAPM because it does not rely upon the assumption that investors can borrow at the risk-free rate, but rather that investors can sell short. The Black CAPM does not, however, overcome a major disadvantage of the Sharpe-Lintner CAPM, which is that there is no statistically significant relationship between beta estimates and stock returns. In

<sup>10</sup> Our estimates here relate to a generic energy network. Issues about whether a particular firm might differ from this generic benchmark are beyond the scope of this report.

our view, the fact that the Black CAPM requires the estimation of an additional parameter does not affect the fact that it provides relevant evidence and some regard should be given to it.

- c) The Fama-French model has the advantage of providing an unambiguously better fit to the data than the Sharpe-Lintner CAPM. However, whereas it is commonly used as an estimate of required returns in academic studies, it is less commonly used in valuation and regulatory practice. Our view is that the Fama-French estimate of the required return is relevant evidence and some regard should be given to it.
- d) The dividend discount model approach has the advantage of not requiring any assumptions about what factors drive required returns – it simply equates the present value of future dividends to the current stock price. It is also commonly used in industry and regulatory practice. Whereas the Guideline materials identify some concerns with the dividend discount approach, the specification adopted in this report addresses most of those concerns. Consequently, our view is that the dividend discount estimate of the required return is relevant evidence and some regard should be given to it.

26. A summary of the relevant estimates of the required return on equity, and our proposed weighting scheme, is set out in Table 4 below. The rationale for the proposed weights is as follows:

- a) 25% weight is applied to the dividend discount model and a total of 75% weight is applied to the three asset-pricing models. Because all four models have different strengths and weaknesses as set out above, our default starting point would be to assign 25% weight to each model. We then adjust weights among the asset pricing models for the reasons set out below;
- b) Of the 75% weight that is applied to asset-pricing models, we apply half to the Fama-French model (37.5%) and half to the CAPM (37.5%). This assigns equal weight to the possibility that we have a reliable estimate of required returns for exposure to the *HML* factor, and whether our estimate of required returns for exposure to the *HML* factor is overstated;<sup>11</sup>
- c) A total of 37.5% weight is applied to the CAPM. The two forms of the CAPM differ only in terms of the intercept that is used (since the same values of beta and the required return on the market are used for both models). The Black CAPM uses an empirical estimate of the intercept – selected to provide the best possible fit to the observed data. The Sharpe-Lintner CAPM uses a theoretical lower bound for the intercept (i.e., the intercept cannot possibly be lower than the risk-free rate). Thus, we do not have two estimates to choose between – we have an empirical estimate and a theoretical lower bound. It is for this reason that we apply twice as much weight to the Black CAPM. This approach is equivalent to setting the CAPM intercept two-thirds of the way between the theoretical lower bound and the empirical estimate.

27. We note that the final estimate of the required return on equity for a benchmark efficient entity is relatively insensitive to the choice of weights. For example, the final estimate varies by less than 25 basis points if:

- a) The Sharpe-Lintner and Black CAPM are assigned equal weight and no other changes are made;

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<sup>11</sup> In the Fama-French model, the *HML* factor is measured as the difference in returns to a portfolio of stocks with high book-to-market ratio for equity, compared to a portfolio of stocks with low book-to-market ratio for equity.

- b) All four models are assigned equal weight;
- c) The dividend discount model is omitted and the other models are assigned equal weight; or
- d) The Fama-French model is omitted and the other models are assigned equal weight.<sup>12</sup>

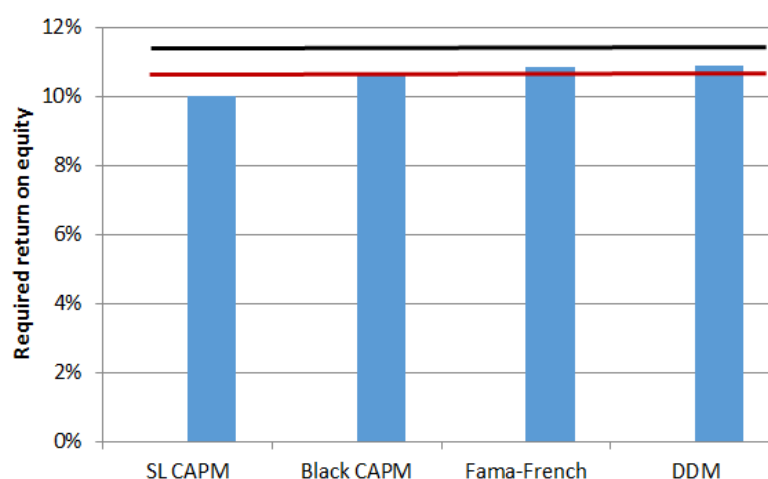
28. We do not recommend any of the alternative weighting schemes set out above – we simply note that the final estimate of the required return on equity is relatively insensitive to the proposed weighting scheme. In our view, the 10.71% estimate in Table 4 is the best available estimate of the required return on equity for a benchmark efficient entity and best reflects the prevailing conditions in the market for equity funds.

**Table 4**  
**Estimates of the required return on equity for a benchmark efficient entity**

Method	Required return on equity	Weighting
Sharpe-Lintner CAPM	10.01%	12.5%
Black CAPM	10.62%	25.0%
Fama-French model	10.87%	37.5%
Dividend discount model	10.92%	25.0%
<b>Weighted average</b>	<b>10.71%</b>	<b>100%</b>

29. Figure 1 below shows the estimates from each of the four models together with the proposed estimate of the required return on equity for a benchmark efficient entity (red line) and the estimate of the required return on equity for the average firm (black line).

**Figure 1**  
**Summary of estimates of the required return on equity**



Source: SFG calculations.

<sup>12</sup> We note that under the AER's Guideline, the cost of equity will either be set to the foundation model estimate, or a different value rounded to the nearest 25 basis points. That is, 25 basis points is considered to be rounding error for the estimate of the required return on equity under the Guideline. We do not advocate rounding to the nearest 0.25% because that approach can only provide a cost of equity estimate that is further away from the estimate of the prevailing cost of funds that uses all available information. We simply note that the AER considers 0.25% to be an indication of a small margin for error. This does not mean that an estimate is better if it is adjusted to the nearest 0.25%.

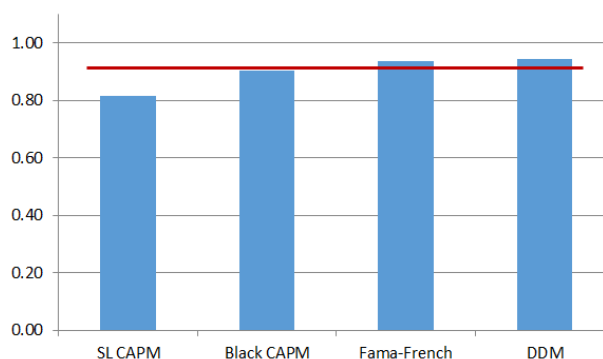
Conclusions and recommendations in relation to the foundation model approach

30. The Guideline proposes a “foundation model” approach whereby the AER first selects a single foundation model. Any other relevant financial models then have an effect only by informing the estimates of the parameters of the foundation model. In particular, the Guideline proposes that other relevant financial models can be used to inform the estimate of equity beta for use in the Sharpe-Lintner CAPM foundation model.
31. Table 5 below summarises the estimates of equity beta that reflect the contemporaneous evidence in relation to each of the relevant financial models – for the purposes of the foundation model approach. As set out in Paragraph 369, the relevant financial models all have different strengths and weaknesses along different dimensions. Consequently, we apply the weights from Table 4 to each of the equity beta estimates and we adopt a composite foundation model equity beta of 0.91, as illustrated in Figure 2.

**Table 5**  
**Estimates of equity beta to reflect evidence from relevant financial models**

Model	Equity beta
SL CAPM	0.82
Black CAPM	0.90
Fama-French	0.94
DDM	0.94
<b>Weighted average</b>	<b>0.91</b>

**Figure 2. Foundation model equity beta estimates**



32. The composite foundation model equity beta estimate of 0.91 produces an estimate of the required return on equity of 10.7%, as set out below:

$$\begin{aligned}
 r_e &= r_f + \beta \times MRP \\
 &= 4.12\% + 0.91 \times 7.21\% = 10.71\%.
 \end{aligned}$$

33. We note that this foundation model estimate of the required return on equity (10.71%) is identical to the estimate that is obtained in Table 4 above. This is because both approaches combine information from the same four relevant financial models and both approaches apply the same weighting scheme. Indeed, the foundation model approach can only produce a different estimate of the required return on equity if it is implemented in such a way as to either (a) omit evidence that would otherwise have

been considered, or (b) change the relative weights that would otherwise have been applied to some evidence.

## 2. Relevant financial models in the AER's Guideline

### The role of the allowed return on equity

#### Relevant legislation

34. Under the Australian regulatory framework, allowed revenues are set using a building block approach. Specifically, revenues are set at a level to provide for:
- Efficient operating costs;
  - Taxes;
  - Efficient depreciation (return of capital);
  - Interest (return on debt capital); and
  - A return on equity capital.
35. 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.
36. Some guidance on how the allowed return on equity should be determined is set out in the National Gas Objective (**NGO**), National Electricity Objective (**NEO**) and Revenue and Pricing Principles (**RPP**). For example, a key part of the NGO is to:
- promote efficient investment in...natural gas services...for the long term interests of consumers.”<sup>13</sup>
37. 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.
38. Similarly, the RPP require that:
- regard should be had to the economic costs and risks of the potential for under and over investment,<sup>14</sup>
- and that:
- a reference tariff [or price or charge] should allow for a return commensurate with the regulatory and commercial risks involved.<sup>15</sup>
39. 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.

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<sup>13</sup> National Gas Law, s. 23; National Electricity (South Australia) Act, s. 7.

<sup>14</sup> National Gas Law, s. 24(6); National Electricity (South Australia) Act, s. 7A(6).

<sup>15</sup> National Gas Law, s. 24(5); National Electricity (South Australia) Act, s. 7A(5).



40. The RPP also require that:

a service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs,<sup>16</sup>

which would seem to require that the allowed return must be at least commensurate with the efficient financing costs of the benchmark efficient entity.

#### Recent AEMC Rule changes

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

42. 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.<sup>17</sup>

43. The AEMC went on to state that:

The Commission considered that no one method can be relied upon in isolation to estimate an allowed return on capital that best reflects benchmark efficient financing costs<sup>18</sup>

44. 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.<sup>19</sup>

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<sup>16</sup> National Gas Law, s. 24(2); National Electricity (South Australia) Act, s. 7A(2).

<sup>17</sup> AEMC Final Determination, p. 48.

<sup>18</sup> AEMC Final Determination, p. 49.

<sup>19</sup> AEMC Final Determination, p. 43.

45. That is, the AEMC has concluded that the NGO and RPP require the regulator to produce the best possible estimate of the required return on equity,<sup>20</sup> which in turn requires the consideration of a range of financial models.

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

relevant estimation methods, financial models, market data and other evidence.<sup>21</sup>

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

[t]he 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 [services].<sup>22</sup>

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

the prevailing conditions in the market for equity funds.<sup>23</sup>

48. 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 NGO, NEO and RPP;
- b) All relevant estimation methods, financial models, market data and other evidence should be considered; and
- c) Some 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.

### Relevant financial models

49. The Guideline sets out four models that the AER considers to be relevant financial models:

- a) The Sharpe-Lintner CAPM;
- b) The Black CAPM;
- c) The Fama-French three factor model; and
- d) The dividend growth model.<sup>24</sup>

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<sup>20</sup> The required return on equity is a key component of the efficient financing costs.

<sup>21</sup> For example, see NGR 87(2)(5); NER 6.5.2(e)(1); NER 6A.6.2(e)(1).

<sup>22</sup> For example, see NGR 87(2)(3); NER 6.5.2(c); NER 6A.6.2(c).

<sup>23</sup> For example, see NGR 87(7); NER 6.5.2(g); NER 6A.6.2(g).

<sup>24</sup> AER Rate of Return Guideline, Table 5.1, p. 13. Throughout this report we refer to the dividend growth model as the dividend discount model. Practitioners sometimes use the term *dividend growth model* to refer to a particular version of the dividend discount model in which dividends are expected to grow at a constant rate in perpetuity from the first forecast year. To mitigate the risk of this interpretation we use the term *dividend discount model* throughout.

50. In this section of the report, we describe each of the models and we discuss how each model was developed, the theoretical and empirical basis for their development, and how they relate to each other.

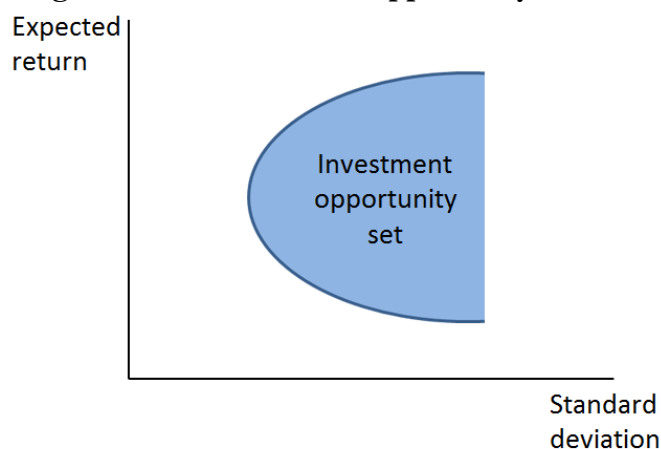
### Markowitz and modern portfolio theory

51. In a series of papers published in the 1950's<sup>25</sup> Harry Markowitz developed a mathematical and statistical framework that has become known as *modern portfolio theory*. Markowitz received the Nobel Prize in economics in 1991 in recognition of this contribution. The framework developed by Markowitz formed the basis for the development of a number of asset pricing models including the CAPM and various multi-factor models. In the remainder of this sub-section, we summarise the relevant components of the Markowitz framework.

#### The efficient frontier

52. Asset pricing models such as the Sharp-Lintner CAPM, the Black CAPM and the Fama-French model all begin with the concept of the **investment opportunity set**. If we plot all risky assets and all possible combinations (portfolios) of risky assets in terms of their expected return and standard deviation, we obtain the investment opportunity set which is the shaded region inside the curve in Figure 3 below. This indicates that an investor is able to obtain any risk/return combination<sup>26</sup> they choose within the shaded area. Different points within the efficient frontier simply represent different combinations of risky assets. To move from one point within the investment opportunity set to another, the investor simply needs to re-weight the assets in their investment portfolio.

**Figure 3. The investment opportunity set.**



53. For risk-averse investors,<sup>27</sup> some points in the investment opportunity set (i.e., some portfolios of risky assets) are better than others. For example, in Figure 4 below, Portfolio B dominates Portfolio C because it offers higher returns for the same level of risk. Similarly, Portfolio A dominates Portfolio C because it offers the same expected return for a lower level of risk. Because Portfolio C is dominated by other portfolios in this way, it is said to be an **inefficient portfolio**.

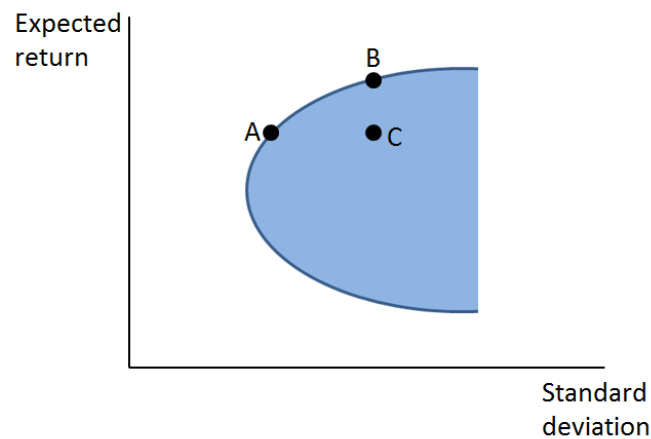
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<sup>25</sup> The most notable of which is Markowitz, H.M., 1952, "Portfolio selection," *Journal of Finance*, 7, 77–91.

<sup>26</sup> That is, any combination of expected return and standard deviation.

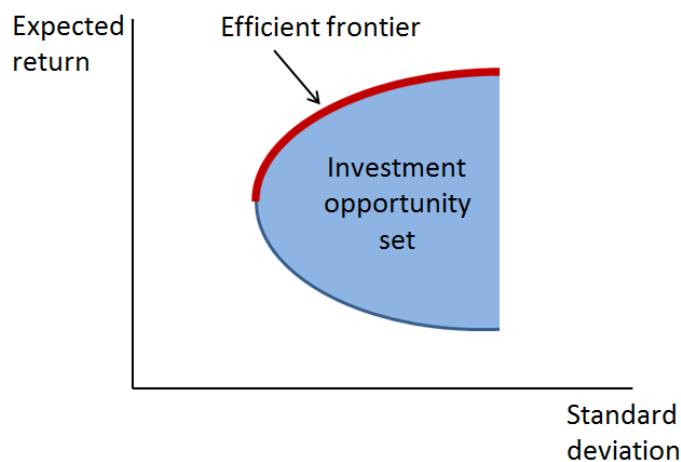
<sup>27</sup> A risk averse investor is one who prefers less risk to more. Such an investor would be prepared to sacrifice some expected return in order to reduce their exposure to risk. It is generally assumed throughout finance and economics that investors in general are risk averse. All of the asset pricing models examined in this report assume that investors are generally risk averse and that there is a positive relationship between risk and required returns.

Figure 4. An inefficient portfolio.



54. Clearly, investors who like high returns and who are averse to risk<sup>28</sup> will not want to hold inefficient portfolios. Rather, they will all want to hold efficient portfolios that maximise return for a given level of risk and minimise risk for a given level of return. The set of efficient portfolios is called the efficient frontier of risky assets and is illustrated in Figure 5 below. For every portfolio on the efficient frontier, there is no other portfolio that offers a higher return for the same (or less) risk.

Figure 5. The efficient frontier.



The fundamental asset pricing relationship

55. Since the work of Markowitz (1952), Sharpe (1964) and Black (1972) it has been well known that the expected return of *every* asset can be written as a linear function of *any* efficient asset or portfolio:<sup>29</sup>

$$r_i = r_z + \beta_i(r_p - r_z) \tag{1}$$

where:

- a)  $r_i$  is the expected return for asset  $i$ ;

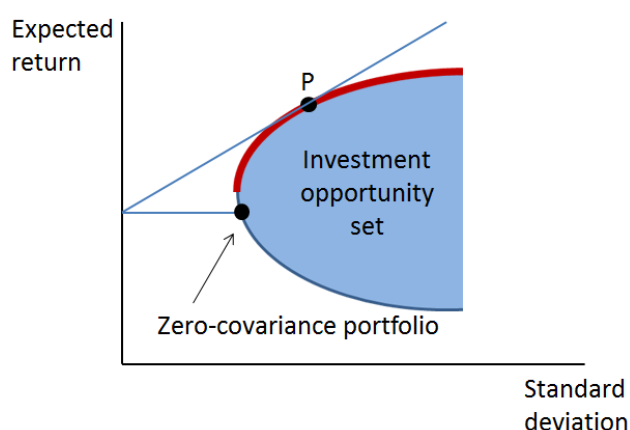
<sup>28</sup> Under standard asset pricing models, all investors are assumed to exhibit these characteristics.

<sup>29</sup> For a useful summary, see Smith and Walsh (2012), p. 74.

- b)  $r_p$  is the expected return for efficient portfolio  $p$ ;
- c)  $r_z$  is the expected return for a portfolio that is uncorrelated with portfolio  $p$ ; and
- d)  $\beta_i$  is the covariance between the returns of asset  $i$  and the returns of portfolio  $p$ , divided by the variance of the returns of portfolio  $p$ .

56. This is a general mathematical result that must always hold. If portfolio  $p$  is efficient, the simple linear relationship above *must* hold for every asset.
57. Moreover, for every efficient portfolio, there must exist a zero-covariance portfolio such that the returns of the two portfolios are uncorrelated. The zero covariance portfolio can be found by drawing a tangent to the efficient portfolio, as illustrated in Figure 6 below.<sup>30</sup>

**Figure 6. The zero-covariance portfolio.**



58. By contrast, if portfolio  $p$  is not on the efficient frontier, the linear relationship in Equation (1) does not hold. Indeed, if portfolio  $p$  is inefficient, there is no reason to believe that it could be used in any way to describe or explain the returns of any asset.

### The Sharpe-Lintner CAPM

59. The Sharpe-Lintner CAPM is one of a class of asset pricing models under which the required return on equity for a particular asset or firm is determined by adding a premium for risk to the return on a risk-free asset. Under these asset pricing models, the required return on equity is estimated as the sum of:
- a) The return that investors could obtain on a risk-free investment; and
  - b) A premium for the risk of the asset or firm being evaluated.
60. The various asset pricing models differ according to the way risk is defined and the way the premium for risk is estimated. Under the Sharpe-Lintner CAPM, the premium for risk is estimated in two steps. The first step requires the estimation of the premium that would be required for an asset or firm of average risk, known as the market risk premium (**MRP**). The second step requires the

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<sup>30</sup> See, for example, Huang and Litzenberger (1988), Figure 3.15.1, p. 71.

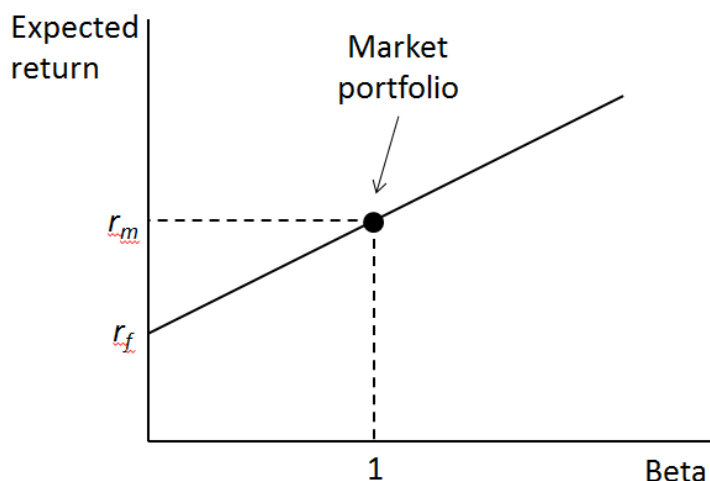
estimation of the risk of the asset or firm in question relative to the average firm or asset. This is known as systematic risk or beta. The required return on equity is then estimated as:

$$r_e = r_f + \beta_e(r_m - r_f)$$

where:

- a)  $r_e$  is the required return on equity for the asset or firm in question;
  - b)  $r_f$  is the return on a risk-free asset;
  - c)  $(r_m - r_f)$  is the risk premium required for the average firm (or market portfolio); and
  - d)  $\beta_e$  is the risk of the firm in question relative to the average, also known as the equity beta.
61. The average firm has an equity beta of 1, such that the risk premium required is  $(r_m - r_f)$  and the total required return is  $r_m$ . A firm with below average risk has equity beta less than 1, such that the risk premium required is less than that required for a firm of average risk. Conversely, a firm with above average risk has equity beta greater than 1, such that the risk premium required is more than that required for a firm of average risk.
62. The Sharpe-Lintner CAPM equation is often displayed in graphical form as in Figure 7 below.

**Figure 7. Sharpe-Lintner Capital Asset Pricing Model**



63. The Sharpe-Lintner CAPM is a special case of the fundamental asset pricing relationship set out in Equation (1) above. The general form of the fundamental asset pricing relationship is that the required return of any asset can be written as a linear function of the expected returns of (a) any efficient portfolio and (b) the corresponding zero-covariance portfolio. The Sharpe-Lintner CAPM is a special case of this general result in which:
- a) The market portfolio is an efficient portfolio; and
  - b) A risk-free asset serves as the zero-covariance portfolio.

64. These two special features of the Sharpe-Lintner CAPM are the result of certain additional assumptions. In particular:
- a) The risk-free rate serves as the zero-covariance portfolio as a consequence of the assumption that a risk-free asset exists and that investors can borrow or lend as much as they like at the risk-free rate. Consequently, the intercept of the line in Figure 7 must be equal to the risk-free rate; and
  - b) The efficiency of a unique market portfolio of risky assets that is held by all investors follows from two key assumptions:
    - i) Homogeneous expectations – all investors share the same beliefs about the joint distribution of the returns of all assets (i.e., we all use the same number for the expected return of BHP and we all use the same number for the standard deviation of ANZ, and so on); and
    - ii) Perfect capital markets – no investors face taxes or transactions costs of any type.
65. Under these assumptions, all investors have the same view about a particular asset – they all have the same belief about the expected return and standard deviation of the asset and they all have the same belief about the correlation between assets. Moreover, there are no distortionary taxes or other market imperfections that would result in different investors receiving different payoffs from the same asset. In summary, because:
- a) all investors have the same beliefs about the joint distribution of assets; and
  - b) there are no taxes or other imperfections

it follows that all investors will want to hold the same efficient portfolio of risky assets.

66. Moreover, since:

- a) all investors want to hold the same portfolio of risky assets; and
- b) investors collectively own the market portfolio,

it follows that the market portfolio (which is the sum total of the portfolios held by all investors) must also be efficient.<sup>31</sup>

### **Early empirical tests of the Sharpe-Lintner CAPM**

[Black, Jensen and Scholes \(1972\)](#)

67. A number of empirical tests are based on the following rearranged version of the Sharpe-Lintner CAPM equation:

$$r_e - r_f = (r_m - r_f)\beta_e$$

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<sup>31</sup> More precisely, the efficiency of the market portfolio follows from the fact that the market portfolio is a convex combination of the portfolios of investors. See Huang and Litzenberger (1988), p. 91.

68. For example, Black, Jensen and Scholes (1972) construct tests of the model in the form of the following regression specification:<sup>32</sup>

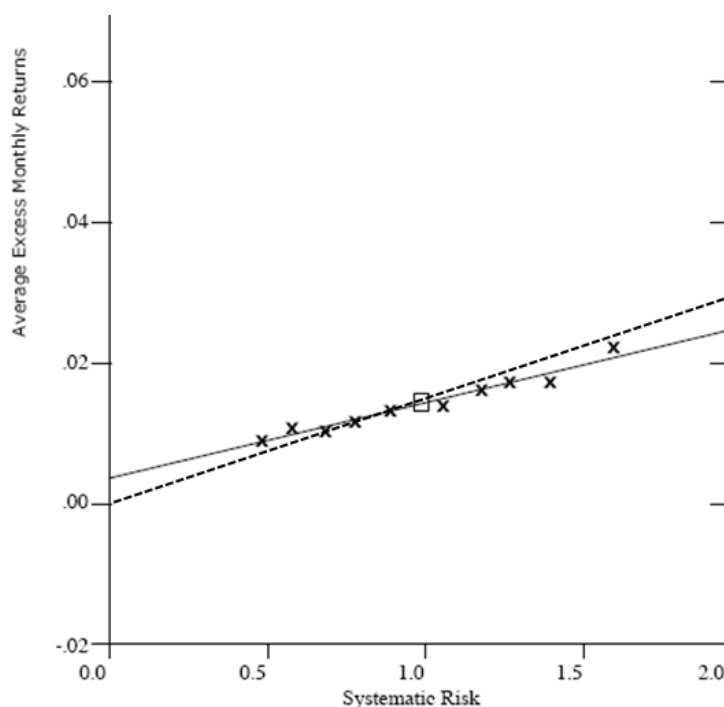
$$r_{e,j} - r_{f,j} = \gamma_0 + \gamma_1 \beta_{e,j} + u_j$$

69. The Sharpe-Lintner CAPM implies that  $\gamma_0 = 0$  and  $\gamma_1 = r_m - r_f$ . However, a series of studies including Black, Jensen and Scholes (1972) report that the intercept of this regression model is higher than the Sharpe-Lintner CAPM would suggest ( $\gamma_0 > 0$ ) and the slope is flatter than the Sharpe-Lintner CAPM would suggest ( $\gamma_1 < r_m - r_f$ ). For example, Black, Jensen and Scholes (1972) state that:

The tests indicate that the expected excess returns on high beta assets are lower than (1) [the Sharpe-Lintner CAPM equation] suggests and that the expected excess returns on low-beta assets are higher than (1) suggests.<sup>33</sup>

70. The main result of Black, Jensen and Scholes (1972) is summarised in Figure 8 below. In that figure, the dashed line represents the security market line<sup>34</sup> that is implied by the Sharpe-Lintner CAPM and the solid line represents the best fit to the empirical data. The data suggests that the intercept is too high and the slope is too flat to be consistent with the Sharpe-Lintner CAPM.

**Figure 8. Results of Black, Jensen and Scholes (1972)**



Source: Black, Jensen and Scholes (1972), Figure 1, p. 21. Dashed line for Sharpe-Lintner CAPM has been added.

<sup>32</sup> See, for example, Black, Jensen and Scholes (1972), p. 3.

<sup>33</sup> Black, Jensen and Scholes (1972), p. 4.

<sup>34</sup> The term “security market line” refers to the linear relationship between beta and expected returns for individual assets or portfolios of assets. In empirical analysis this is typically measured as the line of best fit between beta estimates and realised returns for individual assets or portfolios of assets.



71. Black, Jensen and Scholes (1972) go on to define the intercept of the empirical regression line to be  $R_z$ , a quantity that has since become known as the “zero beta premium.”<sup>35</sup> They report that the zero beta premium over their sample period of 1931 to 1965 was approximately 4% p.a.<sup>36</sup> They go on to conclude that:

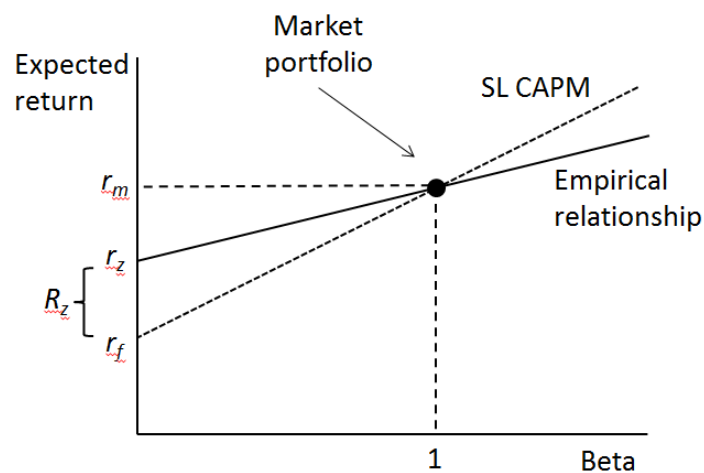
These results seem to us to be strong evidence favoring rejection of the traditional form of the asset pricing model which says that  $R_z$  should be insignificantly different from zero.<sup>37</sup>

and that:

These results indicate that the usual form of the asset pricing model as given by (1) does not provide an accurate description of the structure of security returns.<sup>38</sup>

72. The empirical relationship and the implications of the Sharpe-Lintner CAPM are contrasted in Figure 9 below. Figure 9 shows the Sharpe-Lintner CAPM in its usual form, whereas in Figure 8 Black, Jensen and Scholes (1972) show excess returns, after subtracting the risk-free rate.

Figure 9. Sharpe-Lintner CAPM vs. empirical relationship.



Friend and Blume (1970)

73. Friend and Blume (1970) define the abnormal return to be the observed excess return of a stock (or portfolio) less the expected return from the Sharpe-Lintner CAPM:<sup>39</sup>

$$\eta_i = (r_e - r_f) - (r_m - r_f)\beta_e$$

<sup>35</sup> We have not yet described the Black CAPM, but the term “zero beta premium” refers to the difference between the expected return on an asset with zero systematic risk (a zero beta) and the estimate of the risk-free rate (typically the yield on a government security).

<sup>36</sup> Black, Jensen and Scholes (1972), Table 5, p. 38 reports a monthly zero beta premium of 0.338% per month, which is approximately equivalent to 4% per annum.

<sup>37</sup> Black, Jensen and Scholes (1972), p. 39.

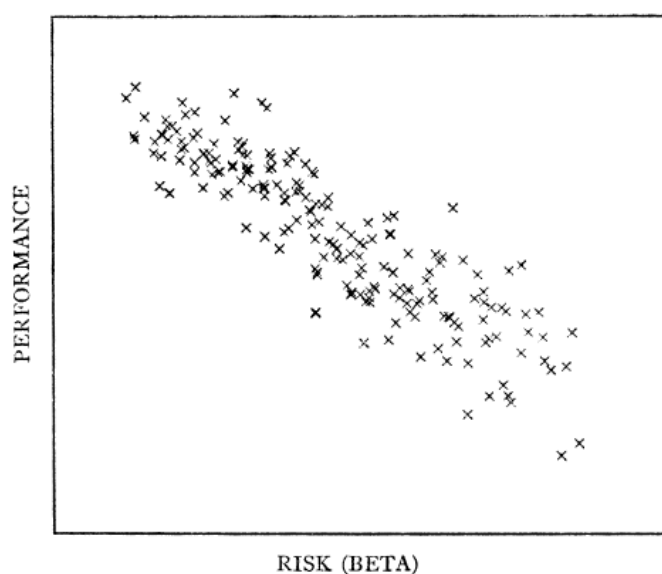
<sup>38</sup> Black, Jensen and Scholes (1972), pp. 3–4.

<sup>39</sup> Friend and Blume (1970), p. 563.

74. Under the Sharpe-Lintner CAPM,  $\eta_i$  should be zero on average and it should be independent of beta. However, Friend and Blume (1970) report a systematic relationship between the abnormal return and beta – low-beta stocks generate higher returns than the Sharpe-Lintner CAPM would suggest and high-beta stocks tend to generate lower returns than the Sharpe-Lintner CAPM would suggest. This relationship is shown clearly in Figure 10 below. Friend and Blume note that:

The absolute values of the performance measures are in excess of market expectations for funds with Beta coefficients below one and below expectations for higher coefficients.<sup>40</sup>

**Figure 10. The relationship between abnormal returns and beta**



Source: Friend and Blume (1970), p. 567.

75. Friend and Blume (1970) go on to consider what it is about the Sharpe-Lintner CAPM that results in it providing such a poor fit to the observed data. They conclude that the most likely source of the problem is the assumption that all investors can borrow or lend as much as they like at the risk-free rate:

Of the key assumptions underlying the market theory leading to one-parameter measures of performance, the one which most clearly introduces a bias against risky portfolios is the assumption that the borrowing and lending rates are equal and the same for all investors. Since the borrowing rate for an investor is typically higher than the lending rate, the assumption of equality might be expected to bias the one-parameter measures of performance against risky portfolios because, for such portfolios, investors do not have the same option of increasing their return for given risk by moving from an all stock portfolio to an investment with additional stock financed with borrowings at the lending rate.<sup>41</sup>

#### Fama and Macbeth (1973)

76. Fama and Macbeth (1973) use the following regression specification:<sup>42</sup>

<sup>40</sup> Friend and Blume (1970), p. 569.

<sup>41</sup> Friend and Blume (1970), p. 569.

<sup>42</sup> See Fama and Macbeth (1973), p. 611.

$$r_{e,j} = \gamma_0 + \gamma_1 \beta_{e,j} + u_j$$

77. Under this specification, the Sharpe-Lintner CAPM implies that  $\gamma_0 = r_f$  and  $\gamma_1 = r_m - r_f$ . Fama and Macbeth (1973) note that previous empirical work has demonstrated violations of both of these implications of the Sharpe-Lintner CAPM:

The work of Friend and Blume (1970) and Black, Jensen, and Scholes (1972) suggests that the S-L hypothesis is not upheld by the data. At least in the post-World War II period, estimates of  $E[\tilde{\gamma}_{0,t}]$  seem to be significantly greater than  $R_{ft}$ .<sup>43</sup>

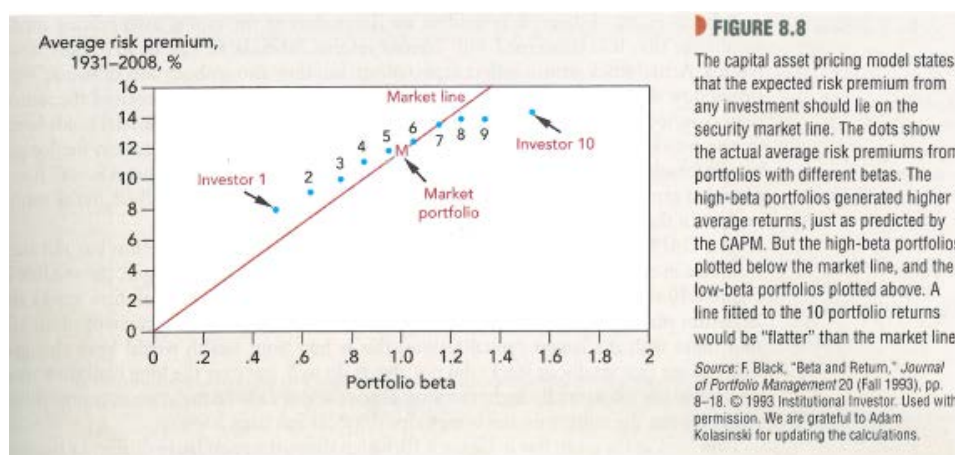
78. Fama and Macbeth (1973) then test the hypothesis that  $\gamma_0 - r_f = 0$  on average. They reject that hypothesis in their data and conclude that:

Thus, the results in panel A, table 3, support the negative conclusions of Friend and Blume (1970) and Black, Jensen, and Scholes (1972) with respect to the S-L hypothesis.<sup>44</sup>

Brealey, Myers and Allen (2011)

79. The consistent results in the studies reviewed above are not unique to the data from the periods examined in those studies. Rather, the results have proven to be consistent through time – low-beta stocks generate higher returns than the Sharpe-Lintner CAPM would imply and high-beta stocks earn lower returns than the Sharpe-Lintner CAPM would imply. For example, Brealey, Myers and Allen (2011) report that the evidence through to the end of 2008 remains consistent with the earlier research. Figure 11 shows the relationship between excess returns (over and above the risk-free rate) and beta. The line represents the relationship that is implied by the Sharpe-Lintner CAPM and each dot represents the observed return for a particular portfolio. Clearly, the low-beta portfolios still earn higher returns than the Sharpe-Lintner CAPM would imply.

Figure 11. The relationship between excess returns and beta



Source: Brealey, Myers, and Allen (2011), p. 197.

<sup>43</sup> Fama and Macbeth (1973), p. 630.

<sup>44</sup> Fama and Macbeth (1973), p. 632.

### Summary of empirical evidence

80. The three seminal papers that are reviewed above all reach the same conclusion – they all reject the Sharpe-Lintner CAPM on the basis that, in the observable data, the relationship between estimated betas and observed stock returns:
- Has an intercept that is economically and statistically significantly above the intercept that is implied by the Sharpe-Lintner CAPM; and
  - Has a slope that is economically and statistically significantly less than the slope that is implied by the Sharpe-Lintner CAPM.
81. This result continues to hold in more recent data. Analysis of more than 70 years of historical stock returns has not led to the initial results being overturned.

### The Black CAPM

82. As set out above, the initial empirical tests of the Sharpe-Lintner CAPM indicated that the relationship between equity beta and stock returns tends to be flatter than the Sharpe-Lintner CAPM would suggest.<sup>45</sup> Black (1972) summarises some of this literature as follows:

...several recent studies have suggested that the returns on securities do not behave as the simple capital asset pricing model described above predicts they should. Pratt analyzes the relation between risk and return in common stocks in the 1926-60 period and concludes that high-risk stocks do not give the extra returns that the theory predicts they should give.

Friend and Blume use a cross-sectional regression between risk-adjusted performance and risk for the 1960-68 period and observe that high-risk portfolios seem to have poor performance, while low-risk portfolios have good performance.

...

Black, Jensen, and Scholes analyze the returns on portfolios of stocks at different levels of  $\beta_i$  in the 1926-66 period. They find that the average returns on these portfolios are not consistent with equation (1) [the Sharpe-Lintner CAPM], especially in the postwar period 1946-66. Their estimates of the expected returns on portfolios of stocks at low levels of  $\beta_i$  are consistently higher than predicted by equation (1), and their estimates of the expected returns on portfolios of stocks at high levels of  $\beta_i$  are consistently lower than predicted by equation (1).<sup>46</sup>

83. In trying to develop a conceptual rationale for this observed and consistent empirical finding, Black (1972) states that:

One possible explanation for these empirical results is that assumption (d) of the capital asset pricing model does not hold. What we will show below is that the relaxation of assumption (d) [all investors can borrow or lend as much as they like at the risk-free rate] can give models that are consistent with the empirical results obtained by Pratt, Friend and Blume, Miller and Scholes, and Black, Jensen and Scholes.<sup>47</sup>

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<sup>45</sup> See, for example, Fama and Macbeth (1973) and Black, Jensen and Scholes (1972).

<sup>46</sup> Black (1972), p. 445.

<sup>47</sup> Black (1972), p. 445.

84. That is, Black (1972):

- a) Notes that there is consistent evidence about the empirical failings of the Sharpe-Lintner CAPM; and
- b) Augments the Sharpe-Lintner CAPM to produce a model that does not suffer from those empirical failings; and then
- c) Sets out the conceptual rationale for his augmentation to the Sharpe-Lintner CAPM.

85. In particular, Black (1972) relaxes the assumption from the Sharpe-Lintner CAPM that investors can borrow and lend as much as they like at the risk-free rate. Rather, he notes that investors will have to pay a higher rate when borrowing than the rate they will receive when lending. This leads Black to revert to the more general version of the asset-pricing relationship where the risk-free rate is replaced by the return on a zero-covariance portfolio, while still retaining the assumption that the market portfolio is efficient.<sup>48</sup> The resulting pricing relationship is:

$$r_i = r_z + \beta_i(r_m - r_z) \quad (2)$$

where  $r_z$  represents the return on a zero-beta asset,<sup>49</sup> and

$$r_z = r_f + R_z$$

where  $R_z$  is known as the zero-beta premium. That is,  $R_z$  is the amount by which the intercept in the pricing relationship exceeds the risk-free rate.

86. When implementing the Black CAPM, the zero-beta premium is estimated empirically, usually using the methodology of Fama and Macbeth (1973). That is, the zero-beta premium is selected to provide the best possible fit between the model and the observed data. It is for this reason that the Black CAPM is referred to as the *Empirical CAPM* in its extensive use in US rate of return regulation cases.<sup>50</sup>

87. The equity beta for use in the Black CAPM has the same definition as the equity beta that is used in the Sharpe-Lintner CAPM so the same estimate should be used for both models. Whichever of these two models is being used to estimate the required return on equity, the same process would be used to estimate the equity beta, as illustrated in Figure 12 below. In that figure, the risk-free rate is 4% and the zero-beta premium is 3%. Consider the case of a stock with an equity beta of 0.4. The Sharpe-Lintner CAPM suggests that the required return on equity is given by:

$$\begin{aligned} r_e &= r_f + \beta(r_m - r_f) \\ &= 4\% + 0.4(10\% - 4\%) = 6.4\% \end{aligned}$$

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

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<sup>48</sup> Under this model, different investors will want to hold different portfolios of risky assets – depending on whether they are net borrowers, net lenders, or neither. However, all investors will still want to hold portfolios of risky assets that lie on the efficient frontier. Since the market portfolio is a weighted average of the portfolios held by each investor, and because such a convex combination of efficient portfolios must also be efficient, it follows that the market portfolio must also be efficient.

<sup>49</sup> Formally, this is the point at which a tangent to the market portfolio crosses the vertical axis.

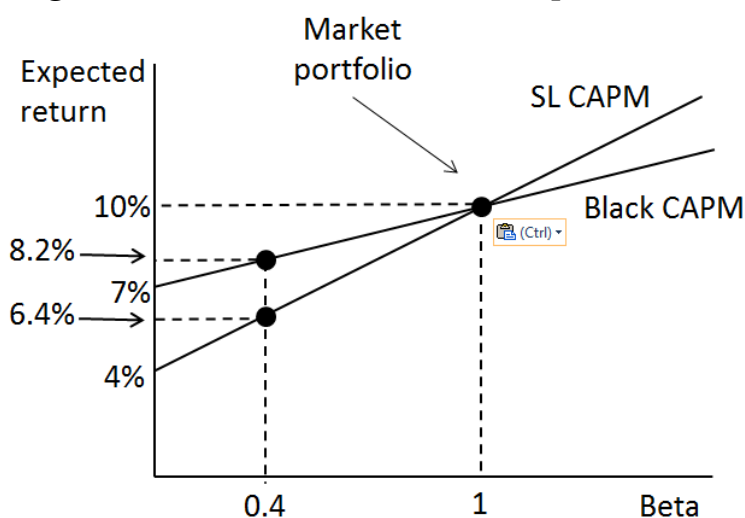
<sup>50</sup> See Morin (2006).

$$r_e = r_z + \beta(r_m - r_z)$$

$$= 7\% + 0.4(10\% - 7\%) = 8.2\%.$$

88. In both cases, beta has the same definition and the same role and the same estimate is used.

**Figure 12. Use of beta in the Black/Empirical CAPM**



Source: SFG calculations.

### What if the market portfolio is not efficient?

89. Recall from above that if the market portfolio is on the efficient frontier, it must be the case that the required return on any asset can be written as a linear function of the returns on the market portfolio and the corresponding zero-covariance portfolio. However, if the market portfolio is not on the efficient frontier, there is no reason to expect that there would be a linear relationship between betas (estimated relative to the market portfolio) and expected returns as the Sharpe-Lintner CAPM suggests. That linear relationship only holds in relation to efficient portfolios.

90. Broadly, there are two reasons why the market portfolio may not be efficient:

- a) Investors may not have mean-variance preferences. The CAPM assumes that investors are concerned only about the expected return and the variance of their investment portfolios. If investors are also concerned about other features of their investment (e.g., the risk of a large loss, returns relative to recent history, or returns relative to other investors) it no longer follows that the market portfolio is expected to be efficient;<sup>51</sup> or
- b) The empirical proxy may not be mean variance efficient. Ultimately, the CAPM needs to be parameterised using observable data. A broad stock market index is usually used as a proxy for the market portfolio. Thus, the relevant question is whether the stock index that is used in the empirical implementation of the model, rather than the theoretical market portfolio, is efficient.

91. Berk and DeMarzo (2014) note that if the empirical proxy for the market portfolio is not efficient (for whatever reason) it would be necessary to use some other means to find a portfolio that *is* efficient:

<sup>51</sup> Formally, if investors hold portfolios that are not mean-variance efficient, the market portfolio will not be mean-variance efficient.

When the market portfolio is not efficient, to use [Equation (1) above] we need to find an alternative method to identify an efficient portfolio.<sup>52</sup>

92. The question then becomes one of how to identify an efficient portfolio to use in Equation (1). In this regard, it is useful to note that we do not need to identify a single portfolio that is efficient – we only need to identify a set of portfolios (each of which might be inefficient alone) that can be combined to form an efficient portfolio. For example, suppose that we identify three portfolios that can be combined in some way to form an efficient portfolio. In this case, Ross (1976) shows that the expected return of any asset can be written as a linear function of the sensitivity (beta) to each of the factor portfolios as follows:<sup>53</sup>

$$r_i = r_f + \beta_{1i}(r_1 - r_f) + \beta_{2i}(r_2 - r_f) + \beta_{3i}(r_3 - r_f) \quad (3)$$

where:

- a)  $r_i$  is the expected return for asset  $i$ ;
- b)  $r_1$  is the expected return for portfolio 1, and similarly for  $r_2$  and  $r_3$ ;
- c)  $r_f$  is the risk-free rate of return; and
- d)  $\beta_1$  is the covariance between the returns of asset  $i$  and the returns of portfolio 1, divided by the variance of the returns of portfolio 1, and similarly for  $\beta_2$  and  $\beta_3$ .

93. Berk and DeMarzo (2014) note that:

There is nothing inconsistent between [Equation (1)] and [Equation (3)]...Both equations hold...When we use an efficient portfolio, it alone will capture all systematic risk...If we use multiple portfolios as factors, then together these factors will capture all systematic risk, but note that each factor in [Equation (3)] captures different components of the systematic risk.<sup>54</sup>

94. That is, if we could identify a single efficient portfolio, we could use that portfolio in Equation (1). If that portfolio really is efficient, the linear relationship in Equation (1) must hold exactly. In particular, there would be no systematic violation of Equation (1) in the observed data – the only violation of Equation (1) would come from random sampling error.
95. If we are unable to identify a single efficient portfolio, we would need to identify a set of portfolios (or “factors”) that could be combined to form an efficient portfolio, in which case Equation (3) must hold exactly.
96. The analysis thus far begs two questions:
- a) Can we identify a single efficient portfolio; and if not

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<sup>52</sup> Berk and DeMarzo (2014), p. 461.

<sup>53</sup> Ross (1976) develops the framework for the case where a risk-free asset exists. If there is not a single risk-free rate at which all investors can borrow or lend,  $r_f$  is simply replaced by  $r_z$ .

<sup>54</sup> Berk and DeMarzo (2014), p. 461.

- b) What additional portfolios or factors should be included?

Can we identify a single efficient portfolio?

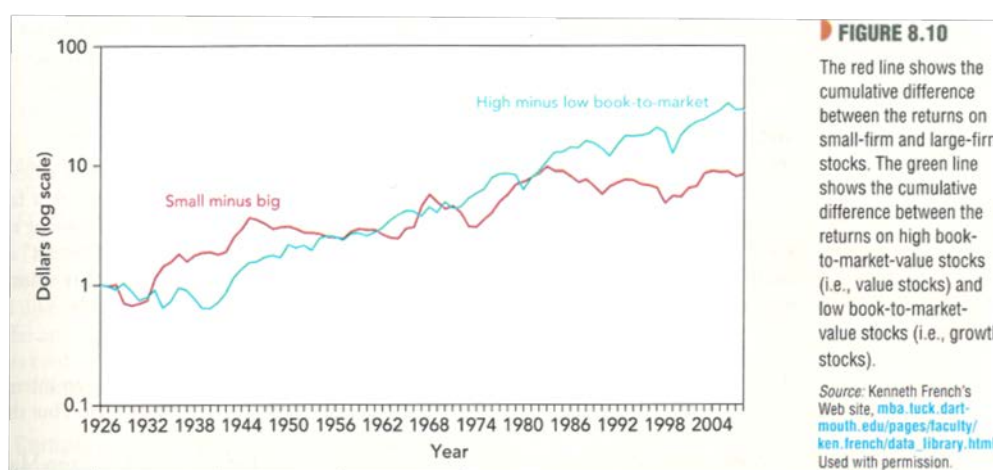
97. Under the Sharpe-Lintner CAPM, the market portfolio is an efficient portfolio. This follows from the assumptions of the model. If the assumptions about mean-variance preferences do not hold in the real world, there is no conceptual reason why the market portfolio should be efficient. Even if the market portfolio *is* efficient in theory, the empirical proxy may not be. In both cases, the linear CAPM relationship will not hold and the CAPM pricing formula cannot be used to estimate the required return on equity.
98. This is, of course, an empirical question. Unfortunately, it is an empirical question that is impossible to answer because the CAPM requires the market portfolio (or, in practice, the stock index that is used as a proxy) to be *ex ante* efficient, but stock returns can only be observed *ex post* and it is possible that *ex post* outcomes might differ from *ex ante* expectations.
99. That is, the empirical tests routinely establish that the relevant stock market index is *ex post* inefficient – that other portfolios had superior risk/return outcomes in the historical data. Because the market portfolio proxy is *ex post* inefficient, the linear relationship in Equation (1), which relies on the efficiency of the reference (market) portfolio, does not hold in the historical data. This does not disprove the CAPM, which relies on the market portfolio (not the stock index) being *ex ante* (not *ex post*) efficient.
100. When using the CAPM to estimate required returns, it is necessary to use a particular stock market index as a proxy for the market portfolio. Thus, the assumption being made is that the particular index is *ex ante* efficient – otherwise the linear relationship in Equation (1) will not hold.
101. In summary:
- a) The assumptions that must hold for the market portfolio to be efficient (and for the CAPM equation to hold) do not hold in practice, so there is no conceptual reason why the market portfolio must be efficient; and
  - b) Empirical tests routinely establish that the relevant stock market index (as a proxy for the market portfolio) is inefficient in the historical data (i.e., is *ex post* inefficient); but
  - c) It is theoretically possible that the relevant stock market index was *ex ante* efficient, and is only *ex post* inefficient because actual outcomes differed from what investors were expecting. That is, investors were expecting the index portfolio to have optimal risk/return properties, but (over a particular period) different portfolios turned out to have superior risk/return properties in a way that was unexpected.
102. What makes this latter possibility unlikely is the fact that the same portfolios consistently outperform the stock market index over time and across markets. If the index portfolio really was *ex ante* efficient, it is highly unlikely that it would be consistently outperformed by the same portfolios. For example, there is consistent evidence (over time and across different markets) that high-book-to-market firms out-perform the returns that the Sharpe-Lintner CAPM would suggest. Over a single historical period for a single market, random chance will ensure that it will always be possible to identify some group of stocks that have out-performed relative to the Sharpe-Lintner CAPM. The CAPM will never be able to perfectly predict the return of every stock, so in a given period there will inevitably be some groups of stocks that under-perform and others that out-perform. However, if the out-performance occurred by random chance it is unlikely to repeat time and again over different



periods and across different markets. As more and more observations are built up, it becomes less and less likely that the particular group of stocks is earning higher returns by random chance and more and more likely that they are earning higher returns as compensation for a relevant risk factor that is not included in the Sharpe-Lintner CAPM.

103. By way of analogy, consider the proposition that tennis fans believe (i.e., expect ex ante) that Jo-Wilfred Tsonga is the best player. Even the best player will lose some matches, so that proposition is not disproved even though we observe Tsonga losing on some occasions (i.e., in the ex post data). However, the fact that we observe Tsonga consistently losing to Djokovic and Nadal, over many years, in different countries, and in different match conditions, would be strong evidence against the proposition. The same applies in empirical asset pricing tests. The same size and book-to-market portfolios have consistently out-performed the stock market index over time and across markets.
104. Portfolios constructed on the basis of size and book-to-market have been shown to out-perform the return implied by a single (market) factor model. For example, Brealey, Myers and Allen (2011) show the extent to which small firms have tended to outperform large firms and the extent to which high book-to-market firms have tended to outperform low book-to-market firms in Figure 13 below.

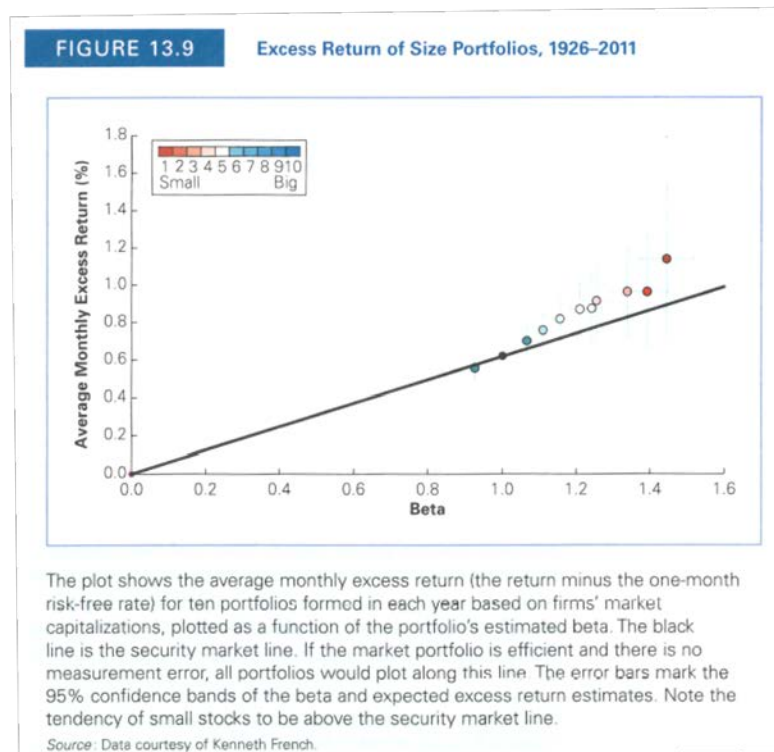
**Figure 13. Return performance by size and book-to-market.**



Source: Brealey, Myers and Allen (2011), Figure 8.10, p. 199.

105. More precisely, Berk and DeMarzo (2014) show that smaller firms have tended to outperform the returns that are implied by a single (market) factor model, as illustrated in Figure 14 below.

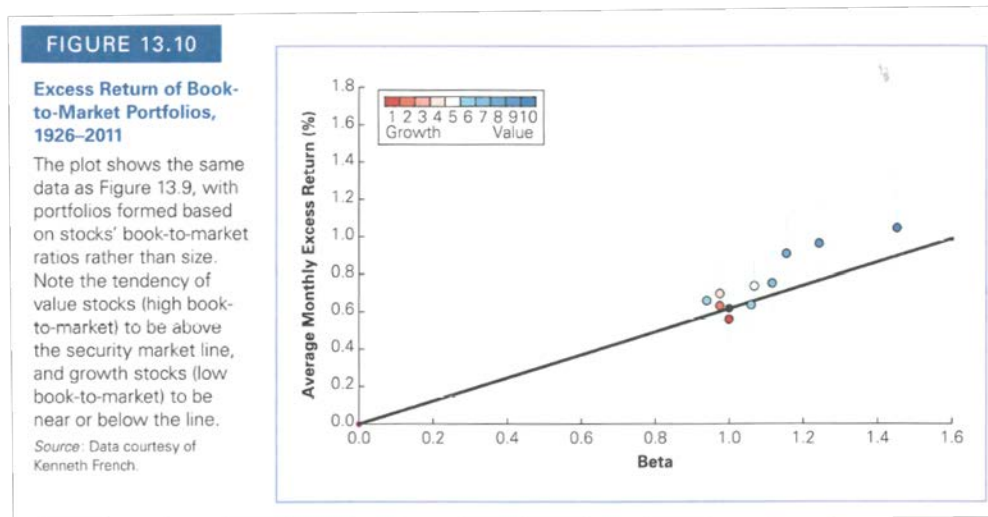
**Figure 14. Out-performance by size.**



Source: Berk and DeMarzo (2011), Figure 13.9, p. 455.

106. Berk and DeMarzo (2014) also show that high book-to-market firms have tended to outperform the returns that are implied by a single (market) factor model, as illustrated in Figure 15 below.

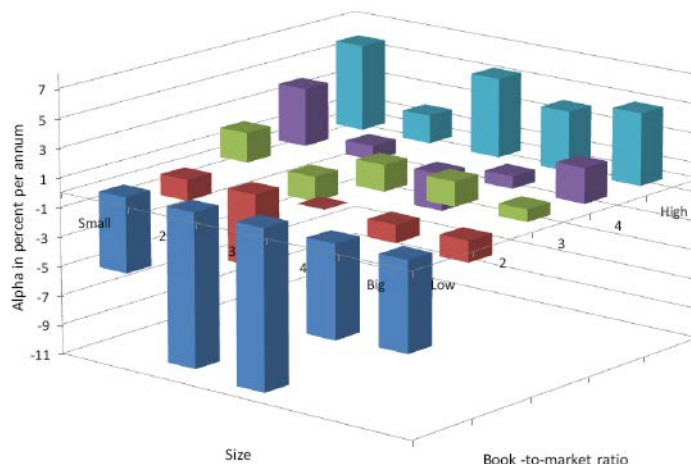
**Figure 15. Out-performance by book-to-market ratio.**



Source: Berk and DeMarzo (2011), Figure 13.10, p. 456.

107. The size and book-to market effects are also present in the Australian data. For example, NERA (2013) plot the alpha values for a variety of size and book-to-market portfolios that are reported by Brailsford, Gaunt and O'Brien (2012), reproduced as Figure 16 below.

**Figure 16. Out-performance by size and book-to-market in Australian data.**



Source: NERA (2013), p. 10, citing results from Brailsford, Gaunt and O’Brien (2012), Table 4, p. 275.

108. In our view, the weight of empirical evidence is inconsistent with the proposition that the stock index portfolio is ex ante efficient – in the same way as the weight of evidence is inconsistent with the proposition that tennis fans believe Tsonga to be the best player.

What additional portfolios or factors should be included?

109. The foregoing analysis begs the question of how we should go about selecting a set of portfolios that might be able to be combined into an efficient portfolio. Berk and DeMarzo (2014) suggest that we should start with the market portfolio, as this is a large and well diversified portfolio that generates average returns materially above the yield on government bonds.<sup>55</sup> At this stage, we have a one-factor model as follows:

$$r_i = r_f + \beta_{mkt,i}(r_m - r_f). \tag{4}$$

110. If the market portfolio is efficient, Equation (4) will hold for all assets and portfolios. This implies that in any regression of excess stock returns on excess market returns, the intercept will be zero. For example, consider the following regression specification:

$$r_i - r_f = \alpha_i + \beta_{mkt,i}(r_m - r_f). \tag{5}$$

If the market portfolio is efficient and single-handedly captures all systematic risk, then we will find that  $\alpha_i = 0$  for all assets and portfolios. If we do not find that  $\alpha_i = 0$  for all assets and portfolios, the implication is that the market portfolio is not efficient and does not single-handedly capture all systematic risk.

111. Moreover, any portfolio for which  $\alpha_i > 0$  has systematically earned a higher return than the single-factor model in Equation (4) suggests. There are two reasons why the return on a particular portfolio might be systematically higher than that suggested by the single factor model:

<sup>55</sup> Berk and DeMarzo (2014), p. 462.

- a) The portfolio has some exposure to a component of systematic risk that is not well captured by the market portfolio (or at least the stock index that is used as a proxy), and the additional return is the compensation that investors require for bearing that systematic risk; or
- b) Random chance – looking backwards through an historical data set, it will always be possible to find some portfolio that, just by random chance, has out-performed the return suggested by Equation (4).

112. If one takes the view that the out-performance of a portfolio is due to its exposure to a component of systematic risk, that portfolio should be included as part of a multi-factor model as in Equation (3). Since portfolios based on size and book-to-market have consistently out-performed, it seems more likely that their higher average returns are compensation for a component of systematic risk that is not well captured by the stock market index. It seems quite unlikely that the same portfolios would consistently out-perform just by random chance.

### The Fama-French three-factor model

#### A multi-factor asset pricing model

113. Fama and French (1993) draw on the evidence about the systematic out-performance of smaller firms and high book-to-market firms when developing their three-factor model. They recognise that:

- a) If the proxy that is used for the market portfolio is efficient, the linear one-factor model will hold for all assets. In this case, there will be no consistent relationship between stock returns and any other factor, once the single market factor has been taken into account; and
- b) If the proxy that is used for the market portfolio is not efficient, the linear one-factor model will not hold. In this case, the asset-pricing literature suggests that a multi-factor model must be used – where the additional factors are drawn from variables that have been shown to be consistently related to stock returns.

114. In this regard, Fama and French (1993) state that:

...if assets are priced rationally, variables that are related to average returns, such as size and book-to-market equity, must proxy for sensitivity to common (shared and thus undiversifiable) risk factors in returns.<sup>56</sup>

115. This leads Fama and French (1993) to develop their three-factor model, where the required return on equity is given by:

$$r_e = r_f + \beta_{mkt} \times MRP + \beta_{size} \times SMB + \beta_{value} \times HML$$

where:

- a)  $r_f$  represents the risk-free rate of interest, as under the Sharpe-Lintner CAPM;
- b)  $MRP$  represents the market risk premium, as under the Sharpe-Lintner CAPM;

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<sup>56</sup> Fama and French (1993), pp. 4-5.

- c)  $\beta_{mkt}$  represents the equity beta relative to a broad market index, as under the Sharpe-Lintner CAPM;
- d)  $SMB$  represents the difference between the returns on a portfolio of small stocks and the returns on a portfolio of large stocks – “small minus big”;
- e)  $\beta_{size}$  represents the particular firm’s sensitivity to the  $SMB$  factor;
- f)  $HML$  represents the difference between the returns on a portfolio of high book-to-market stocks and the returns on a portfolio of low book-to-market stocks – “high minus low”; and
- g)  $\beta_{value}$  represents the particular firm’s sensitivity to the  $HML$  factor.

116. There are three risk factors in the model. The first of these is the return on the broad market index. When the market goes up individual firms go up and when the market goes down individual firms go down, on average. That is, market movements are one source of variation, or risk, in holding shares.

117. Of course, some firms are more sensitive to market movements than others. That is, some firms go up a lot more than average when the market is up and down a lot more than average when the market is down. The sensitivity to the market risk factor is given by  $\beta_{mkt}$ . A firm with average sensitivity to the market risk factor has  $\beta_{mkt} = 1$ , a firm with less than average sensitivity to the market risk factor has  $\beta_{mkt} < 1$ , and a firm with more than average sensitivity to the market risk factor has  $\beta_{mkt} > 1$ .

118.  $MRP$  represents the additional return that investors would require from a firm with average sensitivity to the market risk factor. Firms with above average sensitivity to the market risk factor ( $\beta_{mkt} > 1$ ) will require higher returns as compensation and firms with below average sensitivity to the market risk factor ( $\beta_{mkt} < 1$ ) will require lower returns.

119. The other factor and sensitivity terms in the model play similar roles. Empirical work in the finance literature has shown that, on average, smaller firms generate higher returns than larger firms, even after controlling for the market factor. Fama and French argue that this is not due to the characteristic of size but due to the fact that smaller firms tend to be more sensitive to a second risk factor. That is, small firms do not earn higher returns simply because they are small, but because they are more sensitive to the second risk factor. This second risk factor has been linked to liquidity – with investors requiring relatively higher returns from illiquid stocks.

120. Analogous to the market factor,  $\beta_{size}$  represents the exposure of a particular firm to the second risk factor. Unlike the case for the market factor, however, the average firm has zero sensitivity to this second factor so that for the average firm we have  $\beta_{size} = 0$ . Firms with above average sensitivity to the market risk factor ( $\beta_{size} > 0$ ) will require higher returns as compensation and firms with below average sensitivity to the market risk factor ( $\beta_{size} < 0$ ) will require lower returns. Also analogous to the market factor,  $SMB$  represents the additional return that investors would require from a firm with average sensitivity to this second factor.

121. The third factor should be interpreted in a similar way. Empirical work in the finance literature has shown that there is a relationship between stock returns and the book to market ratio (the ratio of book value per share to market value per share). In particular, firms with a high book to market ratio tend to generate higher returns than firms with a low book to market ratio, even after controlling for

the market factor. Again, Fama and French argue that this is because high book to market stocks are more sensitive to the third risk factor. That is, high book to market firms do not earn higher returns simply because they have a high book to market ratio, but because they are more sensitive to the third risk factor. This third risk factor has been linked to financial distress – with investors requiring relatively higher returns from firms that are more likely to become distressed. As for the second factor, the average firm has  $\beta_{value} = 0$ .

#### The empirical performance of the Fama-French model

122. Fama and French (1993) submit their three-factor model to a battery of empirical tests and conclude that:

Our main results are easy to summarize. For stocks, portfolios constructed to mimic risk factors related to size and *BE/ME* [book value of equity to market value of equity] capture strong common variation in returns, no matter what else is in the time-series regressions. This is evidence that size and book-to-market equity indeed proxy for sensitivity to common risk factors in stock returns. Moreover, for the stock portfolios we examine, the intercepts from three-factor regressions that include the excess market return and the mimicking returns for size and *BE/ME* factors are close to 0. Thus a market factor and our proxies for the risk factors related to size and book-to-market equity seem to do a good job explaining the cross-section of average stock returns.<sup>57</sup>

123. Fama and French (1993) go on to compare the empirical performance of their three-factor model against the one-factor CAPM. They conclude that the three-factor model provides a materially better fit to the observed data:

Given the strong slopes on SMB and HML for stocks, it is not surprising that adding the two returns to the regressions results in large increases in  $R^2$ . For stocks, the market alone produces only two (of 25)  $R^2$  values greater than 0.9 (table 4); in the three-factor regressions (table 6)  $R^2$  values greater than 0.9 are routine (21 of 25). For the five portfolios in the smallest-size quintile,  $R^2$  increases from values between 0.61 and 0.70 in table 4 to values between 0.94 and 0.97 in table 6. Even the lowest three-factor  $R^2$  for stocks, 0.83 for the portfolio in the largest-size and highest-*BE/ME* quintiles, is much larger than the 0.69 generated by the market alone.<sup>58</sup>

124. The leading Australian study in this area reaches the same conclusion. Brailsford, Gaunt and O'Brien (2012) report that:

Our study provides two advances. Firstly, the study utilizes a purpose-built dataset spanning 25 years and 98% of all listed firms. Secondly, the study employs a more appropriate portfolio construction method than that employed in prior studies. With these advances, the study is more able to test the three-factor model against the capital asset-pricing model (CAPM). The findings support the superiority of the Fama–French model, and for the first time align the research in this area between Australia and the USA.<sup>59</sup>

and:

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<sup>57</sup> Fama and French (1993), p. 5.

<sup>58</sup> Fama and French (1993), p. 21.

<sup>59</sup> Brailsford, Gaunt and O'Brien (2012a), p. 261.

In a series of comparative tests, the three-factor model is found to be consistently superior to the CAPM,<sup>60</sup>

and:

the findings appear to settle the disputed question as to whether the value premium is indeed a positive and significant factor in the Australian market.<sup>61</sup>

#### Theoretical rationale for Fama-French factors

125. Fama and French (1993) also discuss the possible theoretical rationale for the two factors that were originally identified in empirical work:

The fact that small firms can suffer a long earnings depression that bypasses big firms suggests that size is associated with a common risk factor that might explain the negative relation between size and average return. Similarly, the relation between book-to-market equity and earnings suggests that relative profitability is the source of a common risk factor in returns that might explain the positive relation between BE/ME and average return.<sup>62</sup>

and:

The tests here show that there are common return factors related to size and book-to-market equity that help capture the cross-section of average stock returns in a way that is consistent with multifactor asset-pricing models. Fama and French (1991b) show that size and BE/ME are related to systematic patterns in relative profitability and growth that could well be the source of common risk factors in returns.<sup>63</sup>

126. Our companion report, SFG (2014 FFM)<sup>64</sup> reviews the theoretical rationale for the Fama-French factors in more detail.

#### Practical uses of the Fama-French model

127. Finally, Fama and French (1993) set out the potential uses of their three-factor model:

...our results can be used in any application that requires estimates of expected stock returns. The list includes (a) selecting portfolios, (b) evaluating portfolio performance, (c) measuring abnormal returns in event studies, and (d) **estimating the cost of capital**.<sup>65</sup>

128. Similarly, Brailsford, Gaunt and O'Brien (2012a) conclude that there may be:

...added benefits of using a multifactor model to estimate cost of capital for firms.<sup>66</sup>

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<sup>60</sup> Brailsford, Gaunt and O'Brien (2012a), p. 279.

<sup>61</sup> Brailsford, Gaunt and O'Brien (2012a), p. 279.

<sup>62</sup> Fama and French (1993), p. 8.

<sup>63</sup> Fama and French (1993), p. 55.

<sup>64</sup> SFG (2014 FFM), *The Fama-French model*, May.

<sup>65</sup> Fama and French (1993), p. 53, emphasis added.

<sup>66</sup> Brailsford, Gaunt and O'Brien (2012a), p. 279.

129. Our companion report, SFG (2014 FFM)<sup>67</sup> reviews the acceptance of the Fama-French three-factor model and the way that it is used in practice for the purpose of estimating the required return on equity. In particular:

- a) Professor Fama was awarded the 2013 Nobel Prize in Economics, with the prize committee making special mention of the development of the three-factor model;
- b) The Fama-French three-factor model has become the standard method for estimating the required return on equity in academic studies;
- c) Proficiency in using the Fama-French model to estimate the required return on equity is a requirement of the leading CFA professional certification; and
- d) Fama-French estimates of the required return on equity have been adopted in a number of court judgments.

## Dividend discount model

### Theoretical basis

130. The dividend discount model (referred to as the “dividend growth model” in the Guideline) differs from the asset pricing models set out above in that it does not require the specification and estimation of the set of factors that determine asset returns. Rather, the dividend discount model requires nothing more than the assumption that stock prices reflect the present value of the cash flows (dividends) that will be paid to the owners. In its general form, the dividend discount model is:

$$P_0 = \sum_{t=1}^{\infty} \frac{d_t}{(1+r_e)^t} \quad (6)$$

where  $P_0$  represents the current stock price and  $d_t$  represents the dividend that is expected to be paid at time  $t$ . For a given set of expected future dividends and the current stock price, there is a unique estimate of the required return on equity,  $r_e$ , that satisfies Equation (6) above.

131. That is, the dividend discount model is based on the principle that the current stock price is equal to the present value of expected future cash flows. In this regard, the draft Guideline recently concluded that:

■ Dividend growth models are well grounded in economic theory.<sup>68</sup>

### Implementation

132. Implementation of the dividend discount model requires a forecast of all future dividends to be paid to holders of the relevant stock. To simplify this task, it is common to impose the additional assumption that, after some point, all future dividends grow at a constant rate,  $g$ . The simplest approach is to assume that the constant growth rate begins immediately. In this case, Equation (6) above becomes a geometric progression that can be written as:<sup>69</sup>

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<sup>67</sup> SFG (2014), *The Fama-French model*, May.

<sup>68</sup> AER Draft Rate of Return Guideline, Explanatory Statement, p. 195.

<sup>69</sup> This expression is usually credited to Gordon and Shapiro (1956).



$$P_0 = \frac{d_1}{r_e - g}. \quad (7)$$

133. Rather than assuming that the constant growth rate begins immediately, it is common to use analyst forecasts of dividends in the short term and to then assume a constant growth rate thereafter. If dividends are explicitly forecasted for the first  $N$  periods, after which they are assumed to grow at a constant rate, the equation to be solved is:<sup>70</sup>

$$P_0 = \frac{d_1}{(1+r_e)^1} + \frac{d_2}{(1+r_e)^2} + \dots + \frac{d_n}{(1+r_e)^n} + \frac{d_n(1+g)}{r_e - g} \times \frac{1}{(1+r_e)^n}. \quad (8)$$

134. The specification set out in Equation (8) is known as a two-stage dividend discount model. One problem with this implementation of the model is that there is potentially an abrupt change from the growth rate implied by the analyst forecasts to the assumed perpetual growth rate. For this reason, it is more common in practice to use a three-stage version of the model. In this specification, the first stage consists of analyst forecasts of future dividends for a finite period as in Equation (8) and the third stage consists of constant growth in perpetuity, also as in Equation (8). However, rather than a potentially abrupt change from the growth rate implied by the analyst forecasts to the assumed perpetual growth rate, there is another stage whereby linear interpolation is used to smooth the transition between growth rates. For example, suppose that the (short-term) growth rate implied by analyst forecasts is 8% and that the assumed perpetual growth rate is 6%. Also suppose that analyst forecasts are available for three years and that a four-year transition period is to be used. In this case:

- a) The analyst forecasts would be used for the first three years;
- b) The dividend would be assumed to grow by 7.5% in year 4;
- c) The dividend would be assumed to grow by 7.0% in year 5;
- d) The dividend would be assumed to grow by 6.5% in year 6; and
- e) The dividend would be assumed to grow by 6.0% in year 7 and beyond.

135. In all of the implementations of the dividend discount model set out above, there are two unknowns – the required return on equity,  $r_e$ , and the growth rate,  $g$  – given an observed stock price and a set of analyst dividend forecasts. There are two ways of dealing with this joint estimation issue:

- a) Use other data to exogenously estimate the growth rate,  $g$ , which leaves only one unknown,  $r_e$ , to solve for; or
- b) Simultaneously estimate  $g$  and  $r_e$  to provide the best fit to the data.

136. In our companion report, SFG (2014 DDM),<sup>71</sup> we demonstrate how  $g$  and  $r_e$  can be simultaneously estimated to provide the best fit to the data, and we explain the merits of the simultaneous estimation approach.

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<sup>70</sup> The corresponding expression is set out in AER Appendix E, p. 115.

<sup>71</sup> SFG (2014), *Alternative versions of the dividend discount model and the implied cost of equity*, May.

137. We also demonstrate that if  $g$  is to be estimated exogenously, it should not be done in a way that results in the same estimate being used for all firms. The easiest way to demonstrate this point is via Equation (7) above. Note that that equation can be rearranged as follows:

$$r_e = \frac{d_1}{P_0} + g$$

138. That is, the required return on equity is the sum of the dividend yield and the assumed perpetual growth rate. It is clearly nonsensical to assume that the growth rate would be the same whether the firm pays a high level of dividends or a low level of dividends. Firms that pay smaller dividends reinvest a greater proportion of their earnings and would be expected, on average, to grow at a faster rate than firms that pay almost all of their earnings out as dividends.<sup>72</sup> This issue is well-known in the literature – the growth rate of dividends cannot possibly be independent of the level of dividends paid by the firm.<sup>73</sup> Higher dividends must mean less growth, other things equal.

139. Consequently, if a two-step approach is to be used (whereby the growth rate,  $g$ , is first estimated and then the required return on equity,  $r_e$ , can be solved for), the estimate of  $g$  must properly reflect (a) the extent to which corporate earnings are reinvested and (b) the return that is expected on those reinvested earnings – which is what causes the growth in earnings and dividends. That is, the estimate of  $g$  depends, at least in part, on the rate of return on reinvested earnings,  $r_e$ . In our view, the best way to break that circularity is to simultaneously estimate  $g$  and  $r_e$ , as explained in our companion report, SFG (2014 DDM).

#### Use in practice

140. SFG (2014 DDM) also summarise how the dividend discount model is used in practice to estimate the required return on equity for individual firms. In particular:

- a) Surveys indicate that the dividend discount model is commonly used by corporate practitioners for the purpose of estimating the cost of capital;
- b) Leading practitioner certification courses require a thorough understanding of the basis for the dividend discount model and the means by which it can be implemented;
- c) There is a rich academic literature on the dividend discount model and specifically on how the model can be best implemented by estimating  $g$  and  $r_e$  simultaneously; and
- d) In other jurisdictions, the dividend discount model is commonly used to estimate the required return on equity for the particular regulated firm. In the United States, the dividend discount model is known as the “discounted cash flow” approach and is the most commonly used approach for the purpose of estimating the required return on equity.

#### Conclusions and recommendations

141. In our view, the four models set out above all provide evidence that is relevant to the estimation of the required return on equity for the benchmark efficient entity. We reach this conclusion for the following reasons:

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<sup>72</sup> Reinvested earnings are expected to generate a positive return commensurate with the risk of the business. This in turn increases earnings and dividends. Thus, reinvestment drives growth.

<sup>73</sup> See, for example, Brealey, Myers and Allen (2011), pp. 82-83 and Berk and DeMarzo (2014), pp. 278-279.

- a) **All four models have a sound theoretical basis.** The Sharpe-Lintner CAPM, Black CAPM and Fama-French models are all based on the notion that the expected return on any asset is equal to a linear combination of the returns on an efficient portfolio and its zero covariance portfolio. This basic theoretical framework is the same for all three models, which differ only according to the way the efficient portfolio and the zero-covariance portfolio are determined. For example, under the Fama-French model the efficient portfolio is formed by combining three factor portfolios, whereas under the Sharpe-Lintner CAPM and Black CAPM the market portfolio (proxied by a stock market index) is assumed to be efficient. The Sharpe-Lintner CAPM further assumes that investors can borrow and lend as much as they like at the risk-free rate. The dividend discount model is based on the notion that the current stock price is equal to the present value of expected future cash flows (dividends).
- b) **All four models have the purpose of estimating the required return on equity as part of the estimation of the cost of capital.** This point is not weakened by the fact that the models can be used to inform other decisions as well. For example, the Sharpe-Lintner CAPM can also be used to compute “alpha” for the purpose of mutual fund performance evaluation.
- c) **All four models can be implemented in practice.** For all four models, there is a long history and rich literature concerning the estimation of model parameters. This literature has developed empirical techniques, constructed relevant data sets, and considered issues such as the trade-off between comparability and statistical reliability.
- d) **All four models are commonly used in practice.** Some form of CAPM is commonly used in corporate practice and by independent expert valuation practitioners. The Black CAPM is commonly used in rate of return regulation cases in other jurisdictions (where it is known as the “empirical CAPM”). The dividend discount model is also commonly used in rate of return regulation cases in other jurisdictions (where it is known as the “discounted cash flow” approach). The Fama-French model has become the standard method for estimating the required return on equity in peer-reviewed academic papers and its use to estimate the required return on equity is required knowledge in professional accreditation programs.

### 3. The required return on the market portfolio

#### Overview

142. One of the key parameters that is required for a number of models is the required return on the market portfolio. This can be estimated directly, or as the sum of the risk-free rate and the market risk premium. In this section of the report, we review the approach that is proposed in the Guideline and we set out our views about how to use all relevant evidence to provide the best possible estimate of the required return on the market.

#### Ex-imputation and with-imputation estimates

143. The Australian regulatory system (and the AER's post-tax regulatory model in particular) requires an estimate of the required return on the market (and/or MRP) that includes the assumed value of imputation credits. In particular, the AER uses the following approach:

- a) Estimate the total required return on equity (including the benefits of imputation credits) using a with-imputation estimate of MRP (that also includes the benefits of imputation credits);
- b) Estimate the return that shareholders obtain from their receipt of imputation credits; and
- c) Estimate the ex-imputation return that the firm is allowed to generate as the difference between (a) and (b), and set allowed revenues accordingly.

144. The various methods that are available for estimating the MRP produce an estimate that does not include the assumed value of imputation credits. Consequently, adjustments must be made to add the assumed value of imputation credits.

145. In the approaches that use historical stock return data, the adjustment for imputation credits is made by adding the assumed value of imputation credits to stock returns from the post-imputation (post-1987) period.

146. In the approaches that use current data to produce an ex-imputation estimate of the required return, the relationship between the ex-imputation credit return<sup>74</sup> and the with-imputation return<sup>75</sup> is well-known from Officer (1994):<sup>76</sup>

$$r_{e,ExIC} = r_{e,WithIC} \left[ \frac{1-T}{1-T(1-\gamma)} \right].$$

147. This equation is examined in detail in Gray and Hall (2006) and Gray and Hall (2008). Its use in the regulatory setting is explained by IPART (2013) and this same approach is embedded into the AER's post-tax revenue model and other models that model tax in the same way as the AER's post-tax revenue model.

148. Throughout this section of the report, we explain how any ex-imputation estimates are converted into the with-imputation estimates that are required for the regulatory process.

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<sup>74</sup> In (c) above.

<sup>75</sup> In (a) above.

<sup>76</sup> Officer (1994), Equation 7, p. 6.

### The approach proposed in the Guideline

149. The Guideline sets out an estimate of MRP. Consequently, the contemporaneous risk-free rate would have to be added to this estimate of MRP to provide an estimate of the required return on the market portfolio.

150. The Guideline proposes retaining the AER's previous approach for estimating MRP. In particular, the AER states that it proposes to:

consider a range of theoretical and empirical evidence—including historical excess returns, survey evidence, financial market indicators and dividend growth model (DGM) estimates<sup>77</sup>

which is:

consistent with our practice over the past five years where we have determined values for the MRP of 6.0 or 6.5 per cent.<sup>78</sup>

151. In the first stage of the process for estimating MRP, the Guideline proposes a range of 5% to 7.5%. This range is formed from:

- a) A lower bound set slightly above the range found by taking the geometric mean of historical excess returns. In particular, the Guideline materials state that:

The geometric mean historical excess return currently provides the lowest estimate of the MRP with a range of 3.6 to 4.8 per cent. However, as we discuss in more detail in appendix D, there are concerns with using the geometric mean as a forward looking estimate. Therefore, we consider a reasonable estimate of the lower bound will be above the geometric average. However, we give some weight to geometric mean estimates. Therefore, we consider a lower bound estimate of 5.0 per cent appropriate.<sup>79</sup>

and:

- b) An upper bound set according to the AER's dividend growth model estimate. In particular, the Guideline materials state that:

On the other hand, using our proposed models, the DGM currently provides the highest estimate of the MRP at about 7.5 per cent. We consider this an appropriate upper bound for the range.<sup>80</sup>

152. The Guideline then adopts a point estimate of 6.5% from within this range, concluding that:

Given the available information we consider 6.5 per cent an appropriate estimate of the MRP having regard to prevailing market conditions.<sup>81</sup>

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<sup>77</sup> AER Rate of Return Guideline, Explanatory Statement, p. 89.

<sup>78</sup> AER Rate of Return Guideline, Explanatory Statement, p. 89.

<sup>79</sup> AER Rate of Return Guideline, Explanatory Statement, p. 93.

<sup>80</sup> AER Rate of Return Guideline, Explanatory Statement, p. 93.

<sup>81</sup> AER Rate of Return Guideline, Explanatory Statement, p. 93.

153. In selecting the 6.5% point estimate, the AER has had regard to the information that was used to specify the range (as set out above) as well as additional information as follows:

- a) Arithmetic and geometric mean historical excess return estimates. The AER concludes (and has consistently concluded) that this evidence supports an MRP point estimate of 6%:

We consider 6.0 per cent an appropriate estimate of this source of evidence. This represents the starting point for our determination of a point estimate. We note that while a point estimate of 6.0 per cent is common, the choice of the averaging period and judgments in the compilation of the data result in a range for plausible estimates of about 5.0–6.5 per cent.<sup>82</sup>

- b) Various manifestations of the AER's dividend discount models, which the Guideline interprets as supporting an MRP range of 6.1% to 7.5%, with a mid-point of 6.8%:

these estimates, from two applications of the DGM and a range of inputs, suggest a range of 6.1–7.5 per cent is reasonable<sup>83</sup>

- c) Survey evidence, which the Guideline interprets as consistently supporting an MRP estimate of 6%:

surveys of market practitioners consistently support 6.0 per cent as the most commonly adopted value for the MRP.<sup>84</sup>

- d) Conditioning variables, which the Guideline interprets as providing “mixed results”;<sup>85</sup> and

- e) Recent decisions by Australian regulators and the Tribunal, which the Guideline interprets as supporting a 6% MRP.

154. The Guideline materials summarise the process for selecting an MRP point estimate as follows:

In determining an MRP of 6.5 per cent, we had regard to each source of evidence. Reflecting our assessment of the various sources of evidence, we give greatest consideration to historical averages followed by estimates of the MRP from DGMs and then surveys. We also give some consideration to conditioning variables and other regulators' estimates of the MRP.<sup>86</sup>

155. In particular, the Guideline places most weight on historical mean excess returns, followed by estimates from the AER's DGM. The Guideline materials note that whereas the historical mean returns might be more robustly estimated, they are estimates of the risk premium required in the average conditions in the market over the historical period, which may differ from the prevailing conditions in the market. Hence the consideration of DGM estimates:

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<sup>82</sup> AER Rate of Return Guideline, Explanatory Statement, p. 97.

<sup>83</sup> AER Rate of Return Guideline, Explanatory Statement, p. 94.

<sup>84</sup> AER Rate of Return Guideline, Explanatory Statement, p. 94.

<sup>85</sup> AER Rate of Return Guideline, Explanatory Statement, p. 94.

<sup>86</sup> AER Rate of Return Guideline, Explanatory Statement, p. 94.

We consider DGM estimates of the MRP a useful source of evidence. While the estimates are not as robust as historical averages they may reflect current market conditions more closely.<sup>87</sup>

156. The Guideline's point estimate is essentially drawn from the overlap between the AER's historical mean range of 5.0% to 6.5% and the AER's DGM range of 6.1% to 7.5%.
157. In our view, a number of issues need to be addressed in relation to the Guideline's estimation of MRP. In particular, in some places the Guideline relies on dated evidence that has now been updated, in other places it relies on inaccurate data that has since been corrected, and in other places it makes improper comparisons (e.g., where estimates that *include* the benefit of imputation credits and estimates that *exclude* that benefit are compared as equals). In the remainder of this section of the report, we review each piece of relevant evidence and discuss the relevant estimation issues.

### Historical mean excess returns

158. In this subsection of the report, we consider a range of issues that relate to the estimation of historical mean excess returns.

#### Arithmetic or geometric means

##### *Context*

159. There are two different types of average of historical excess returns. An arithmetic average is computed by adding the observations over the sample period and then dividing by the number of observations:

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

whereas a geometric average is computed as:

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

##### *The arithmetic average should be used to estimate expected returns*

160. The arithmetic average assumes that each historical year represents an independent observation of the return that the stock market might generate. For example, if in the historical data a return of 10% was observed in 2% of the historical years and a return of 12% was observed in 3% of the historical years, the arithmetic average says that in each year looking forward there is a 2% chance of observing a return of 10%, a 3% chance of observing a return of 12% and so on.
161. By contrast, the geometric average is designed to estimate what return an investor did receive on a past investment, not what returns an investor might receive in the future. For example, the geometric average over the last 10 years is a measure of the return that an investment made 10 years ago did earn over the 10-year period. The geometric mean assumes that the next 10 years will repeat the last 10 years exactly, so that the return over the next 10 years will be identical to the return over the last 10 years, which is clearly unreasonable.

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<sup>87</sup> AER Rate of Return Guideline, Explanatory Statement, p. 94.

162. It is for these reasons that the arithmetic mean is most commonly used when using historical data to estimate the MRP.

*Guideline approach*

163. The Guideline materials set out estimates of the historical mean excess return in Appendix D, Table D.2, p. 83. That table reports both arithmetic means (the simple average) and geometric means. The AER notes that:

There are some concerns with using the geometric mean as a forward looking estimate<sup>88</sup>

but nevertheless decides that:

We give some weight to geometric mean estimates.<sup>89</sup>

164. The Guideline materials go on to conclude that:

The best estimate of historical excess returns over a 10 year period is therefore likely to be somewhere between the geometric average and the arithmetic average of annual excess returns.<sup>90</sup>

165. The Guideline materials contain no reference for that assertion. The reasoning in the Guideline appears to be that (a) the arithmetic average is higher than the geometric average, therefore (b) the arithmetic average must over-estimate MRP. However, as set out below, it is generally accepted that the arithmetic average is an appropriate estimate of MRP and the geometric average is not.

*Advice from AER consultants*

166. In his advice to the AER, Lally (2013 MRP) provides an appendix that demonstrates the *opposite* of the assertion that the arithmetic average will be an upwardly biased estimate. In that appendix he sets out a test of whether each type of average is consistent with his NPV=0 principle. He concludes that:

The geometric mean fails this test whilst the arithmetic mean will satisfy it if annual returns are independent and drawn from the same distribution. So, if historical average returns are used, they should be arithmetic rather than geometric.<sup>91</sup>

167. Lally (2013 MRP) goes on to advise that:

I favour arithmetic over geometric averaging.<sup>92</sup>

168. Lally (2012 MRP) has also advised the AER that:

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<sup>88</sup> AER Rate of Return Guideline, Explanatory Statement, p. 93.

<sup>89</sup> AER Rate of Return Guideline, Explanatory Statement, p. 93.

<sup>90</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 83.

<sup>91</sup> Lally (2012 MRP), p. 40.

<sup>92</sup> Lally (2012 MRP), p. 28.



if historical average returns are used, they should be arithmetic rather than geometric averages.<sup>93</sup>

169. McKenzie and Partington (2011) advise the AER that:

the arithmetic average is arguably appropriate when attempting to find the best representation of expectations that are formed based on historical data,<sup>94</sup>

and that:

a geometric average is clearly inappropriate for the purposes of characterising expectations.<sup>95</sup>

170. They also advise that:

The arithmetic mean is also consistent with the assumptions of asset pricing models such as the CAPM.<sup>96</sup>

and that:

Arithmetic averages are certainly more popular.<sup>97</sup>

171. McKenzie and Partington (2011) go on to note that it might be possible to make an adjustment to the arithmetic mean to reflect the fact that the forward-looking market volatility might differ from the historical market volatility, but conclude that:

Until such time as the bias inherent in the volatility adjustment process is more fully understood, **we recommend using the arithmetic average.**<sup>98</sup>

172. Two months later, McKenzie and Partington (2012 MRP) updated their advice to the AER, recommending that:

In our opinion there is no indisputable single best estimator for long run returns. The widespread current practice is to use unadjusted geometric and arithmetic averages. Given the current state of knowledge, we see no strong case to depart from this common practice and recommend that (sic) the use of both of these metrics, tempered by an understanding of their inherent biases.<sup>99</sup>

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<sup>93</sup> Lally (2012 MRP), p. 5, repeated at pp. 32 (twice) and 34.

<sup>94</sup> McKenzie and Partington (2011), Paragraph 31; McKenzie, M. and G. Partington, 2011, *Equity Market Risk Premium*, Report for the AER, 21 December.

<sup>95</sup> McKenzie and Partington (2011), Paragraph 34.

<sup>96</sup> McKenzie and Partington (2011), Paragraph 31.

<sup>97</sup> McKenzie and Partington (2011), Paragraph 31.

<sup>98</sup> McKenzie and Partington (2011), Paragraph 34, emphasis added.

<sup>99</sup> McKenzie and Partington (2012 MRP), pp. 8-9.

173. McKenzie and Partington (2012 MRP) do not suggest precisely how a regulator should “use unadjusted geometric and arithmetic averages...tempered by an understanding of their inherent biases,” other than to note that one suggestion is that 10% weight might be applied to the geometric mean and 90% weight applied to the arithmetic mean.<sup>100</sup>
174. The Guideline materials do not reference any of the advice that has been received from either of the AER’s consultants on the question of arithmetic vs. geometric averages.

*Other relevant evidence*

175. The Guideline materials discuss the practice of other regulators in relation to other aspects of MRP estimation, but are silent on the approach that other regulators take to the issue of arithmetic vs. geometric averages. For completeness, we note that three regulators have specifically considered this issue and that:
- a) IPART uses arithmetic averages only;
  - b) The ERA uses arithmetic averages only; and
  - c) The QCA uses arithmetic averages only.
176. Other relevant evidence on this issue includes a Harvard Business School Case that compares the use of arithmetic and geometric means of historical excess stock returns. The instructor solutions to that case note that it is the *expected* annual return that is relevant when estimating MRP and that:

Students focusing on the geometric average will argue that it is the appropriate growth rate of an investment...However, the arithmetic average is a better measure of the *expected* return on an investment.<sup>101</sup>

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

The arithmetic average annual return is the correct measure of the expected annual return.<sup>102</sup>

*Tribunal comments*

178. The Guideline materials note that the AER’s approach has always been to have regard to both arithmetic and geometric means and that “[t]he Tribunal has found no error with this approach.”<sup>103</sup>
179. In the relevant *Envestra* Case, the Tribunal noted that it did not need to decide the arithmetic vs. geometric mean issue, but indicated that it would make “some comments.”<sup>104</sup> The Tribunal then made no formal conclusion on the issue, stating that:

The material before the Tribunal in this matter does not allow it to decide this issue. Rather, it is a matter that the AER should consider in consultation with service providers and other interested parties.<sup>105</sup>

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<sup>100</sup> McKenzie and Partington (2012 MRP), p. 8.

<sup>101</sup> HBS Marriott Corporation Case, Instructor Guide.

<sup>102</sup> HBS Marriott Corporation Case, Instructor Guide.

<sup>103</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 83.

<sup>104</sup> Application by Envestra Ltd (No 2), ACompT 3, Paragraph 147.

180. That is, whereas the Tribunal has “found no error” with the use of geometric means, it has not endorsed their use either.

181. The Tribunal goes on to note that for any particular historical period, the geometric mean will be less than the arithmetic mean, except for the case where the return is constant over the period, in which case the two means will be equal.

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

imagine a portfolio that is worth 100 at the beginning of year one. Suppose that in year one the portfolio falls to 80, a -20% return, before returning to 100 in year two. The cumulative two year return is zero, whereas the average annual return is  $(-0.2 + 0.25)/2 = 2.5\%$ .<sup>106</sup>

183. An individual who invested \$100 in this portfolio at the beginning of the two-year period has clearly earned a zero return over the two years. There is obviously no dispute about this. But that is not the relevant question in terms of estimating the MRP to apply to a forward-looking period.

184. To see this, consider the following simple example which is based on the Tribunal’s illustration above. Suppose that the historical data consists of two years in which the returns were -20% and +25%, respectively. Also suppose that we want to estimate the expected return over the next two years. There are two ways to interpret the historical data:

- a) Assume that the historical data will repeat in exactly the same sequence in the future, so that the returns over the next two years will be -20% and 25% respectively, with 100% probability; or
- b) Assume that the historical data tells us that for each future year there is a 50% probability of a return of -20% and a 50% probability of a return of 25%. That is, for each year in the future, returns occur with the same probability as has been observed in the past.

185. The former interpretation (which is clearly unreasonable) implies the use of the geometric mean, and the latter (standard) interpretation implies the use of the arithmetic mean. The standard arithmetic interpretation is set out in Table 6 below. In this case, each year there is a 50/50 chance of the return being -20% or 25%, in which case there are four possible outcomes over the two-year forecast period.

**Table 6. Possible sequences of two-year returns in Tribunal example**

Year 1	Year 2	Final value of initial \$100 investment	Probability
25%	25%	156.25	0.25
25%	-20%	100	0.25
-20%	25%	100	0.25
-20%	-20%	64	0.25

186. First note that the arithmetic mean return from the historical data is:

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<sup>105</sup> Application by Envestra Ltd (No 2), ACompT 3, Paragraph 155.

<sup>106</sup> Application by Envestra Ltd (No 2), ACompT 3, Paragraph 150.

$$\frac{-20\% + 25\%}{2} = 2.5\% .$$

187. Now note that the expected value of an initial \$100 investment is:

$$0.25 \times 156.25 + 0.25 \times 100 + 0.25 \times 100 + 0.25 \times 64 = 105.0625 ,$$

which is identical to the initial investment growing at the arithmetic mean return:

$$100(1.025)^2 = 105.0625 .$$

*Summary of evidence on arithmetic and geometric means*

188. As set out above:

- a) The arithmetic mean is consistent with the assumption that each year in the historical sample provides an indication of what the future return might be – that for each year in the future, the return is equally likely to be equal to any of the historical returns; and
- b) The geometric mean is consistent with the assumption that the historical data will repeat in exactly the same sequence in the future.

189. IPART, the ERA and the QCA use arithmetic means only.

190. Lally (2012) has advised the AER that arithmetic means should be used.

191. McKenzie and Partington (2011) advised the AER that they “recommend using the arithmetic average.” Even after the AER commissioned a supplementary report two months later, McKenzie and Partington (2012 MRP) did not suggest that the geometric mean should receive more than 10% weight.

192. For the reasons set out above, our view is that the arithmetic mean should be used and the geometric mean should not.

[Corrected historical excess returns](#)

193. The AER has traditionally relied on historical excess returns compiled by Brailsford, Handley and Maheswaran (2008, 2012), updated from time to time by Associate Professor Handley in reports commissioned by the AER.

194. In a submission to the AER in June 2013, NERA (2013)<sup>107</sup> identified and corrected a number of inaccuracies in the adjustments that were made in the Brailsford et al (2008, 2012) calculations. In particular, the data for part of the period examined by Brailsford et al were sourced from Lamberton (1961). The Lamberton data reported the mean dividend yield where the mean was taken only over those companies that paid dividends. Consequently, it overstated the dividend yield in that it excluded from the calculation those companies that did not pay any dividends at all.<sup>108</sup> This led

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<sup>107</sup> NERA (2013), *The market, size and value premiums*, June.

<sup>108</sup> This is not a criticism of Lamberton (1961), who was simply reporting the average yield for dividend-paying companies. The point here is that some adjustment to his data is required (for non-dividend-paying companies) if it is to be used for the purposes of estimating the historical MRP.

Brailsford et al to adjust all of the Lamberton data points using an adjustment based on the proportion of firms that paid no dividends in 1966. NERA show that the proportion of firms that paid no dividends in 1966 was materially different to the proportion that paid no dividends during each of the years actually covered by the Lamberton data. That is, the Brailsford et al adjustment is inaccurate in such a way that it creates a systematic downward bias.

195. NERA (2013) correct the bias in the Brailsford et al (2008, 2012) estimates and go on to make a more accurate and appropriate adjustment according to the proper contemporaneous proportion of non-dividend-paying stocks for each year of the Lamberton data period.<sup>109</sup>

196. The Guideline does not employ the corrected data,<sup>110</sup> citing the following three reasons:

- a) “The original data is published in a peer-reviewed academic journal”;<sup>111</sup>
- b) “The original data (including adjustment in early years) is supplied by a credible source (the ASX)”;<sup>112</sup> and
- c) The AER has not yet tested NERA’s submissions.<sup>113</sup>

197. With respect to the first reason, Brailsford et al (2012) provide an annual time series of historical information in an appendix, but that appendix does not include dividend information nor information about the adjustment made to it. The dividend yield adjustment is explained in Brailsford et al (2008). Even if all of the relevant information was set out in a journal, that would not substantiate the information as fact, never to be corrected or improved upon. Rather, the correction of the inaccuracy allows the field to move one more incremental step towards the best estimate of the cost of capital.

198. With respect to the second reason, the data that has been supplied by Lamberton (1961) is not in question at all – what is in question is the adjustment that Brailsford et al have applied to it. Lamberton provides data on the average dividend yield for dividend-paying stocks. Brailsford et al make an adjustment to that data to account for non-dividend-paying stocks. The “adjustment in early years” was performed by Brailsford et al, not by any ASX source, as the Guideline materials claim. NERA (2013) simply point out that the Brailsford et al adjustment was inaccurate in such a way as to cause a downward bias in the mean estimate. Indeed, the NERA adjustment is based on the same original sources that Lamberton (1961) used, whereas Brailsford et al simply multiply all of the Lamberton dividend yields by a constant 0.75.<sup>114</sup>

199. Finally, the fact that the AER has not (since the NERA submission in June 2013) yet “had the opportunity”<sup>115</sup> to satisfy itself of the inaccuracy of the Brailsford et al data is not a strong reason to support the continued use of the inaccurate data.

200. In our view, there is no legitimate reason for refusing to use the more accurate data provided by NERA (2013).

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<sup>109</sup> We review this correction and update the data through to the end of 2013 in the following sub-section of this report.

<sup>110</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 83.

<sup>111</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 83.

<sup>112</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 83.

<sup>113</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 84.

<sup>114</sup> See NERA (2013), pp. 6-17.

<sup>115</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 84.

Current estimates

201. The Guideline materials set out estimates of the historical mean excess return in Appendix D, Table D.2, p. 83. These estimates are based on a theta estimate of 0.7 and use data through to the end of 2012. We have updated the relevant data series to the end of 2013, based on the more accurate data compiled by NERA (2013), and report the updated estimates in Table 7 and Figure 17 below.

**Table 7**  
**Mean excess return by sampling period**

Period	Mean excess return
1883 to 2013	6.8%
1937 to 2013	6.1%
1958 to 2013	6.7%
1980 to 2013	6.7%
1988 to 2013	6.1%

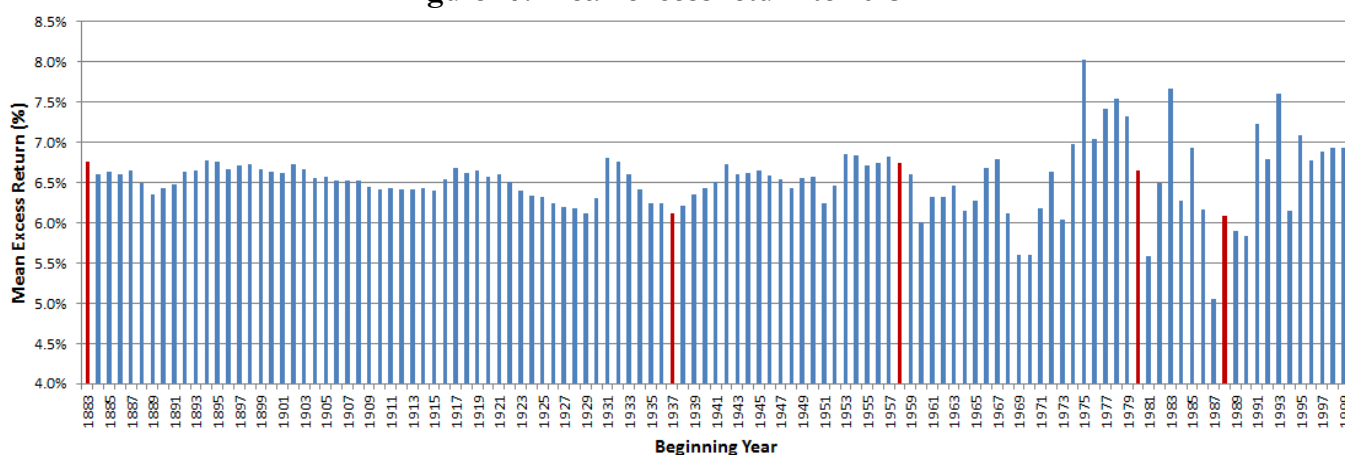
Source: NERA data through to 2011, updated from RBA publications.  
These values include imputation credits (valued at 70% of face value) on franked dividends paid since 1987.

202. Table 7 shows that the mean excess return from every one of the sample periods exceeds 6%. The average estimate over the five sample periods is 6.5%.<sup>116</sup>

203. Figure 17 shows the mean excess return through to 2013 as the beginning year of the sample period varies. That is, the first bar represents the mean excess return from 1883 to 2013, the second pertains to the period 1884 to 2013, and so on. The five start dates used in the Guideline materials are highlighted. We note that the volatility of these estimates increases from left to right as the sample size becomes smaller. Of all of the estimates set out in Figure 17:

- a) 95% are greater than 6%; and
- b) 58% are greater than 6.5%.

**Figure 17: Mean excess return to 2013**



Source: NERA data through to 2011, updated from RBA publications.  
The five start dates used in the Guideline materials are highlighted in red.

<sup>116</sup> The mean over the five periods is essentially a weighted-average wherein more recent periods receive progressively more weight than older periods.

204. Based on the estimates set out in Appendix D, Table D.2, p. 83, the Guideline materials conclude that:

█ The arithmetic average provides a range of 5.7 to 6.4 per cent.<sup>117</sup>

205. Our results above correct the inaccuracy in the Brailsford et al (2008, 2012) dividend yield adjustment and update the data to the end of 2013. The range of estimates from the five start years specified in the Guideline materials is 6.1% to 6.8%. The evidence set out above is inconsistent with the conclusion that the historical data supports an estimate of the market risk premium of 6% when theta is set to 0.7.

206. In our view, all of the available data should be used to maximise the statistical reliability of the estimate of the average excess return. Data periods that begin in the 1980s are too short to provide any sort of meaningful estimate. For example, when theta is set to the Guideline value of 0.7, a sample period beginning in 1980 would have produced MRP estimates of 7.6% in 2007, 5.7% in 2008 and 6.7% in 2009. We recognise that there is an argument that more recent data might be more representative, and that the reliability of the data improved in 1958. However, Table 8 shows that the MRP estimates are not materially different even if the data set is constrained to post-1958 data only. Consequently, we adopt historical MRP estimates based on the entire data set in the remainder of this report.

**Table 8**  
**Current estimates of MRP from historical data: Ibbotson approach**

	Theta=0.35	Theta=0.7
Entire data set	6.63%	6.76%
Post-1958 data only	6.45%	6.74%

Source: NERA data through to 2011, updated from RBA publications.

#### Interpretation of historical mean excess return

207. In any long historical period it is likely that there will be a range of market conditions and consequently the market risk premium will be higher in some market conditions and lower in other market conditions. In this regard, the Guideline materials note that:

█ Evidence suggests the MRP may vary over time. In their advice to the AER, Professor Lally and Professor Mackenzie and Associate Professor Partington have expressed the view that the MRP likely varies over time.<sup>118</sup>

208. The historical mean excess return is, by definition, an estimate of the excess return in the average market conditions over the sampling period. That is, the historical mean estimates in Table 7 above are estimates of the average risk premium over the relevant sampling periods. The estimates in that table range from 6.1% to 6.8%. This does *not* imply that the MRP could be as low as 6.1% in some market conditions or as high as 6.8% in other market conditions. What it *does* imply is that a point estimate for the MRP in *average* market conditions should come from the range of 6.1% to 6.8%.

<sup>117</sup> AER Rate of Return Guideline, Explanatory Statement, p. 93.

<sup>118</sup> AER Rate of Return Guideline, Explanatory Statement, p. 91.

209. Such an estimate of the MRP in *average* market conditions could inform an estimate of the MRP in *prevailing* market conditions after consideration of the extent to which the prevailing conditions might differ from the average conditions.

#### Implications of using the historical mean excess return to estimate MRP

210. If estimated over a long sample period, the historical mean excess return will be very slow to move as each additional year of data becomes available – indeed, it will be effectively constant. For example, the AER has traditionally used 6% as an estimate of the historical mean excess return and continues to adopt that estimate.<sup>119</sup>

211. If a constant historical mean estimate is used to estimate the MRP for the Sharpe-Lintner CAPM, the implication is that required returns on equity are at a minimum when government bond yields are at their minimum. This is because the required return on the average firm would be estimated as the constant historical mean plus the prevailing government bond yield.

212. Government bond yields tend to fall during financial crises and have been at historical lows since the onset of the global financial crisis (**GFC**). Consequently, setting the MRP equal to a constant historical mean would imply that the onset of the GFC caused the cost of equity across the economy to also fall to historical lows, which is clearly unreasonable.<sup>120</sup>

213. This point was made in the CEG (2013) submission to the AER's Guideline process. They show the prevailing government bond yields at the time of the AER's final determinations since 2001 in a figure that is reproduced as Figure 18 below. The onset of the global financial and European debt crises resulted in dramatic falls in government bond yields. If beta and MRP are fixed to constant numbers, the allowed return on equity is computed by adding a constant risk premium to the government bond yield. For example, if beta is fixed at 0.8 and MRP is fixed to 6%, the allowed return on equity is a fixed 4.8% above the prevailing government bond yield. Thus, when government bond yields fall dramatically, the allowed return on equity falls by the same amount. Consequently, this approach implies that the onset of the GFC and European debt crises resulted in investors dramatically *reducing* their required return on equity – which is clearly implausible.

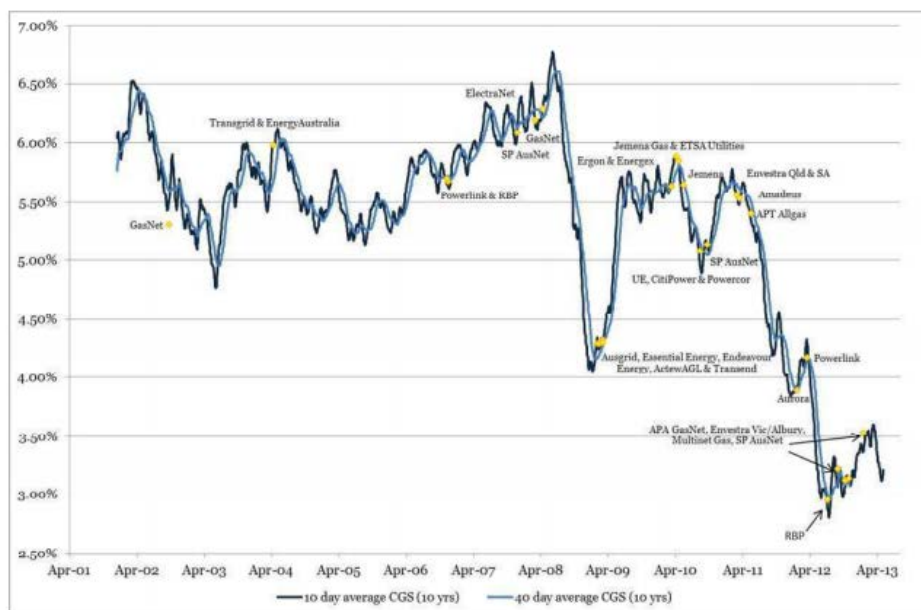
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<sup>119</sup> AER Rate of Return Guideline, Explanatory Statement, p. 93.

<sup>120</sup> In its Explanatory Statement (p. 81) the AER questions whether it is correct to say that government bond yields fell to historically low levels with the onset of the GFC, on the basis that pre-war government bond yields were similar to post-GFC yields. Appendix 3 to this report shows why the comparison to pre-war yields is inappropriate. In any event, the simple point being made here is that government bond yields fell materially with the onset of the GFC and it would be clearly unreasonable to conclude that a global financial crisis would result in a material decline in the required return on equity.



**Figure 18: Government bond yields at the time of AER determinations**



Source: Regulator's decisions, CEG analysis. Note that 2009 decision for Energy Australia et al is before amendment by the ACT.

Source: CEG, 2013, *Estimating the return on the market*, June, Figure 1, p. 29.

Conclusions in relation to historical mean excess returns

214. Our conclusions in relation to historical mean excess returns are:

- a) The arithmetic mean should be used and the geometric mean should not;
- b) The data should be updated to include 2013 and the more accurate dividend yield adjustment provided by NERA (2013);
- c) Historical mean excess returns produce an estimate of the MRP in *average* market conditions and could inform an estimate of the MRP in *prevailing* market conditions after consideration of the extent to which the prevailing conditions might differ from the average conditions;
- d) Government bond yields tend to fall during financial crises and have been at historical lows (relative to the last 50 years) since the onset of the GFC. Consequently, setting the MRP equal to a constant historical mean would imply that the onset of the GFC caused the cost of equity across the economy to also fall to record lows, which is clearly implausible. In our view, an estimate of the required return on equity that falls to historical lows during a severe financial crisis is neither commensurate with the prevailing conditions in the market nor reflective of the efficient financing costs of a benchmark efficient entity; and
- e) We adopt historical MRP estimates based on the entire available data set (noting that the estimates are not materially different if post-1958 data is used). The relevant estimates are as follows:

	<b>Theta=0.35</b>	<b>Theta=0.7</b>
Required return on the market <sup>a</sup>	10.75%	10.87%
Market risk premium	6.63%	6.76%

a: Based on a risk-free rate of 4.12%  
 Figures rounded to two decimal places.

## The Wright approach

### Context

215. The Guideline materials observe that there are two ways to estimate the required return on the market (or for the average firm) – each at the end point of a theoretical spectrum:

- a) At one end of the spectrum, one could assume that the MRP is constant over time, in which case the required return on the market would be estimated as the sum of the constant MRP and the prevailing risk-free rate. This approach is often called the *Ibbotson* approach in the regulatory setting, and was discussed in the previous sub-section above; and
- b) At the other end of the spectrum, one could assume that the required return on the market is constant, in which case the MRP could be estimated by subtracting the prevailing risk-free rate from that constant required return. This approach has become known as the *Wright* approach in the Australian regulatory setting.<sup>121</sup>

216. That is, the Wright approach is not a model for estimating the required return on equity that is an alternative to the CAPM. Rather, it is a method for estimating the required return on the market and the MRP (which is simply the required return on the market less the risk-free rate). These estimates can then be used in any asset pricing model where those parameters are required. The Guideline recognises that the Wright approach is “an alternative implementation of the Sharpe-Lintner CAPM,”<sup>122</sup> but proposes that it should be used only as a final reasonableness check on the overall allowed return on equity.<sup>123</sup>

217. In summary, under the Ibbotson approach, the required return on the market is assumed to vary up and down one-for-one with changes in the risk-free rate, and under the Wright approach the required return on the market is assumed to be constant.

218. The Guideline materials recognise that it is unlikely that either of these extreme cases perfectly reflects reality, in which case some weight should be given to both:

our approach to estimating the expected return on equity will consider estimates of the Sharpe–Lintner CAPM that assume both no consistent relationship, and a negative relationship between the MRP and risk free rate.<sup>124</sup>

### Implementation of the Wright approach

219. The Wright approach assumes that the real required return on the market (or average stock) is constant. This approach implies that the real risk-free rate and the MRP are perfectly negatively correlated – any increase in the real risk-free rate is exactly offset by a corresponding decrease in the MRP such that the real required return on the market remains constant.

220. The Wright approach involves the following steps:

- a) Estimate the real return on the market portfolio each year for some historical period using the Fisher relation:

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<sup>121</sup> This terminology stems from a submission to the 2012 Victorian Gas Distribution Review by Professor Stephen Wright – Wright, S., 2012, *Review of risk free rate and cost of equity estimates: A comparison of UK approaches with the AER*, October.

<sup>122</sup> AER Rate of Return Guideline, Explanatory Statement, p. 52.

<sup>123</sup> AER Rate of Return Guideline, p. 14.

<sup>124</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix B, p. 26.

$$r_{m,t}^{real} = \frac{1 + r_{m,t}^{nominal}}{1 + inflation_t} - 1;$$

- b) Take the average real market return over the relevant historical period; and
- c) Use the Fisher relation, and a contemporaneous estimate of expected (forward-looking) inflation to obtain an estimate of the nominal required return on the market:

$$r_m^{nominal} = \left(1 + \overline{r_m^{real}}\right) \left(1 + E[inflation]\right) - 1.$$

221. The Wright approach produces a direct estimate of the required return on the market. The implied MRP can be determined by deducting the contemporaneous estimate of the risk-free rate.

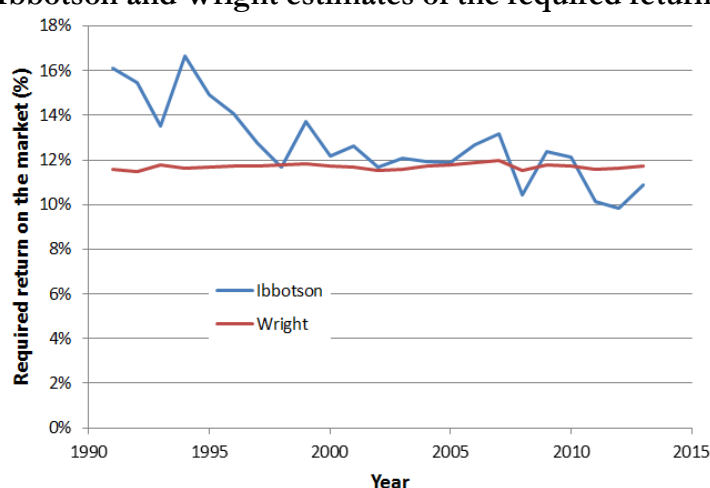
#### Comparison of the Ibbotson and Wright approaches

222. The key differences between the Ibbotson and Wright approaches are illustrated in Figure 19 and Figure 20 below. These figures show data from 1991 because the Wright approach requires an estimate of expected inflation and inflation has been contained and stable since that time.

223. The Ibbotson approach produces a very stable estimate of MRP,<sup>125</sup> in which case the required return on the market varies directly with the risk-free rate. By contrast, the Wright approach produces a very stable estimate of the required return on the market,<sup>126</sup> in which case the MRP varies inversely with the risk-free rate.

224. Figure 19 shows that the Wright estimate of the required return on the market is stable throughout the period. By contrast the Ibbotson approach implies that equity is more expensive than average during economic expansions and bull markets (the late 1990s and mid 2000s) and cheaper than average during financial crises (the pronounced reduction in 2008).

**Figure 19**  
**Comparison of Ibbotson and Wright estimates of the required return on the market**

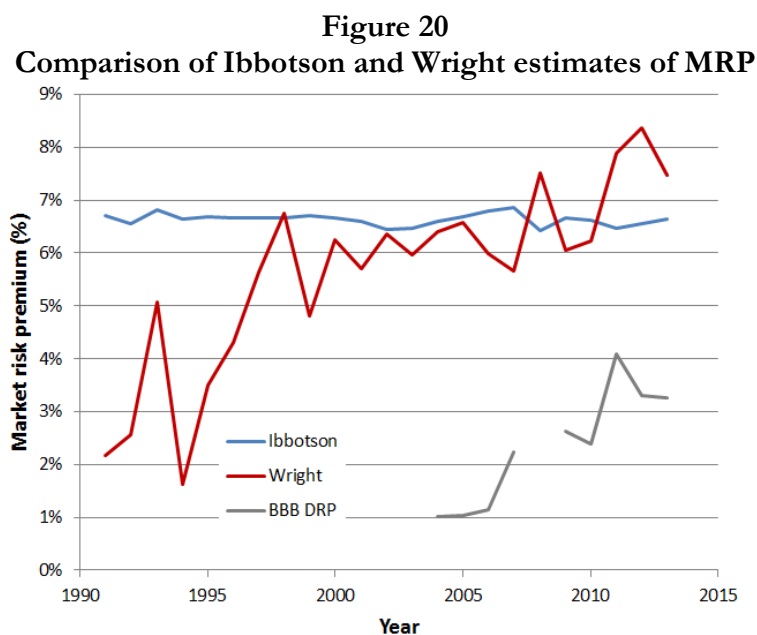


Source: SFG calculations. Theta set to 0.35.

<sup>125</sup> Changing each year only due to the addition of another year of data when estimating the mean historical excess return.

<sup>126</sup> Changing each year only due to the addition of another year of data when estimating the mean historical real return.

225. Figure 20 shows that the Wright estimate of the market risk premium varies over different market conditions – the implied MRP is lower than average during economic expansions and bull markets (the late 1990s and mid 2000s) and higher than average during financial crises (the pronounced increase in 2008). This is consistent with the notion that the perceived amount of risk and the price of risk fall during expansions and rise during crises. By contrast, the Ibbotson approach implies that the MRP is essentially constant across all market conditions. Figure 20 also shows the RBA estimate of the 10-year BBB debt risk premium for the periods where that figure is available.<sup>127</sup> Clearly, the Wright estimates of MRP correspond more closely with the RBA estimates of the debt risk premium.



Source: SFG calculations, RBA. Theta set to 0.35.

### Recommended use of the Wright approach

226. In his advice to the AER, Lally (2012 MRP) implies that the Ibbotson and Wright estimates of MRP should both be considered in the same way – he includes these two estimates in his set of relevant estimates for the AER to consider.<sup>128</sup>

227. In his more recent advice to the QCA, Lally (2013 QCA) confirms his view that the Wright estimate of MRP is one of the estimates that should be considered, along with the Ibbotson estimate and other relevant estimates:

I consider that the set of methodologies considered by the QCA should be augmented by one involving estimating the expected real market cost of equity from the historical average actual real return and then...converting the estimate of the expected real market cost of capital to its nominal counterpart.<sup>129</sup>

228. In recommending that the Wright approach should be used, Lally (2013 MRP) recognises that the two approaches set out above are the end points of a spectrum. The first assumes that the MRP is constant so that the required return on the market varies one-for-one with the risk-free rate. The

<sup>127</sup> See <http://www.rba.gov.au/statistics/tables/xls/f03hist.xls?accessed=2014-05-14-09-26-20>. The 2008 figure is an outlier that is omitted on the basis that there were no 10-year BBB bonds available at that time.

<sup>128</sup> Lally (2012), p. 7.

<sup>129</sup> Lally (2013), p. 3.

second assumes that the (real) expected return on the market is constant so that the MRP varies one-for-one with the risk-free rate. Lally (2013 MRP) concludes that the evidence on which end of the spectrum should be preferred is “not decisive”<sup>130</sup> and consequently recommends that both approaches should be given some weight.

229. Lally (2013 MRP) also notes that the Wright approach is used extensively by UK regulators.<sup>131</sup>

#### The Guideline’s use of the Wright approach

230. The Guideline materials conclude that the Wright approach produces relevant evidence that should be considered when determining the allowed return on equity. In setting out reasons for having regard to the Wright approach, the Guideline materials note that the Wright approach is likely to produce allowed returns on equity that are more stable over time than those produced by a mechanistic implementation of the Sharpe-Lintner CAPM:

...the Wright approach (for implementing the Sharpe–Lintner CAPM) will result in estimates of the return on equity that may be relatively stable over time. The informative use of these implementations of the Sharpe–Lintner CAPM...is expected to lead to more stable estimates of the return on equity than under our previous approach.<sup>132</sup>

231. The Guideline materials also note that more stability in the allowed return on equity was favoured by a broad cross section of stakeholders and is more likely to properly reflect the efficient financing costs of a benchmark efficient entity.<sup>133</sup>

232. The Guideline materials also conclude that the Wright approach has the attractive features of transparency and replicability – relative to a mechanistic implementation of the CAPM:

...we consider that implementing the Wright approach is more transparent and replicable than our standard implementation of the Sharpe–Lintner CAPM.<sup>134</sup>

233. Having decided that the Wright approach is relevant, the AER has determined that it will have regard to that approach to “inform the overall return on equity”<sup>135</sup> rather than to inform its estimate of MRP. That is, the Ibbotson method of processing the historical data is directly used to set the point estimate for the allowed return on equity and the Wright method of processing the historical data is relegated to be one of five things that will be considered when deciding whether or not to maintain the initial estimate of the required return on equity. It seems highly unlikely that the Wright approach, used in this way, would ever have a tangible effect on the allowed return on equity. Consistent with this view is the fact that, in the sample implementation in the Guidelines, there is no reference to the use of the Wright approach. There is also no mention of the Wright approach in the AER’s recent transitional decisions, which apply the Guideline.<sup>136</sup>

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<sup>130</sup> Lally (2013 MRP), p. 6.

<sup>131</sup> Lally (2013 MRP), p. 13.

<sup>132</sup> AER Rate of Return Guideline, Explanatory Statement, p. 66.

<sup>133</sup> AER Rate of Return Guideline, Explanatory Statement, p. 66.

<sup>134</sup> AER (2013), Draft Rate of Return Guideline, Explanatory Statement, p. 186.

<sup>135</sup> AER Guideline, p. 14.

<sup>136</sup> For example, the TransGrid and Transend Transitional Transmission Determinations 2014-15 contain no reference to the Wright approach nor to any cross checks whatsoever.

234. Using the parameter estimates set out in the Guideline materials,<sup>137</sup> and a risk-free rate of 4%, the AER's point estimate for the allowed return on equity for the benchmark firm is:<sup>138</sup>

$$r_e = r_f + \beta \times MRP = 4\% + 0.7 \times 6.5\% = 8.55\%.$$

235. The Guideline's estimate of the nominal required return on equity from the Wright approach is 9.6%<sup>139</sup> – a material increase of more than 12%. The Guideline materials provide no indication of how, or even whether, this evidence would be used to “inform the overall cost of equity.” It is clearly materially higher than the default estimate, but it is not at all clear how it could have any tangible effect.

236. In our view, the Wright approach should be one of the techniques that are used to inform the estimate of MRP, as recommended by Lally (2012 MRP, 2013 MRP). The practice under the Guideline thus far is that the evidence that is said to be relegated to a final round of reasonableness cross-checks is, in fact, not used at all. In our view, the Wright approach produces relevant evidence and the appropriate place to have regard to that evidence is in informing the estimate of the required return on the market and MRP. We also note that this is the manner in which UK regulators have regard to the Wright approach.

#### Current estimates from the Wright approach

237. We have computed the average real return on the market portfolio using:

- a) Data from 1883 to 2013, inclusive;
- b) The NERA (2013) correction for the inaccuracy of the Brailsford et al (2012) dividend yield adjustment; and
- c) An estimate of the value of distributed imputation credits of 0.7, consistent with the Guideline.

238. The average real return on the market portfolio (including imputation credits with theta set to 0.7) is 9.10%. If expected inflation is set to 2.5% (the mid-point of the RBA target band), a 9.10% real return is consistent with a nominal return of 11.83% (using the standard Fisher relation). That is, if the current real return is expected to be the same as the long-run historical average, the current nominal required return is 11.83%. If the current risk-free rate is set to 4.12%, the implied MRP is 7.71%.

239. If theta is set to 0.35 the Wright approach produces a current estimate of MRP of 7.59%.

#### Conclusions on the Wright approach

240. There are two approaches for estimating MRP from the historical data. The Ibbotson approach assumes that the MRP is constant across all market conditions and estimates the MRP as the mean historical excess return. At the other end of the spectrum, the Wright approach assumes that the required return on the market is constant and estimates the MRP by subtracting the contemporaneous risk-free rate.

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<sup>137</sup> Beta of 0.7 and MRP of 6.5%.

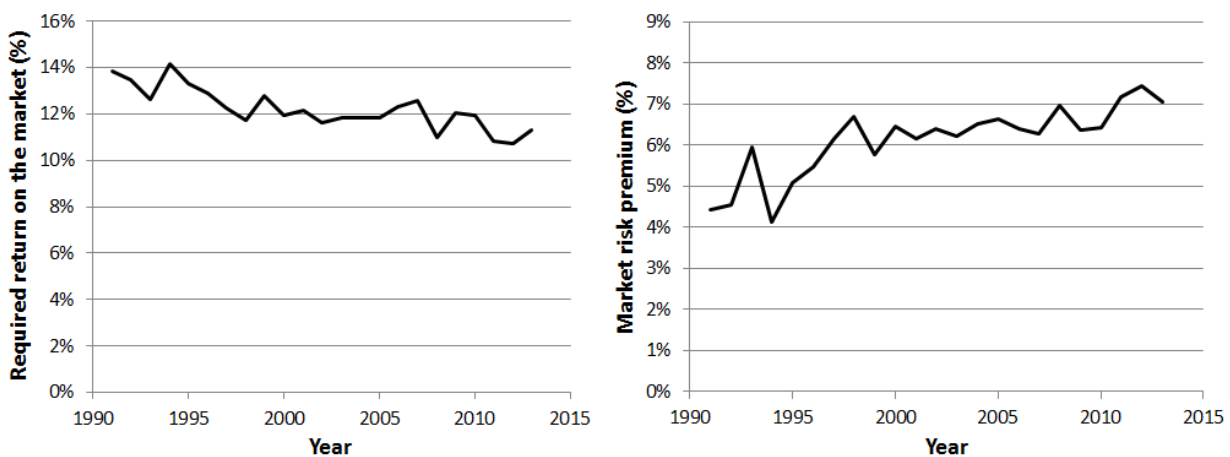
<sup>138</sup> All parameter inputs in this equation are based upon figures in the Guideline materials because the point is that the Guideline materials are unclear about what consideration is given to the Wright approach.

<sup>139</sup> Using an MRP estimate of 8%, as set out in Appendix D, p. 104.

241. In our view, the Ibbotson and Wright approaches should both be used to inform the estimate of MRP for use in a Sharpe-Lintner CAPM foundation model. Applying equal weight to each of the approaches<sup>140</sup> for processing the historical data produces the outcomes in Figure 21 below. The composite approach produces current estimates of the required return on the market that are lower than the recent average and estimates of the market risk premium that are higher than the recent average. Both of these outcomes are due to the recent decline in government bond yields:

- a) Under the Ibbotson approach a decline in government bond yields has no direct effect on the estimate of MRP and downward effect on the estimate of the required return on the market; and
- b) Under the Ibbotson approach a decline in government bond yields has an upward effect on the estimate of MRP and no direct effect on the estimate of the required return on the market.

**Figure 21**  
**Composite Ibbotson/Wright estimates of**  
**the required return on the market and MRP**



242. Moreover, Lally (2012 MRP, 2013 MRP) also recommends that the Ibbotson and Wright approaches should both be used to estimate MRP, and the Wright approach is also used extensively by UK regulators.

243. The Wright approach currently produces the following estimates:

	<b>Theta=0.35</b>	<b>Theta=0.7</b>
Required return on the market	11.71%	11.83%
Market risk premium	7.59%	7.71%

<sup>140</sup> We consider an equally weighted approach on the basis that these two approaches form ends of a theoretical spectrum. Whereas the Ibbotson approach has produced implausibly low estimates of the required return on equity during the financial crises, it is unlikely that the required return on equity would be as stable as the Wright approach suggests.

## Dividend discount models

### The proposed use of dividend discount models in the Guidelines

244. The Guideline uses dividend discount models<sup>141</sup> to inform the estimate of the market risk premium.<sup>142</sup> The Guideline materials summarise some of the strengths and weaknesses of dividend discount models as follows:

Strengths include the theoretical underpinnings of this estimation method and there is some support for the ability of valuation models (DGMs) to predict returns.

Limitations include the practical difficulties with estimating the DGM. These models are highly sensitive to assumptions made when estimating them and there is no clear answer about what those assumptions should be.<sup>143</sup>

245. The Guideline materials also recognise that dividend discount models have a strong theoretical foundation (in that they are simply based on stock prices properly reflecting the present value of future cash flows) and that they reflect current required returns (as opposed to historical averages):

we consider DGM estimates have strong theoretical grounding and are more likely to reflect prevailing market conditions than other approaches.<sup>144</sup>

246. When specifying the precise form of the dividend discount model to be used, a range of choices are available. In the simplest form of dividend discount model, one can impose the additional assumption that dividends grow at a single constant rate in perpetuity. However, multi-stage models (whereby different growth rates apply to different future periods) provide more accurate results and are more commonly used in practice. For these reasons, the Guideline adopts two- and three-stage dividend discount models, noting that:

Our use of two and three stage versions of the DGM reflects that these models are commonly used. Reputable sources including the Bank of England and Damodaran support this conclusion.<sup>145</sup>

and:

Bloomberg provides estimates of the cost of equity using a three-stage model.<sup>146</sup>

### Downward adjustments

247. However, unlike the Bank of England, Damodaran, and Bloomberg, the Guideline proposes to apply a downward adjustment to the estimate of the long-run growth in dividends. The source of this

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<sup>141</sup> This class of models is interchangeably referred to as “dividend discount models” and “dividend growth models” (DGMs). Our practice is to use the former term on the basis that it is descriptive of the basis for these models – observable stock prices are modelled as the sum of discounted future dividends. The AER’s Guideline materials use the latter term, but both refer to the same class of models.

<sup>142</sup> See, for example, AER Guideline, p. 13.

<sup>143</sup> AER Rate of Return Guideline, Explanatory Statement, p. 90.

<sup>144</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 85.

<sup>145</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 85.

<sup>146</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, Footnote 385, p. 85.



downward adjustment is a practitioner paper by Bernstein and Arnott (2003), who argue that the dividends (and consequently the market capitalisation) of existing companies must grow at a slower rate than the rest of the economy. They suggest that long-run dividend growth should be set equal to long-run GDP growth less a 2% downward adjustment. The Guideline adopts a long-run real GDP growth estimate of 3% and three different downward adjustments (0.5%, 1% and 1.5%) that produce (lower) long-run real dividend growth rates of 1.5%, 2.0% and 2.5%, respectively.

248. The downward adjustments appear to be based on Bernstein and Arnott (2003) and Lally (2013 DDM). Bernstein and Arnott recommend a downward adjustment of 2%, but Lally identifies two errors in their approach, both of which lead to their calculation being upwardly biased. Consequently, the Guideline examines three downward adjustments that are arbitrarily selected to be above 0% and below 2%. The Guideline materials claim that this:

█ reflects the range of Lally's estimates.<sup>147</sup>

249. However, in his recent advice to the AER, Lally (2013 DDM)<sup>148</sup> does not suggest that the long-run real dividend growth rate could be 1.5% or 2.5%. Rather, Lally's actual advice is as follows:

█ In summary, all of this evidence suggests that an appropriate estimate for the long-run expected real growth rate in DPS is 2% per year, which accords with the AER's view.<sup>149</sup>

250. Moreover, this class of dividend discount models is adopted in the Guideline based on their use by "reputable sources" such as the Bank of England, Damodaran, and Bloomberg. None of these sources apply any Bernstein-Arnott adjustment at all despite the fact that Bernstein and Arnott (2003) was published more than 10 years ago.

251. IPART also provides estimates of MRP based on the dividend discount models of the Bank of England, Damodaran and Bloomberg.<sup>150</sup> IPART does not apply any Bernstein-Arnott adjustment and reports a contemporaneous MRP estimate of 7.9%.

252. Finally, our companion report, SFG (2014 DDM) shows that the difference between real GDP growth and earnings per share growth does not exist, in either Australia or the United States, over the entire time period since inflation fell to current levels and central banks began explicitly adopting policies designed to maintain inflation at moderate levels. Thus, the entire basis for any downward adjustment no longer holds – since 1991 there has been no evidence that real corporate earnings growth differs from real GDP growth.

### The SFG approach

253. In our companion report, SFG (2014 DDM)<sup>151</sup> use a multi-stage dividend discount model similar to those adopted by the AER and IPART. However, rather than imposing a particular long-run growth rate (with or without a downward adjustment) we simultaneously *estimate* it. That is, the SFG approach selects the combination of long-run growth rate and required return on equity that best fits the observable data. In our view, there are a number of reasons to have regard to the SFG approach:

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<sup>147</sup> AER Rate of Return Guideline, Explanatory Statement, p. 119.

<sup>148</sup> Lally (2013 DDM), *Review of the AER's proposed dividend growth model*, 16 December.

<sup>149</sup> Lally (2013 DDM), p. 18.

<sup>150</sup> IPART (2013), p. 15.

<sup>151</sup> SFG (2014 DDM), *Alternative versions of the dividend discount model and the implied cost of equity*, May.

- a) As set out above, by estimating the long-run dividend growth rate that best fits the observable data, SFG avoid having to make arbitrary assumptions about existing companies growing at a slower rate than the broad economy;
- b) The SFG approach is based on Fitzgerald, Gray, Hall and Jeyaraj (2013), a peer-reviewed paper published in a journal that has an A\* rating in the Australian Business Deans Council rating system;
- c) IPART has indicated that it has regard to the SFG approach when estimating the contemporaneous MRP; and
- d) The Guideline materials indicate that its dividend discount approach cannot be applied at the industry level because it produces estimates that are volatile and fail a “basic sanity check” in that they suggest that the required return is higher for the benchmark firm than for the average firm.<sup>152</sup> Estimates produced using the SFG approach do not exhibit either of these problems.

#### Conclusions in relation to dividend discount models

254. The Guideline materials summarise a number of dividend discount estimates of MRP in Appendix D, Table D.4, p. 88. The last four entries in that table use more recent estimates of dividend yields and government bond yields and are repeated in Table 9 below.

**Table 9**  
**AER summary of dividend discount estimates of MRP**

Submission	MRP mid-point estimate	Risk-free rate	Required return on the market
NERA (March 2012)	7.71%	3.99%	11.70%
CEG (November 2012)	8.89%	3.05%	11.94%
Lally (March 2013)	7.15%	3.26%	10.41%
SFG (June 2013)	7.90%	3.10%	11.00%

Source: AER Rate of Return Guideline, Explanatory Statement, Appendix D, Table D.4, p. 88.

All estimates are ex-imputation.

255. Since the compilation of the SFG (2013) estimate in the first half of 2013, government bond yields have increased materially. Using updated data, SFG (2014 DDM) report the following estimates:<sup>153</sup>

	Theta=0.35	Theta=0.7
Required return on the market	11.42%	12.53%
Market risk premium	7.31%	8.41%

256. The recent estimates compiled by Australian regulators are summarised in Table 10 below.

<sup>152</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix E, p. 121.

<sup>153</sup> We recognise that the AER is still considering how the implied MRP estimates from this approach should be adjusted to incorporate the assumed value of imputation credits. See for example AER Appendix E, p. 125. Resolution of that issue is beyond the scope of this report. The current estimate of 7.1% is an estimate that has been computed on the same basis as the 7.9% estimate included in the AER’s Table D.1.

**Table 10**  
**Regulatory dividend discount estimates of MRP**

Regulator	MRP Estimate
AER (with Lally recommended adjustment)	6.7 - 7.1% <sup>a</sup>
AER (with no adjustment)	7.6 - 7.9% <sup>b</sup>
IPART	7.9% <sup>c</sup>
ERA	7.0 - 7.5% <sup>d</sup>

Sources: a=AER Rate of Return Guideline, Explanatory Statement, Appendix E, Table E.1, p. 119;  
b=SFG calculation based on AER approach; c=IPART (2013), p. 70; d=ERA Explanatory Statement, Paragraph 732.

257. For the reasons set out in our companion report, it is our view that the SFG (2014 DDM) estimates are the most robust, reliable and up-to-date estimates that are currently available – they are commensurate with the prevailing conditions in the market for equity funds and best reflect the efficient financing costs of the benchmark efficient entity.

### Survey responses

#### Proposed use of survey responses

258. The Guideline materials conclude that one of the key strengths of survey data is the fact that MRP is a forward-looking parameter and survey data seeks to obtain a direct indication of investor expectations at a point in time. The Guideline materials also note that survey data can be compared against empirical estimates of MRP:

Strengths include the direct theoretical link between expected excess returns and stated expectations, and the triangulation of results across surveys and across time.<sup>154</sup>

259. The Guideline materials also set out some of the limitations of survey data:

Limitations include timeliness, survey design and the representativeness of the respondents.<sup>155</sup>

260. Ultimately, the Guideline materials concludes that:

We propose to give survey estimates some consideration when estimating MRP<sup>156</sup>

and that:

In December 2013, these estimates generally support an MRP of about 6.0 per cent.<sup>157</sup>

<sup>154</sup> AER Rate of Return Guideline, Explanatory Statement, p. 90.

<sup>155</sup> AER Rate of Return Guideline, Explanatory Statement, p. 90.

<sup>156</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 88.

<sup>157</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 88.

Advice from AER consultants

261. In the discussion of the use of survey data, the Guideline materials cite advice from McKenzie and Partington (2011<sup>158</sup>, 2012 MRP<sup>159</sup>) and Lally (2013 MRP)<sup>160</sup> on the use of survey data under the previous Rules.

262. Lally (2013 MRP) recommends that survey results “should be considered”<sup>161</sup> but warns against the use of older survey information on the basis that it may be untimely (and consequently not reflect the prevailing conditions in the market for equity funds):

■ Since the MRP may have risen since the commencement of the GFC, surveys conducted prior to 2009 are not relevant.<sup>162</sup>

263. McKenzie and Partington (2011)<sup>163</sup> conclude that survey evidence suffers from potential problems and review a number of those problems, which include:

- a) the wording of the survey questions is unclear – it is generally not known precisely what respondents were asked to provide;
- b) the surveys typically do not explain how those surveyed were chosen;
- c) a majority of those surveyed did not respond;
- d) it is unclear what incentives were provided to ensure respondents would provide accurate responses, or whether respondents face incentives to provide self-serving responses;
- e) whether respondents supplied MRP estimates that use continuously compounded or not continuously compounded returns is unclear;
- f) the risk-free rate that respondents use is unclear;
- g) whether the respondents supplied MRP estimates that include the assumed effect of dividend imputation tax credits is not made explicit; and
- h) the relevance of some of the surveys is unclear given changes in market conditions since the surveys were conducted.

264. Nevertheless, McKenzie and Partington (2012 MRP) conclude that:

■ despite the potential problems, we give significant weight to the survey evidence.<sup>164</sup>

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<sup>158</sup> McKenzie, M. and G. Partington, 2011, *Equity market risk premium*, Report to Coors Chambers Westgarth, December 22.

<sup>159</sup> McKenzie, M. and G. Partington, 2012 MRP, *Review of regime switching framework and critique of survey evidence*, Report to the AER, September 7.

<sup>160</sup> Lally, M., 2013, *Review of the AER's methodology for the risk free rate and the market risk premium*, 4 March.

<sup>161</sup> Lally (2013 MRP), p. 29.

<sup>162</sup> Lally (2013 MRP), p. 29.

<sup>163</sup> See McKenzie and Partington (2011), pp. 21-22.

<sup>164</sup> McKenzie and Partington (2012 MRP), p. 6.

### Tribunal requirements

265. The Australian Competition Tribunal has also recognised the problems that relate to the use of survey data and has ruled that:

Surveys must be treated with great caution when being used in this context.<sup>165</sup> Consideration must be given at least to the types of questions asked, the wording of those questions, the sample of respondents, the number of respondents, the number of non-respondents and the timing of the survey. Problems in any of these can lead to the survey results being largely valueless or potentially inaccurate.

When presented with survey evidence that contains a high number of non-respondents as well as a small number of respondents in the desired categories of expertise, it is dangerous for the AER to place any determinative weight on the results.<sup>166</sup>

266. In essence, the Tribunal requires that three conditions must be met for survey responses to be given any material consideration:

- a) The survey must be timely – there must have been no change in the prevailing conditions in the market for funds since the survey was administered;
- b) There must be clarity about precisely what respondents were asked so that there is no ambiguity about how to interpret their responses; and
- c) The survey must reflect the views of the market and not a sample that is small, unresponsive, or without sufficient expertise.

### Use of survey information in the Guideline

267. The Guideline materials set out a list of 13 surveys.<sup>167</sup> These surveys are divided into groups and discussed in turn below.

#### *Pre-2009 surveys*

268. The first five of the surveys cited in the Guideline materials use data from 2009 or before. Under the previous Rules, Lally (2013 MRP) has advised that such dated information is “not relevant”<sup>168</sup> and should be “disregarded.”<sup>169</sup> Under the new Rules, it seems unlikely that data pre-dating the GFC, European debt crisis, and the AER’s previous WACC Review could be said to be commensurate with the prevailing conditions in the market for equity funds.

#### *Asher surveys*

269. Two of the remaining studies are by Asher (2011, 2012). These studies are singled out for special criticism by both Lally (2013 MRP)<sup>170</sup> and McKenzie and Partington (2012 MRP).<sup>171</sup>

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<sup>165</sup> The “context” being referred to here is the use of survey responses to inform the regulatory estimate of MRP.

<sup>166</sup> Application by Envestra Ltd (No 2), ACompT 3, Paragraphs 162-163.

<sup>167</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, Table D.5, p. 92.

<sup>168</sup> Lally (2013 MRP), p. 29.

<sup>169</sup> Lally (2013 MRP), p. 30.

<sup>170</sup> Lally (2013 MRP), p. 30 notes that these surveys are targeted at a narrow segment of the professional community and warrant lower weight.

<sup>171</sup> McKenzie and Partington (2012 MRP), p. 29 argue that surveys should be weighted according to their reliability so that less reliable surveys receive “lesser weight,” noting that “one such survey is provided by Asher.”

270. The Asher surveys are both short notes in a magazine. For example, the Asher (2012) survey is sandwiched between letters to the editor and the puzzle page, which notes that the name of the South Australian town of Glenelg is a palindrome. Moreover, more than 12% of the respondents indicated that there was no risk premium at all and the text commentary indicates that respondents provided different MRP estimates for assets in different risk classes. This is a clear indication that the respondents were not providing estimates of MRP for use in the Sharpe-Lintner CAPM. In addition, McKenzie and Partington (2012) note that:

Asher stated in a seminar in front of individuals whom he later surveyed that, “the implied equity premium is more or less equal to the dividend yield which is probably at this stage somewhere between 3 and 4 per cent”.<sup>172</sup>

For the reasons set out above, our view is that the Asher surveys should receive no weight at all.

#### *Fernandez surveys: Reliability*

271. Of the remaining surveys, four have been performed by Spanish academic Pablo Fernandez and various of his co-authors. Obviously, the most recent of these surveys provides the most timely information and is most likely (relative to more dated information) to be commensurate with the prevailing conditions in the market. In their most recent reports on MRP issues, both Lally (2013 QCA)<sup>173</sup> and McKenzie and Partington (2013 QRC)<sup>174</sup> refer only to the most recent Fernandez survey that was available at the time.

272. The most recent Fernandez survey that is available is that of Fernandez (2013), which asks respondents about MRP estimates for 2013. This is also the most recent survey in the list that appears in the Guideline materials.<sup>175</sup> The AER notes that the mean MRP estimate from this survey is 6.8%.<sup>176</sup> However, there are a number of problems with this survey:

- a) The results are based on only 17 participants;
- b) There is no information about the qualifications of respondents;
- c) There is no information about the non-response rate;
- d) There is no information about what the respondents use their estimate of MRP for (e.g., classroom examples vs. long-term equity investment decisions);
- e) There is no information about the estimates that participants use for other WACC parameters (e.g., whether they are using higher estimates of the risk-free rate in lieu of a higher estimate for MRP); and
- f) There is a wide dispersion of estimates among the 17 participants.

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<sup>172</sup> McKenzie and Partington (2012 MRP), p. 28.

<sup>173</sup> Lally, M., 2013 QCA, *Response to submission on the risk-free rate and the MRP*, Report for the QCA, 22 October.

<sup>174</sup> McKenzie, M. and G. Partington, 2013, *Review of Aurizon Network's draft access undertaking*, Report for the Queensland Resources Council, October 5.

<sup>175</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, Table D.5, p. 92.

<sup>176</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, Table D.5, p. 92.

273. In our view, it is difficult to imagine that any survey could fare worse against the criteria set out by the Tribunal.

274. In spite of these problems, the Guideline's interpretation of this study is that:

■ This survey adds to the triangulation of evidence around 6.0 per cent<sup>177</sup>

on the basis that “outliers at the upper end”<sup>178</sup> have inflated the mean estimate of 6.8%. However, if the data is to be truncated such that some observations are eliminated or given less weight, the reasons for doing so should be set out in detail. In our view, it is not enough to simply observe that the mean of 6.8% would have been closer to the proposed point estimate of 6.0% if some of the higher observations were eliminated from the sample – and to conclude, on that basis, that the survey supports an estimate of 6.0%.

*Fernandez surveys: Relevance*

275. Another issue with the Fernandez surveys has been identified by Lally (2013 QCA). He suggests that the Fernandez surveys may not reflect the views of investors who actually provide equity capital in the market. He suggests that actual equity investors may arrive at their estimate of MRP using a different set of information to that used by survey respondents. In particular, he states that:

■ However, the respondents to these surveys are academics, analysts and managers rather than investors per se.<sup>179</sup>

276. The fact that the Fernandez survey results do not reflect the views or requirements of actual investors is another factor that might lead to them being afforded less weight.

*Fernandez surveys: Stability*

277. The Fernandez surveys consistently produce mean and median estimates that are close to 6%, regardless of the prevailing conditions in the market at the time. The mean and median MRP estimates for Australia from the Fernandez surveys are set out in Figure 22 below. These figures clearly are very slow-moving over time. Indeed Fernandez himself notes that:

■ The median has been remarkably stable: 6% for USA and Australia.<sup>180</sup>

and Lally (2013 QCA) concludes that between 2007 and 2012 “there has been no significant movement”<sup>181</sup> in the Fernandez survey results.

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<sup>177</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 91.

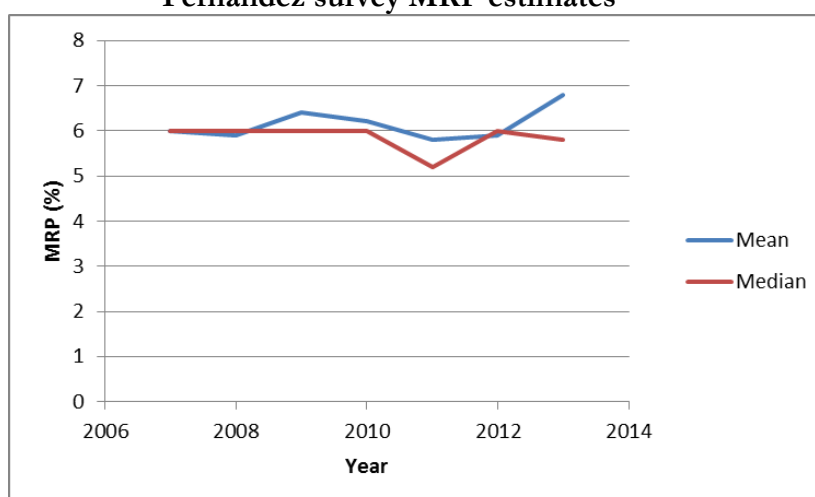
<sup>178</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 91.

<sup>179</sup> Lally (2013 QCA), p. 23.

<sup>180</sup> Fernandez (2010), p. 6.

<sup>181</sup> Lally (2013 QCA), p. 64.

**Figure 22**  
**Fernandez survey MRP estimates**



Source: Fernandez surveys. No adjustment for assumed value of gamma.

278. The period covered by Figure 22 includes the last year of a remarkable bull market and the peak of the GFC and European debt crises, yet the estimate is essentially stuck at 6% throughout. That is, there is something about the phrasing of the questions and the nature of the small sample of respondents that (empirically) has had the effect of producing an estimate of close to 6% over all market conditions since 2007.

279. The Fernandez surveys pertaining to 2012 and 2013 both report that the vast majority have based their MRP estimates on the Ibbotson estimate, historical data, or textbooks. The fact that the vast majority of respondents have provided MRP estimates that are historical averages that are very slow to move (rather than contemporaneous forward-looking estimates) is consistent with the stability of the survey averages over different market conditions.

280. In summary, the survey evidence appears to simply regurgitate the long-run historical average excess return.

*KPMG (2013)*

281. The Guideline materials refer to a KPMG survey of six banks, six professional services firms, and six infrastructure funds. No information is provided about which organisations responded to the survey, what the response rate was, which individuals within each organisation completed the survey or their qualifications or roles within the organisation. Consequently, this survey does not fare well against the criteria set out by the Tribunal.

282. The Guideline materials note that this survey concludes that:

Survey participants are overwhelmingly using an MRP of 6.0 per cent for Australia, with some bias to 7.0 per cent.<sup>182</sup>

283. The information set out in Figure 12 of the KPMG document enables the mean MRP estimate to be computed as 6.24%.<sup>183</sup>

<sup>182</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, p. 91.

<sup>183</sup>  $0.03 \times 5\% + 0.72 \times 6\% + 0.23 \times 7\% + 0.02 \times 8\% = 6.24\%$ .



284. KPMG (2013) also report that 81% of the survey respondents based their estimate in full or in part on historical excess returns and that more than two thirds of respondents have not revised their estimate of MRP to reflect the increased volatility in financial markets brought on by the GFC.<sup>184</sup> Both of these results indicate that, like the Fernandez survey results, participants are simply regurgitating the long-run historical average excess return. This evidence suggests that it would be dangerous to interpret the KPMG survey results as a forward-looking estimate of MRP that is commensurate with the prevailing conditions in the market.

*Independent expert reports*

285. The Guideline materials also refer to a summary of independent expert valuation reports conducted by Ernst and Young (2012). That study has since been updated by SFG (2013 IE)<sup>185</sup> in a report that was submitted to the AER in June of 2013. A further update has been performed by Incenta (2014). These reports differ from the surveys that are considered by the AER in that they do not ask for a participant's view of what the MRP is or should be, they document the practice of independent expert valuation professionals. For this reason, we deal separately with the summaries of independent expert valuation reports in the following sub-section of this report.

*Summary of survey evidence*

286. As set out above, we disregard the pre-2009 and Asher survey information, noting the recommendations of Lally (2013 MRP) and McKenzie and Partington (2012 MRP) in this regard. We also note that the advice the AER has received on this issue was under the previous Rules and if anything it is more important under the new Rules to obtain a timely estimate that is commensurate with the prevailing conditions in the market. Also, we note that we consider independent expert evidence separately in the following section of this report.

287. This leaves the following survey information:

- a) **The Fernandez surveys.** In the above discussion we have highlighted many problems with these surveys and concluded that it is difficult to imagine that any survey could fare worse against the criteria set out by the Tribunal. One of the key issues is that these surveys consistently report mean and median estimates that are close to 6.0%, across a range of market conditions and it is difficult to imagine that an MRP of 6% could be commensurate with the prevailing conditions in an historic bull market and with the prevailing conditions in the market during a global financial crisis. The most recent survey reports mean and median estimates of 6.8% and 5.8% respectively.
- b) **The KPMG (2013) survey.** In the above discussion we have also highlighted many problems with the KPMG survey and concluded that it too should not be afforded any material weight. One of the key issues is that 81% of the survey respondents based their estimate in full or in part on historical excess returns and that more than two thirds of respondents have not revised their estimate of MRP to reflect the increased volatility in financial markets brought on by the GFC.<sup>186</sup> Both of these results indicate that, like the Fernandez survey results, participants are simply regurgitating the long-run historical average excess return. The KPMG survey reports mean and median estimates of 6.24% and 6% respectively.

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<sup>184</sup> KPMG (2013), p. 18.

<sup>185</sup> SFG, 2013, *Evidence on the required return on equity from independent expert reports*, June.

<sup>186</sup> KPMG (2013), p. 18.

288. In our view, neither of these surveys should be afforded material weight. However, if they are considered to be relevant, they support an MRP estimate in the range of 5.8% to 6.8%. Importantly, as we explain below, these estimates of MRP cannot be compared directly with the AER's estimate of MRP because the survey estimates do not include the benefits of imputation credits whereas the regulatory estimate does.

#### Incorporation of imputation credits

##### *Comparison of with-imputation and ex-imputation returns*

289. None of the survey estimates considered in the Guideline materials can be directly compared with the AER's estimate of MRP. This is because the AER MRP estimate includes the benefit of imputation credits, whereas the survey estimates do not. As set out above, the AER uses the following approach:

- a) Estimate the total required return on equity (including the benefits of imputation credits) using a with-imputation estimate of MRP (that also includes the benefits of imputation credits);
- b) Estimate the return that shareholders obtain from their receipt of imputation credits; and
- c) Estimate the ex-imputation return that the firm is allowed to generate as the difference between (a) and (b), and set allowed revenues accordingly.

290. The relationship between the ex-imputation credit return that will be generated by the firm's allowed revenues,<sup>187</sup> and the with-imputation total required return<sup>188</sup> is well-known from Officer (1994):<sup>189</sup>

$$r_{e,ExIC} = r_{e,WithIC} \left[ \frac{1-T}{1-T(1-\gamma)} \right].$$

291. This equation is examined in detail in Gray and Hall (2006) and Gray and Hall (2008). Its use in the regulatory setting is explained by IPART (2013) and this same approach is embedded into the AER's post-tax revenue model and other models that model tax in the same way as the AER's post-tax revenue model.

292. By analogy, one cannot directly compare an ex-GST price in one store against a with-GST price in another – but there is a well-known formula to convert one definition of price into the other.<sup>190</sup>

##### *Surveys report ex-imputation returns*

293. KPMG (2013) explicitly acknowledge the difference between with-imputation and ex-imputation returns by showing how their base ex-imputation MRP would have to be grossed-up to incorporate the benefits of imputation.<sup>191</sup>

294. None of the Fernandez surveys make any mention of imputation credits. In our view, the most reasonable interpretation is that the survey responses represent unadjusted ex-imputation MRP estimates – the same definition of MRP that is used for all other countries in the Fernandez surveys.

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<sup>187</sup> In (c) above.

<sup>188</sup> In (a) above.

<sup>189</sup> Officer (1994), Equation 7, p. 6.

<sup>190</sup> The with-GST price can be obtained by multiplying the ex-GST price by 1.1.

<sup>191</sup> KPMG (2013), p. 17.

295. In this regard, Lally (2013 MRP) notes that the Fernandez survey:

does not invite respondents to include imputation credits to the extent they think appropriate, because an MRP of this type is sought here. However, given that the survey asks the respondent for the MRP estimate that they are using, respondents could reasonably be expected to have included imputation credits in their estimate to the extent that they thought to be appropriate.<sup>192</sup>

296. However, all of the evidence suggests that the dominant market practice is to make no adjustment for imputation credits anywhere in the valuation process. Consequently, it seems unlikely that a material number of survey respondents would have provided a grossed-up with-imputation estimate of MRP. The vast majority of respondents are likely to have provided a standard ex-imputation estimate of MRP. Consistent with this view, McKenzie and Partington (2012 MRP)<sup>193</sup> have advised the AER that:

the survey evidence suggests that imputation credits are not typically allowed for in project evaluation or expert valuations, so it would seem unlikely that they would typically be added to the market risk premium.<sup>194</sup>

297. In summary, the advice to the AER and the relevant evidence suggests that the survey estimates of MRP should be interpreted as standard ex-imputation estimates.

298. McKenzie and Partington (2012 MRP) go on to conjecture about reasons why survey respondents may be providing standard ex-imputation estimates of MRP. For example, they conjecture that survey respondents may believe that imputation credits will be taken into account elsewhere in the valuation process so that there is no need to take them into account in the MRP estimate or that they may simply be regurgitating long-run historical excess return estimates.<sup>195</sup> However, the reason for the provision of an estimate of the ex-imputation required return on equity is not really important here. The key point is that, in both of the above cases, the survey participant will have provided a standard *ex-imputation* estimate of MRP, which cannot be directly compared with the regulatory *with-imputation* estimate of MRP.

#### *Like-with-like comparisons*

299. Having concluded that survey respondents are likely to be reporting standard ex-imputation estimates of MRP, whereas regulators use a with-imputation definition of MRP, McKenzie and Partington (2012 MRP) recommend that no adjustment should be made to the survey estimate of MRP because any such adjustment would be relatively small:

any adjustment for imputation would likely lie within the margin of measurement error.<sup>196</sup>

300. But nowhere in their report do McKenzie and Partington (2012 MRP) consider the conversion of an estimate of the (practitioner) ex-imputation MRP into an estimate of the (regulatory) with-imputation MRP and nowhere do they show that the adjustment would be relatively small.

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<sup>192</sup> Lally (2013 MRP), Footnote 15, p. 30.

<sup>193</sup> McKenzie, M. and G. Partington, 2012, *Supplementary report on the market risk premium*, Report to the AER, February 22.

<sup>194</sup> McKenzie and Partington (2012 MRP), p. 16.

<sup>195</sup> McKenzie and Partington (2012 MRP), p. 16.

<sup>196</sup> McKenzie and Partington (2012 MRP), p. 16.

301. In their recent WACC Review, IPART (2013) devoted substantial consideration to the exact question of how an ex-imputation estimate of MRP should be converted to a with-imputation estimate. IPART begins by noting that it is well-known from Officer (1994) that the with-imputation and ex-imputation required returns on equity are linked by the familiar equation:<sup>197</sup>

$$r_{e,ExIC} = r_{e,WithIC} \left[ \frac{1-T}{1-T(1-\gamma)} \right]$$

302. For example, if the ex-imputation MRP is considered to be 6.0% and the risk-free rate is 4.12% (commensurate with the contemporaneous yield on 10-year government bonds), the estimate of the ex-imputation required return on the market is 10.12%. The corresponding with-imputation required return, using the AER's proposed gamma estimate of 0.5, is then:

$$\begin{aligned} r_{e,WithIC} &= r_{e,ExIC} \div \frac{1-T}{1-T(1-\gamma)} \\ &= 10.12\% \div \frac{1-0.3}{1-0.3(1-0.5)} \\ &= 12.29\%, \end{aligned}$$

in which case the with-imputation MRP (which can be compared directly to the regulatory with-imputation MRP) is 8.17%.<sup>198</sup> IPART (2013) use exactly this approach to convert estimates of "MRP including imputation benefits" into estimates of "MRP excluding imputation benefits."<sup>199</sup>

303. That is, given the AER's estimate of gamma, a 6.00% estimate of the ex-imputation MRP is equivalent to a 12.29% estimate of the required return on the market and an 8.17% estimate of the (regulatory) with-imputation MRP according to Officer (1994) and as implemented by IPART (2013) and the AER's PTRM. When gamma is set to the current estimate of 0.25, the corresponding estimates are 11.20% for the required return on the market and 7.08% for MRP.

#### Conclusions on the use of survey responses

304. In our view, none of the surveys discussed above fare well against the criteria that have been set out by the Tribunal, in which case "it is dangerous for the AER to place any determinative weight on the results."<sup>200</sup>

305. If the AER is to have regard to the survey responses, it should not interpret (standard) ex-imputation estimates of MRP provided by survey respondents as (regulatory) with-imputation estimates of MRP. Rather, it should convert standard ex-imputation estimates into regulatory with-imputation estimates according to Officer (1994) and as implemented by IPART (2013) and the AER's PTRM. A 6% estimate of the ex-imputation MRP is equivalent to an 8.17% estimate of the (regulatory) with-imputation MRP if gamma is set to 0.5 and a 7.09% estimate if gamma is set to 0.25.

<sup>197</sup> Officer (1994), Equation 7, p. 6.

<sup>198</sup> 12.29%-4.12%=8.17%.

<sup>199</sup> IPART (2013), pp. 17-18 sets out a worked example of the conversion process.

<sup>200</sup> Application by Envestra Ltd (No 2), ACompT 3, Paragraphs 162-163.

## Independent expert valuation reports

### Role of independent expert reports

306. In a submission to the AER Guideline process, SFG (2013 IE)<sup>201</sup> note that independent expert valuation reports that are prepared as part of the process of corporate transactions (such as mergers, acquisitions and divestitures) are:

- a) Governed by the Corporations Law and ASX Listing Rules;
- b) Regulated by the Australian Securities and Investments Commission;<sup>202</sup> and
- c) Form the basis of numerous transactions involving the investment of material amounts of equity capital.

307. Incenta (2014) make similar points. For these reasons, information from independent expert valuation reports is likely to be relevant evidence for the purpose of determining allowed returns in the regulatory setting.

### Use of independent expert reports

308. The Guideline materials conclude that information from independent expert valuation reports is relevant evidence that should be considered.<sup>203</sup> In particular, the Guideline materials state that “takeover and valuation reports” will be used to inform the estimate of the overall return on equity.<sup>204</sup> This implies that the independent expert reports will not be used to inform the estimates of individual Sharpe-Lintner CAPM parameters, but will be used in the final step when the AER considers whether any adjustment might be required to its point estimate from the Sharpe-Lintner CAPM. However, in its discussion of MRP estimation, the Guideline materials include two summaries of independent expert reports.<sup>205</sup>

309. We agree with the use of independent expert reports to inform the estimate of MRP. In our view, these reports provide relevant evidence which, if relegated to the final cross-check stage of the estimation process, is unlikely to ever receive any real weight.

310. Consistent with this view, Lally (2013 QCA)<sup>206</sup> recommends that the QCA should have regard to independent expert valuation reports when estimating MRP.<sup>207</sup> Lally goes on to propose that these reports should receive equal weight to survey responses.

311. In its Guideline materials the ERA indicates that independent expert valuation reports (which the ERA refers to as “brokers’ estimates” even though they are compiled by independent expert valuation and accounting firms rather than brokers) “have potential to provide relevant information.”<sup>208</sup> However, the ERA provides no real guidance on precisely how it considers that these reports should be used.

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<sup>201</sup> SFG Consulting, 2013, *Evidence on the required return on equity from independent expert reports*, June.

<sup>202</sup> See ASIC Regulatory Guides 111 and 112.

<sup>203</sup> AER (2013), Rate of Return Guideline, pp. 14, 16.

<sup>204</sup> AER (2013), Rate of Return Guideline, pp. 14, 16.

<sup>205</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix D, pp. 90-91.

<sup>206</sup> Lally, M., 2013, *Response to submissions on the risk-free rate and the MRP*, Report for the QCA, 22 October.

<sup>207</sup> Lally (2013 QCA), p. 5.

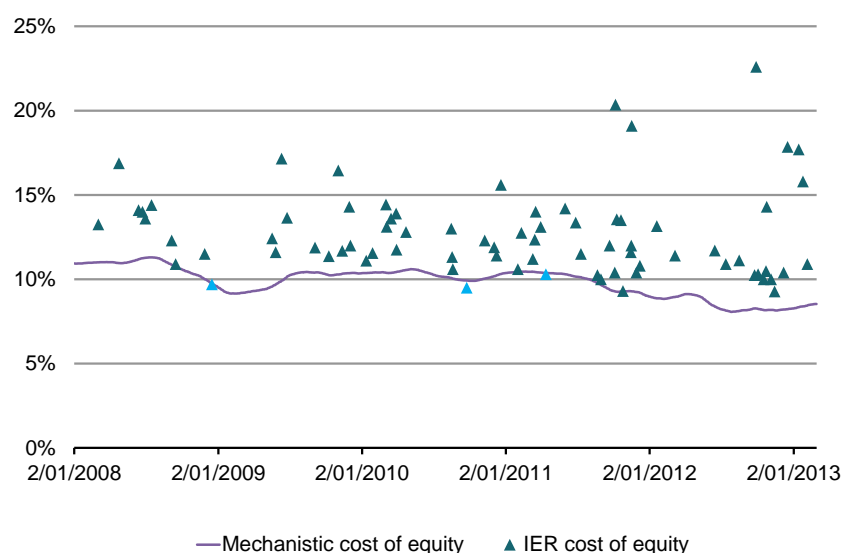
<sup>208</sup> ERA Rate of Return Guideline, Appendix 29, Paragraph 65.

Evidence from independent expert reports

312. SFG (2013 IE), in a report submitted to the AER in June 2013, examine all of the 154 independent expert valuation reports from January 2008 to April 2013 that set out a cost of capital calculation. Figure 23 below shows a comparison between:

- a) Mechanistic estimates of the required return on the market (10-year government bond yield plus 6%); and
- b) Independent expert estimates of the final required return on equity for firms for which the independent expert adopted an equity beta estimate between 0.75 and 1.25. They restricted the sample to this set of firms with an equity beta estimate close to 1.0 to ensure a reasonable basis of comparison with an estimate of the required return on the market (which also has a beta of 1.0).

**Figure 23**  
**Expert report cost of equity estimates (for beta estimates between 0.75 and 1.25) compared to mechanistic market cost of equity (for beta of 1.0)**



Source: SFG analysis

313. The striking feature of this graph is that, with only three exceptions, every one of the independent expert estimates of the required return on equity is higher than the mechanistic estimate. The three exceptions all have equity beta estimates between 0.75 and 0.80 – below the market beta of 1.0 – and all have cost of equity estimates that are only marginally below the mechanistic estimate of the market cost of equity.

314. SFG (2013 IE) also determine, for each report in their sample, the overall cost of equity capital estimated by the independent expert. The average cost of equity capital calculated for the entire sample (2008-2013) is 14.4%, within a range of 9.3% to 35%.

315. They then compare:

- a) The independent expert’s estimate of the required return on equity for each firm; with
- b) An estimate formed by inserting the following estimates into the Sharpe-Lintner CAPM:

- i) Contemporaneous 10-year government bond yield for risk-free rate;
- ii) 6% for market risk premium; and
- iii) The equity beta estimate adopted by the independent expert.

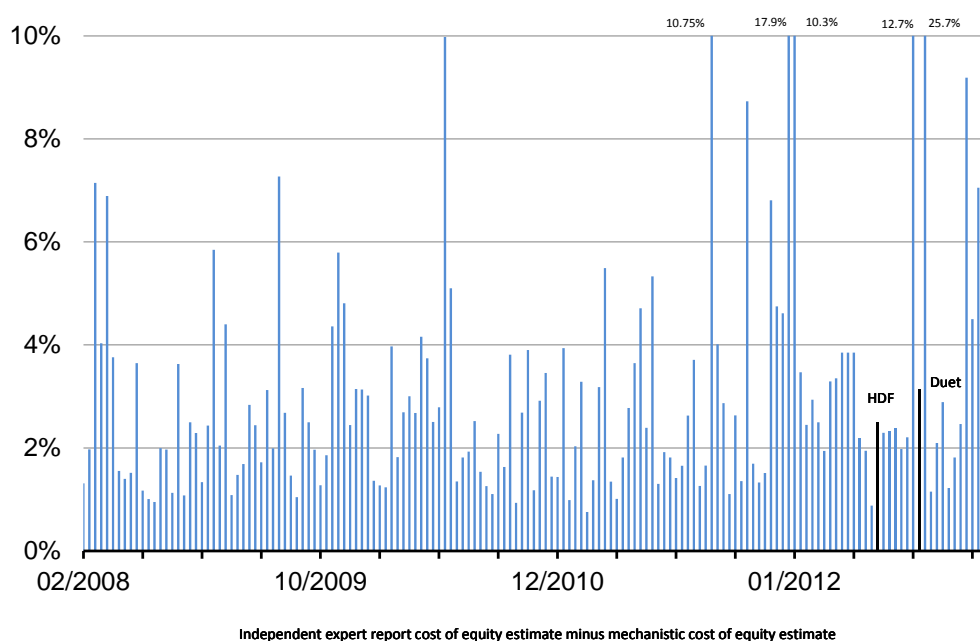
316. The average estimate of the required return on equity from the former approach is 14.4%, and the average from the latter approach is 11.1%.

317. The pair-wise comparisons of the two estimates for each asset are set out in Figure 24 below, which shows that in every case the mechanistic estimate is below the figure that is adopted in the independent expert report. In that figure, the vertical scale is capped at 10% to show sufficient detail, but in a number of cases the difference is even greater than that. In almost every case, the difference is greater than 1% and the difference is greater than 2% in many cases.

318. The results for the 2012-13 period are particularly striking. In almost every case the difference between the two estimates exceeds 2% and the average differential of 4.1% is substantially higher than for the earlier period.

319. Highlighted in the graph are the differences between the expert estimate and the mechanistic estimate for the only two utilities companies in the data (Hastings Diversified Fund and the Duet Group) in the recent period sub-sample. Both show that the market-based assessment of the cost of equity is materially higher than the mechanistic approach would suggest. That is, the approach that the independent experts have taken in the Hastings and Duet cases has resulted in estimates of the required return on equity that are materially greater than the mechanistic approach would suggest – in line with all of the other expert reports in the sample.

**Figure 24**  
**Difference between expert report and adjusted mechanistic estimates of cost of equity**



Source: SFG analysis

320. In summary, SFG (2013 IE) show that the return on equity estimates used in independent expert reports are materially higher than comparable regulatory estimates. It can be misleading to compare the MRP estimates from independent expert reports with regulatory estimates because it is common for independent expert reports to make other adjustments in their estimation process. SFG (2013 IE) note that such adjustments include adopting a risk-free rate above the contemporaneous yield on government bonds and adding a margin to the required return on equity to reflect the extent to which a mechanistic CAPM estimate might not reflect the prevailing conditions in the market. It is for this reason that SFG (2013 IE) present comparisons at the overall return on equity level. To extract information about MRP requires a case-by-case consideration of each report, such as the example set out below.

[Incenta \(2014\) update](#)

321. Incenta (2014) provide a summary of independent expert valuation reports through to April 2014. They report that, on average, independent experts continue to:

- a) Adopt a risk-free rate above the prevailing government bond yield;
- b) Adopt an ex-imputation market risk premium above 6%; and
- c) Add other “uplift” factors beyond the Sharpe-Lintner CAPM estimate.

322. The Incenta (2014) results are summarised in Table 11 below. The key result from this table is the fact that independent expert valuation practitioners continue to adopt ex-imputation MRP estimates that are at least 6%, and on average above 6%. They also employ other techniques that have the effect of increasing the estimate of the required return on equity above the estimate that would be produced by a mechanical implementation of the Sharpe-Lintner CAPM.

**Table 11**  
**Estimates of market risk premium**

Parameter	Mechanistic CAPM	Independent experts
<b>10/12 to 04/13</b>		
Risk-free rate	3.05%	3.47%
MRP	6.50%	6.62%
<b>04/13 to 04/14</b>		
Risk-free rate	3.74%	4.10%
MRP	6.50%	6.34%

Source: Incenta (2014), Table 3.2, p. 19.

[Example: Grant Samuel Envestra report](#)

323. One very recent independent expert report is particularly relevant. Grant Samuel (2014) present a discounted cash flow valuation of Envestra Ltd, a company that is primarily engaged in gas distribution and transmission. Grant Samuel adopt a risk-free rate of 4.2% (commensurate with the contemporaneous yield on 10-year government bonds at the time) and a market risk premium of 6%. This implies an ex-imputation return on equity for the average firm of 10.2%. However, Grant Samuel state that this is not a mid-point estimate but is towards the lower end of the reasonable range, and that a particularly conservative estimate, which was appropriate given the purpose of the particular report.



324. Grant Samuel (2014) go on to explain that they consider this to be a conservative estimate for the following reasons:

- a) They note that “alternative approaches for estimating the cost of equity such as the Gordon Growth Model suggest higher rates”,<sup>209</sup>
- b) They note that “equity investors have repriced risk since the global financial crisis and that acquirers are pricing offers on the basis of hurdle rates above those implied by theoretical models”<sup>210</sup> and go on to consider “an increase in the market risk premium of 1%”<sup>211</sup>;
- c) They note that government bond yields are at historical lows, in which case it may be “inappropriate to add a “normal”<sup>212</sup> market risk premium (e.g. 6%) to a temporarily depressed bond yield, and go on to consider the use of a higher estimate for the risk-free rate; and
- d) They have indicated that the return on equity estimate that they have adopted is “towards the lower end”<sup>213</sup> of the reasonable range “in order to ensure that the fairness assessment for the Proposal is robust (i.e. higher NPV’s are generated)”<sup>214</sup>.

325. Grant Samuel (2014) also clearly state that their MRP estimate of 6% “makes no explicit allowance for Australia’s dividend imputation system.”<sup>215</sup> Consequently, even if the 6% figure was adopted for MRP, it would have to be converted from a standard ex-imputation estimate into a with-imputation estimate for use in the regulatory setting. As set out in Paragraphs 301 to 303 above, with gamma set to 0.5, an ex-imputation MRP of 6% is equivalent to a with-imputation MRP of 8.17% according to Officer (1994) and as implemented by IPART (2013) and the AER’s PTRM. When gamma is set to 0.25, the corresponding estimate of MRP is 7.08%.

#### Incorporation of imputation credits

326. SFG (2013 IE) note that the uniform practice of independent experts is to make no allowance for imputation credits when estimating MRP (or in any part of the cost of capital estimation process). In this regard, SFG (2013 IE) report that:

For the entire sample over the period 2008 – 2013, we were unable to find any independent expert report that made any adjustment in relation to dividend imputation. No adjustments of any kind were made to any cash flows and no adjustments of any kind were made to any discount rates.

We identified nineteen independent expert reports in 2012/13 that made a specific reference to dividend imputation in relation to cost of capital. Every one of these reports concluded that no adjustment should be made to any cash flows or to any discount rates.<sup>216</sup>

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<sup>209</sup> Grant Samuel (2014), Appendix 3, p. 8.

<sup>210</sup> Grant Samuel (2014), Appendix 3, p. 9.

<sup>211</sup> Grant Samuel (2014), Appendix 3, p. 9.

<sup>212</sup> Grant Samuel (2014), Appendix 3, p. 9.

<sup>213</sup> Grant Samuel (2014), Appendix 3, p. 9.

<sup>214</sup> Grant Samuel (2014), Appendix 3, p. 9.

<sup>215</sup> Grant Samuel (2014), Appendix 3, p. 6.

<sup>216</sup> SFG (2013 IE), Paragraphs 88-89.

327. Incenta (2014) also note that the independent expert estimates “are not directly comparable to the AER’s rate of return on equity as they have not been adjusted for dividend imputation.”<sup>217</sup>

328. Consequently, ex-imputation MRP estimates from independent expert reports would have to be routinely converted into the corresponding with-imputation estimate of MRP (as set out above) for use in the regulatory process.

#### Conclusions on the use of independent expert reports

329. We agree with the use of independent expert reports to inform the estimate of MRP. In our view, these reports provide relevant evidence which, if relegated to the final cross-check stage of the estimation process, is unlikely to ever receive any real weight.

330. Our assessment of the relevant evidence is that independent expert valuation reports support higher estimates of the required return on equity than those that would be produced by a mechanistic application of the Sharpe-Lintner CAPM. In particular, SFG (2013) and Incenta (2014) show that the return on equity estimates used in independent expert reports are materially higher than comparable regulatory estimates.

331. Independent expert reports provide ex-imputation MRP estimates that would have to be routinely converted into the corresponding with-imputation estimate of MRP for use in the regulatory process. An ex-imputation estimate of MRP of 6% (which we consider to be conservative for the reasons set out above) implies the following with-imputation estimates of MRP and the required return on the market (where the risk-free rate is set to 4.12%):

	Theta=0.35	Theta=0.7
Required return on the market	11.20%	12.29%
Market risk premium	7.08%	8.17%

#### Conclusions in relation to market risk premium

332. Our main conclusions in relation to the market risk premium evidence are as follows.

333. In relation to historical excess returns evaluated using the Ibbotson approach:

- a) The arithmetic mean should be used and the geometric mean should not;
- b) The data should be updated to include 2013 and the more accurate dividend yield adjustment provided by NERA (2013)<sup>218</sup>;
- c) Historical mean excess returns produce an estimate of the MRP in *average* market conditions and could inform an estimate of the MRP in *prevailing* market conditions after consideration of the extent to which the prevailing conditions might differ from the average conditions;
- d) Government bond yields tend to fall during financial crises and have been at historical lows (relative to the last 50 years) since the onset of the GFC. Consequently, setting the MRP equal to a constant historical mean would imply that the onset of the GFC caused the cost of equity across the economy to also fall to record lows, which is clearly implausible. In our view, an estimate of the required return on equity that falls to historical lows during a severe

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<sup>217</sup> Incenta (2014), p. 19.

<sup>218</sup> NERA, 2013, *The market, size and value premiums*, June.

financial crisis is neither commensurate with the prevailing conditions in the market nor reflective of the efficient financing costs of a benchmark efficient entity; and

- e) We adopt historical MRP estimates based on the entire available data set (noting that the estimates are not materially different if post-1958 data is used). The relevant estimates are as follows:

	<b>Theta=0.35</b>	<b>Theta=0.7</b>
Required return on the market <sup>a</sup>	10.75%	10.87%
Market risk premium	6.63%	6.76%

a: Based on a risk-free rate of 4.12%  
 Figures rounded to two decimal places.

334. In relation to historical market returns evaluated using the Wright approach:

- a) There are two approaches for estimating MRP from the historical data. The Ibbotson approach assumes that the MRP is constant across all market conditions and estimates the MRP as the mean historical excess return. At the other end of the spectrum, the Wright approach assumes that the required return on the market is constant and estimates the MRP by subtracting the contemporaneous risk-free rate.
- b) In our view, the Ibbotson and Wright approaches should both be used to inform the estimate of MRP for use in a Sharpe-Lintner CAPM foundation model.
- c) Moreover, Lally (2012 MRP, 2013 MRP) also recommends that the Ibbotson and Wright approaches should both be used to estimate MRP, and the Wright approach is also used extensively by UK regulators to estimate the required return on the market and the MRP.
- d) The Wright approach currently produces the following estimates:

	<b>Theta=0.35</b>	<b>Theta=0.7</b>
Required return on the market	11.71%	11.83%
Market risk premium	7.59%	7.71%

335. In relation to dividend discount models:

- a) It is our view that the SFG (2014 DDM) estimates are the most robust, reliable and up-to-date estimates that are currently available – they are commensurate with the prevailing conditions in the market for equity funds and best reflect the efficient financing costs of the benchmark efficient entity.
- b) Using up to date data, SFG (2014 DDM) report the following estimates:<sup>219</sup>

	<b>Theta=0.35</b>	<b>Theta=0.7</b>
Required return on the market	11.42%	12.53%
Market risk premium	7.31%	8.41%

<sup>219</sup> We recognise that the AER is still considering how the implied MRP estimates from this approach should be adjusted to incorporate the assumed value of imputation credits. See for example AER Appendix E, p. 125. Resolution of that issue is beyond the scope of this report. The current estimate of 7.1% is an estimate that has been computed on the same basis as the 7.9% estimate included in the AER's Table D.1.

336. In relation to the responses of survey participants:

- a) In our view, none of the surveys that have been proposed for use in the regulatory setting fare well against the criteria that have been set out by the Australian Competition Tribunal (**the Tribunal**), in which case we agree with the Tribunal’s conclusion that “it is dangerous for the AER to place any determinative weight on the results;”<sup>220</sup> and
- b) If the AER is to have regard to the survey responses, it should not interpret (standard) ex-imputation estimates of MRP provided by survey respondents as (regulatory) with-imputation estimates of MRP. Rather, they should convert standard ex-imputation estimates into regulatory with-imputation estimates according to Officer (1994) and as implemented by the AER’s post-tax revenue model (**PTRM**) and by IPART (2013).

337. In relation to independent expert valuation reports:

- a) We agree with the use of independent expert reports to inform the estimate of MRP. In our view, these reports provide relevant evidence which, if relegated to the final cross-check stage of the estimation process, is unlikely to ever receive any real weight.
- b) Our assessment of the relevant evidence is that independent expert valuation reports support higher estimates of the required return on equity than those that would be produced by a mechanistic application of the Sharpe-Lintner CAPM. In particular, SFG (2013 IE) and Incenta (2014) show that the return on equity estimates used in independent expert reports are materially higher than comparable regulatory estimates.
- c) Independent expert reports provide ex-imputation MRP estimates that would have to be routinely converted into the corresponding with-imputation estimate of MRP for use in the regulatory process. An ex-imputation estimate of MRP of 6% (which we consider to be conservative for the reasons set out above) implies the following with-imputation estimates of MRP and the required return on the market (where the risk-free rate is set to 4.12%):

	<b>Theta=0.35</b>	<b>Theta=0.7</b>
Required return on the market	11.20%	12.29%
Market risk premium	7.08%	8.17%

338. The MRP estimates from the various approaches are summarised in Table 12 below. The estimates that form the basis of our final estimate of MRP appear in bold face. Historical excess return estimates are based on the longest data set available. We note that the historical excess returns and Wright approach are less sensitive to the estimate of theta because they are largely based on pre-imputation historical data.

**Table 12**  
**Estimates of market risk premium**

<b>Method</b>	<b>Theta=0</b>	<b>Theta=0.35</b>	<b>Theta=0.7</b>
Historical excess returns	6.51%	<b>6.63%</b>	6.76%
Wright approach	7.46%	<b>7.59%</b>	7.71%
Dividend discount model	6.20%	<b>7.31%</b>	8.41%
Survey responses	6.00%	7.08%	8.17%
Independent expert valuation reports	6.00%	<b>7.08%</b>	8.17%

<sup>220</sup> Application by Envestra Ltd (No 2), ACompT 3, Paragraphs 162-163.

339. For the reasons set out in our companion report, SFG (2014 Gamma),<sup>221</sup> we adopt an estimate of theta of 0.35, and an estimate of gamma of 0.25. These are the estimates that were adopted by the Tribunal.<sup>222</sup> Our recommended estimate of MRP is based on these estimates of theta and gamma. If theta and gamma are to be revised in accordance with the AER's Guideline, the estimate of MRP would be correspondingly higher.

340. In compiling a final estimate of MRP, we have regard to the following evidence:

- a) First, we note that historical returns can be processed in two ways – by assuming that MRP is constant in all market conditions (Ibbotson approach) or by assuming that real required returns are constant in all market conditions (Wright approach). We apply equal weight to each of these approaches, producing an estimate of MRP from historical returns of 7.11%<sup>223</sup>;
- b) The estimate from dividend discount models of 7.31%; and
- c) The estimate from independent expert reports of 7.08%.

341. The estimates of the required return on the market from what we consider to be the relevant evidence (given a risk-free rate of 4.12% and theta of 0.35) are set out in Table 13 below. Note that we place no weight on survey response data as we do not consider that approach to produce reliable estimates.

342. In our view, the approaches set out in Table 13 have different relative strengths and weaknesses:

- a) The Wright and Ibbotson approaches each represent end points of a spectrum when using historical data to estimate the required return on the market. The Wright approach assumes that the real required return on equity is constant across different market conditions and the Ibbotson approach assumes that the MRP is constant so that the required return on equity rises and falls directly with changes in the risk-free rate. We agree with the conclusion in the Guideline materials that there is no compelling statistical evidence to support one or the other of these assumptions and that regard should be had to both. We also note that both approaches are used in practice, including regulatory practice. We also note that it is common in practice to have some regard to long-run historical data when estimating the required return on the market.
- b) We agree with the Guideline's assessment that dividend discount model evidence is relevant and should be considered when estimating the required return on the market. The dividend discount model is theoretically sound in that simply it equates the present value of future dividends to the current stock price and it is commonly used for the purpose of estimating the required return on the market. This approach is also the only approach that provides a forward-looking estimate of MRP.
- c) Independent expert valuation reports provide an indication of the required return on equity that is being used in the market for equity funds. We agree with the Guideline's conclusion that this information is relevant and should be considered. However, we note that certain assumptions must be made when seeking to extract an appropriate MRP estimate from an independent expert report (in particular, the extent to which various uplift factors should be incorporated into the MRP estimate). It is for this reason that we adopt a conservative ex-imputation MRP estimate of 6% in this report.

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<sup>221</sup> SFG, 2014 Gamma, *An appropriate regulatory estimate of gamma*, May.

<sup>222</sup> By contrast the AER's Guideline and its recent transitional decisions adopt a gamma of 0.50.

<sup>223</sup> 7.11% is the mean of 6.63% and 7.59%.

343. Taking account of the relevant strengths and weaknesses of the different estimation approaches, we propose the weighting scheme set out in Table 13 below. Our reasons for proposing this weighting scheme are as follows:

- a) We apply 50% weight to the forward-looking DDM estimate and 50% weight to the approaches that are based on historical averages;
- b) We apply equal weight to the Ibbotson and Wright approaches for processing the historical market return data, those two approaches representing the two ends of the spectrum in relation to the processing of that data; and
- c) We apply some weight to our estimate from independent expert valuation reports, noting that this is a conservative estimate in that it is not influenced by any uplift factors or adjustments to the historically low risk-free rate.

344. We note that the final estimates are relatively insensitive to the proposed weighting scheme. For example, the final MRP estimate changes by less than 10 basis points if:

- a) If a weight of 25% was applied to each of the four estimates;
- b) Equal weight is applied to the Ibbotson and Wright approaches only; or
- c) Equal weight is applied to the Ibbotson, Wright and DDM approaches only.

345. We consider that the final estimates set out in the table below are commensurate with the prevailing conditions in the market for equity funds.

**Table 13**  
**Estimates of the required return on the market and MRP**

Method	MRP	Required return on the market	Weighting
Historical returns (Ibbotson/Wright)	6.63%	10.75%	20%
Wright approach	7.59%	11.71%	20%
Dividend discount model	7.31%	11.42%	50%
Independent expert valuation reports	7.08%	11.20%	10%
<b>Weighted average</b>	<b>7.21%</b>	<b>11.33%</b>	<b>100%</b>

## 4. The best estimates of model parameters

### The Sharpe-Lintner CAPM

346. The Sharpe-Lintner CAPM requires the estimates of three parameters: the risk-free rate, the required return on the market, and equity beta. In this section, we consider the best available estimates of each of these parameters.

#### Risk-free rate

347. The Guideline proposes to set the risk-free rate to the contemporaneous yield on 10-year government bonds.<sup>224</sup> We agree with this approach and note that:

- a) This is the same approach that the AER has used for many years and consistent with prevailing market conditions as set out in the NGR/NER;<sup>225</sup>
- b) This approach is used by other regulators such as IPART;<sup>226</sup> and
- c) This approach is the standard approach used in independent expert valuation reports.<sup>227</sup>

348. For the purposes of this report, we adopt an estimate of 4.12%, which is the 20-day average as per our instructions. This would be updated to reflect the most recent data at the time of each determination.

#### Required return on the market (or average firm)

349. As set out in the previous section of this report, our view is that the best available estimate of the required return on the market is currently 11.32%, incorporating the effect of imputation credits where theta is set to 0.35.

#### Equity beta

350. We consider the best empirical estimate of equity beta in our companion report, SFG (2014 Beta).<sup>228</sup> In that report, we conclude that:

- a) The “conceptual analysis” that is performed in the Guideline cannot be used to meaningfully inform the estimate of equity beta;
- b) The analysis of regulatory estimates of beta for water utilities that is performed in the Guideline cannot be used to meaningfully inform the estimate of equity beta;
- c) The statistical analysis of domestic comparable firms (five of which currently exist) is relevant information that should be used to inform the estimate of equity beta. However, the sample size is too small to produce reliable results by itself. Indeed, there is evidence that the results produced by this small sample of firms is statistically unreliable when considered alone;

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<sup>224</sup> AER Rate of Return Guideline, p. 15.

<sup>225</sup> For example, the AER’s last WACC Review in 2009 confirmed its existing practice of setting the risk-free rate to the contemporaneous yield on 10-year government bonds.

<sup>226</sup> IPART, 2013, *Review of WACC Methodology: Final Report*, December.

<sup>227</sup> See, for example, SFG, 2013 IE, *Evidence on the required return on equity from independent expert reports*, June.

<sup>228</sup> SFG, 2014 Beta, *Equity beta*, May.

- d) The statistical analysis of international comparable firms (which currently number in excess of fifty) is relevant information that should be used to inform the estimate of equity beta; and
- e) The tiered approach that is proposed in the Guideline, whereby a subset of the relevant evidence is used to determine an initial range (of 0.4 to 0.7) and other relevant evidence is used only to select a point from within that range (even though it supports an estimate strictly above 0.7) should not be used. Rather, all relevant evidence should be considered together in light of the relative strengths and weaknesses of each piece of evidence.

351. SFG (2014 Beta) conclude that the best empirical estimate of equity beta, having regard to all relevant evidence and considering the relative strengths and weaknesses of each piece of evidence, is 0.82. That estimate is based on a range of regression analyses applied to domestic and international comparables, with each domestic comparable firm receiving twice as much weight as an international comparable firm. As set out above and in SFG (2014 Beta), our view is that this is an appropriate estimate of beta because it has regard to all relevant evidence and because the alternative “domestic only” estimate is unreliable.

352. Our primary reason for adopting the approach and the estimate set out in SFG (2013 Beta) is that the domestic data set is too small (currently only five firms) to produce any sort of reliable estimates. Evidence in support of the unreliability of estimates from this tiny sample is set out in SFG (2014 Beta) and includes:

- a) The fact that the range of estimates is very wide such as the vast majority of estimates do not even fall within the AER’s proposed range;
- b) The estimates are unstable and vary dramatically over short periods of time;
- c) Movement in the estimates is inconsistent over time with estimates for some comparables materially increasing over the same period that estimates for other comparables materially decrease; and
- d) The estimates vary materially depending on which day of the week is used to measure returns.

353. By contrast, the sample of 56 international comparables is much larger and not affected by small-sample issues to nearly the same degree. Moreover, the international comparables were carefully selected to ensure that they are primarily engaged in regulated distribution and transmission activities.

354. The final estimate from SFG (2014 Beta) is based on an average that includes the domestic and international comparables (to obtain a sample size that is sufficient to produce meaningful results) but with each domestic comparable receiving twice as much weight as each international comparable to reflect their greater comparability. We adopt that estimate of 0.82 in this report.

#### [Sharpe-Lintner CAPM estimate of the required return on equity for the benchmark firm](#)

355. Our implementation of the Sharpe-Lintner CAPM adopts the following parameter estimates:

- a) We adopt a contemporaneous risk-free rate of 4.12%;
- b) We adopt an estimate of the required return on the market of 11.32% for the reasons set out above; and



c) We adopt a Sharpe-Lintner CAPM beta estimate of 0.82 from SFG (2014 Beta).

356. These parameter estimates produce an estimate of the required return on equity of:

$$\begin{aligned} r_e &= r_f + \beta(r_m - r_f) \\ &= 4.12\% + 0.82(11.33\% - 4.12\%) = 10.01\%. \end{aligned}$$

### The Black CAPM

357. The Black CAPM requires estimates of the same parameters as the Sharpe-Lintner CAPM as well as an estimate of the zero-beta premium. In our view, the best available estimate of the zero-beta premium is set out in our companion report, SFG (2014 Black).<sup>229</sup> That report provides an estimate of the zero-beta premium of 3.34%, which is within the reasonable range set out in the Guideline materials.<sup>230</sup> This estimate is also consistent with the estimates that have been reported for US data – which led to the original development of the Black CAPM.<sup>231</sup>

358. Adding the zero-beta premium of 3.34% to the risk-free rate of 4.12% provides an estimate of the required return on a zero-beta asset of 7.46%. Consequently, the required return on equity is estimated as:

$$\begin{aligned} r_e &= r_f + \beta(r_m - r_f) \\ &= 7.46\% + 0.82(11.33\% - 7.46\%) = 10.62\%. \end{aligned}$$

### The Fama-French three-factor model

359. For the Fama French model, SFG (2014 FFM)<sup>232</sup> sets out the most recently available estimates of the parameters required for the Fama-French model. Parameter estimates are supplied for a sample of nine domestic firms (five of which are currently listed) and 56 international firms. The estimates set out below apply twice as much weight to each of the nine domestic firms (based on their greater comparability) relative to the international firms. However, we show below that the final estimate of the required return on equity is not at all sensitive to this choice.<sup>233</sup>

360. We begin by using the Fama-French model to estimate the ex-imputation required return on equity. This requires an estimate of the ex-imputation risk premium associated with each of the three factors. SFG (2014 FFM) report ex-imputation estimates of the Fama-French SMB and HML factors. As set out above, we adopt a with-imputation market risk premium of 7.21%, which corresponds to an ex-imputation market risk premium of 6.11% using the approach of Officer (1994) as implemented by IPART (2013)<sup>234</sup> and the AER's PTRM.

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<sup>229</sup> SFG (2014 Black), *Cost of equity in the Black capital asset pricing model*, May.

<sup>230</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix C, p. 71.

<sup>231</sup> See Friend and Blume (1970), Black, Jensen and Scholes (1972), and Fama and MacBeth (1973).

<sup>232</sup> SFG (2014 FFM), *Using the Fama-French model to estimate the required return on equity for the benchmark efficient entity*, May.

<sup>233</sup> This occurs because Australian-listed firms have relatively higher estimates of exposure to the HML factor than U.S.-listed firms and U.S.-listed firms have relatively higher estimates of beta. These two results are offsetting.

<sup>234</sup>  $(7.21 + 4.12) \left( \frac{1 - 0.3}{1 - 0.3(1 - 0.25)} \right) - 4.12 = 6.11$ .

361. In summary, the relevant estimates are:

- a) Market beta of 0.77<sup>235</sup> and ex-imputation market risk premium of 6.11%;<sup>236</sup>
- b) Risk premium in relation to the size factor ( $s \times SMB$ ) of -0.19%;<sup>237</sup> and
- c) Risk premium in relation to the book-to-market factor ( $h \times HML$ ) of 1.15%.<sup>238</sup>

362. Using these estimates in the Fama-French model yields an estimate of the ex-imputation required return on equity of 9.82%, as set out below:

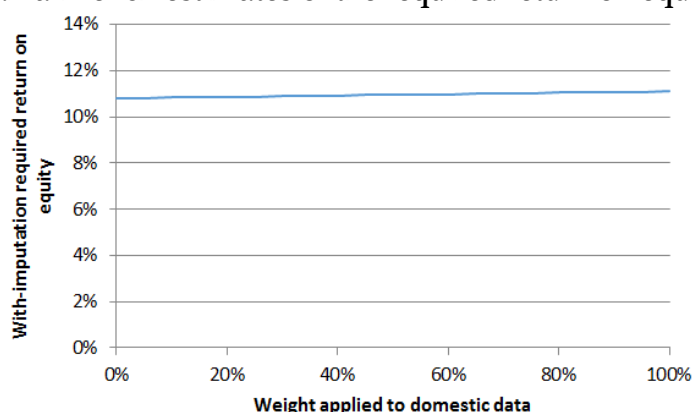
$$r_e = r_f + \beta \times MRP + s \times SMB + h \times HML$$

$$= 4.12\% + 0.77 \times 6.11\% - 0.19\% + 1.15\% = 9.82\%.$$

363. This corresponds to a with-imputation estimate of the required return on equity of 10.87%.<sup>239</sup>

364. The estimates set out above are based on the application of 24% weight to the domestic data and 76% weight applied to the international data. The final estimate of the required return on equity is insensitive to the choice of weights because the domestic and international data produce final estimates that are not materially different. This is illustrated in Figure 25 below.

**Figure 25**  
Fama-French estimates of the required return on equity



Source: SFG calculations. Gamma set to 0.25.

365. In summary, we adopt a Fama-French with-imputation estimate of the required prevailing market return on equity of 10.87%. This is higher than the CAPM estimates due primarily to the book-to-market factor. The comparable firms tend to be high book-to-market firms and the Fama-French

<sup>235</sup> For Australian-listed firms, the beta estimate in the Fama-French model is 0.48 and for U.S.-listed firms the beta estimate in the Fama-French model is 0.87. On average across the two sets of firms,  $0.48 \times 0.243 + 0.87 \times 0.757 = 0.77$ .

<sup>236</sup> Note that this estimate of the market beta will only be exactly equal to the Sharpe-Lintner CAPM beta estimate if the market factor is statistically orthogonal to the other two Fama-French factors, so a different estimate is not evidence of inconsistency. In any event, in this case, the estimate of 0.77 is very close to the Sharpe-Lintner CAPM estimate of 0.82.

<sup>237</sup> For Australian-listed firms,  $s \times SMB = 0.03 \times -0.43\% = -0.01\%$  and for U.S.-listed firms,  $s \times SMB = -0.07 \times 3.58\% = -0.25\%$ . On average across the two sets of firms,  $(-0.01\% \times 0.243) + (-0.25\% \times 0.757) = -0.19\%$ .

<sup>238</sup> For Australian-listed firms,  $b \times HML = 0.30 \times 9.97\% = 2.99\%$  and for U.S.-listed firms,  $b \times HML = 0.12 \times 4.81\% = 0.56\%$ . On average across the two sets of firms,  $(2.99\% \times 0.243) + (0.56\% \times 0.757) = 1.15\%$ .

<sup>239</sup>  $9.82 \div \left( \frac{1-0.3}{1-0.3(1-0.25)} \right) = 10.87$ .

model accommodates the fact that such firms consistently generate (require) returns that are above CAPM estimates.

### **Dividend discount model**

366. In our view, the best available dividend discount model estimate of the required return on equity for the benchmark firm is that set out in our companion report, SFG (2014 DDM).<sup>240</sup> SFG apply their approach to a broad market index and also to the set of comparable firms that are used to estimate equity beta for use in the CAPM. They compare the estimates of the required returns of the comparable firms with those of the broad market index. They report that the risk premium for the comparable firms (i.e., the difference between the dividend discount model estimate of the required return and the risk-free rate) averages 94% of the risk premium of the market. This implies a dividend discount model estimate of the with-imputation required return of the benchmark comparable firm of 10.92%.<sup>241</sup>

367. Finally, we note that the use of the dividend discount model to estimate the required return on the market portfolio and the required return on a benchmark efficient entity does not amount to double counting. The dividend discount model is simply a framework for processing relevant data into an estimate of the required return. Data for the market portfolio produces an estimate of the required return on the market, and data for the benchmark firm produces an estimate of the required return for the benchmark firm. Similarly, there is no double counting involved in using historical stock returns to estimate the required return on the market and for the benchmark firm – market data is used to estimate the market return and benchmark firm data is used to estimate the return for the benchmark firm.

### **Aggregation of available evidence**

368. The estimates of the (with-imputation) required return of the benchmark firm that are set out above are as follows:

- a) The Sharpe-Lintner CAPM estimate is 10.01%;
- b) The Black CAPM estimate is 10.62%;
- c) The Fama-French estimate is 10.87%; and
- d) The DGM estimate is 10.92%.

369. All of these approaches have different strengths and weaknesses. For example:

- a) The Sharpe-Lintner CAPM has the disadvantage of producing estimates of expected returns that have little or no relationship with actual returns – that is, it provides a poor fit to the observed data. However, the Sharpe-Lintner CAPM is commonly used in practice, albeit often in a modified form and we agree that systematic risk is a useful way to think about risks incorporated into market prices. Also, the Australian regulatory practice has been to use the Sharpe-Lintner CAPM exclusively, in which case it would be appropriate to at least continue to have regard to that approach. Consequently, our view is that the Sharpe-Lintner CAPM estimate of the required return is relevant evidence and some regard should be given to it.

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<sup>240</sup> SFG (2014 DDM), *Alternative versions of the dividend discount model and the implied cost of equity*, May.

<sup>241</sup>  $4.12 + 0.94 \times 7.21 = 10.92$ .

The limitations of the Sharpe-Lintner CAPM are that it does not account for all priced risks and its parameter estimates from standard empirical analysis have limited reliability.

- b) The Black CAPM provides a better fit to the empirical data than the Sharpe-Lintner CAPM and it is commonly used in rate of return regulation cases in other jurisdictions (where it is known as the “empirical CAPM”). The Black CAPM is also more theoretically sound than the Sharpe-Lintner CAPM because it does not rely upon the assumption that investors can borrow at the risk-free rate, but rather that investors can sell short. The Black CAPM does not, however, overcome a major disadvantage of the Sharpe-Lintner CAPM, which is that there is no statistically significant relationship between beta estimates and stock returns. In our view, the fact that the Black CAPM requires the estimation of an additional parameter does not affect the fact that it provides relevant evidence and some regard should be given to it.
- c) The Fama-French model has the advantage of providing an unambiguously better fit to the data than the Sharpe-Lintner CAPM. However, whereas it is commonly used as an estimate of required returns in academic studies, it is less commonly used in valuation and regulatory practice. Our view is that the Fama-French estimate of the required return is relevant evidence and some regard should be given to it.
- d) The dividend discount model approach has the advantage of not requiring any assumptions about what factors drive required returns – it simply equates the present value of future dividends to the current stock price. It is also commonly used in industry and regulatory practice. Whereas the Guideline materials identify some concerns with the dividend discount approach, the specification adopted in this report addresses most of those concerns. Consequently, our view is that the dividend discount estimate of the required return is relevant evidence and some regard should be given to it.

370. Because all of the models have different strengths and weaknesses along different dimensions, it is impossible to identify one superior model that alone would out-perform the combined evidence of all of the relevant models. This is consistent with the AEMC’s views that:

- a) “no one method can be relied upon in isolation to estimate an allowed return on capital that best reflects benchmark efficient financing costs;”<sup>242</sup> and that
- b) The NEO, NGO and RPP can only be achieved by obtaining “the best possible estimate of the benchmark efficient financing costs,” which in turn requires the use of a range of financial models.<sup>243</sup>

371. Consequently, our view is that any approach that adopts a single “superior” model, and which effectively disregards other relevant models, will not provide the best possible estimate of “the best possible estimate of the benchmark efficient financing costs.” Any sub-standard estimate of financing costs will inevitably lead to investors being either under- or over-compensated – neither of which are in the long-run interests of consumers.

372. A summary of the relevant estimates of the required return on equity, and our proposed weighting scheme, is set out in Table 14 below. The rationale for the proposed weights is as follows:

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<sup>242</sup> AEMC Final Determination, p. 49.

<sup>243</sup> AEMC Final Determination, p. 43.

- a) 25% weight is applied to the dividend discount model and a total of 75% weight is applied to the three asset-pricing models. Because all four models have different strengths and weaknesses as set out above, our default starting point would be to assign 25% weight to each model. We then adjust weights among the asset pricing models for the reasons set out below;
- b) Of the 75% weight that is applied to asset-pricing models, we apply half to the Fama-French model and half to the CAPM. That is the question of whether the value premium is a proxy for a risk factor or a statistical aberration is addressed by applying equal weight to each possibility;
- c) A total of 37.5% weight is applied to the CAPM. The two forms of the CAPM differ only in terms of the intercept that is used (since the same values of beta and the required return on the market are used for both models). The Black CAPM uses an empirical estimate of the intercept – selected to provide the best possible fit to the observed data. The Sharpe-Lintner CAPM uses a theoretical lower bound for the intercept (i.e., the intercept cannot possibly be lower than the risk-free rate). Thus, we do not have two estimates to choose between – we have an empirical estimate and a theoretical lower bound. It is for this reason that we apply twice as much weight to the Black CAPM. This approach is equivalent to setting the CAPM intercept two-thirds of the way between the theoretical lower bound and the empirical estimate.

373. We note that the final estimate of the required return on equity for a benchmark efficient entity is relatively insensitive to the choice of weights. For example, the final estimate varies by less than 25 basis points if:

- a) The Sharpe-Lintner and Black CAPM are assigned equal weight and no other changes are made;
- b) All four models are assigned equal weight;
- c) The dividend discount model is omitted and the other models are assigned equal weight; or
- d) The Fama-French model is omitted and the other models are assigned equal weight.<sup>244</sup>

374. We do not recommend any of the alternative weighting schemes listed above – we simply note that the final estimate of the required return on equity is relatively insensitive to the proposed weighting scheme. In our view, the 10.71% estimate in Table 14 is the best available estimate of the required return on equity for a benchmark efficient entity and best reflects the prevailing conditions in the market for equity funds.

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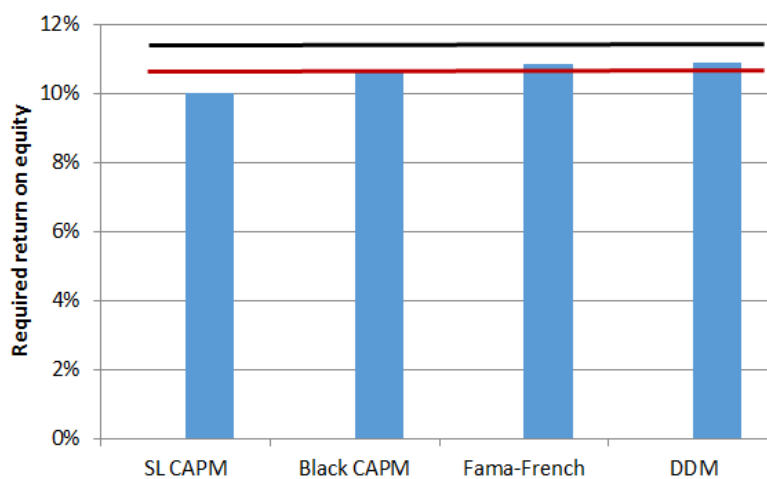
<sup>244</sup> Recall that under the AER's Guideline, the cost of equity will either be set to the foundation model estimate, or a different value rounded to the nearest 25 basis points. That is, 25 basis points is considered to be rounding error for the estimate of the required return on equity under the Guideline. We do not advocate rounding to the nearest 0.25% because that approach can only provide a cost of equity estimate that is further away from the estimate of the prevailing cost of funds that uses all available information. We simply note that the AER considers 0.25% to be an indication of a small margin for error. This does not mean that an estimate is better if it is adjusted to the nearest 0.25%.

**Table 14**  
**Estimates of the required return on equity for a benchmark efficient entity**

Method	Required return on equity	Weighting
Sharpe-Lintner CAPM	10.01%	12.5%
Black CAPM	10.62%	25.0%
Fama-French model	10.87%	37.5%
Dividend discount model	10.92%	25.0%
<b>Weighted average</b>	<b>10.71%</b>	<b>100%</b>

375. Figure 26 below shows the estimates from each of the four models together with the proposed estimate of the required return on equity for a benchmark efficient entity (red line) and the estimate of the required return on equity for the average firm (black line).

**Figure 26**  
**Summary of estimates of the required return on equity**



Source: SFG calculations.

## 5. The foundation model approach

### Adjustment of parameter estimates under the foundation model approach

376. The previous section of this report sets out estimates of the required return on equity from a number of relevant financial models and demonstrates how these estimates can be distilled into a single allowed return on equity. Under this approach, the first step is to determine which financial models are relevant. All relevant financial models are then estimated and the results are then distilled into an allowed return on equity, having regard to the relative strengths and weaknesses of each model.

377. The Guideline proposes a different “foundation model” approach whereby the regulator first selects a single foundation model. Any other relevant financial models then have an effect only by informing the estimates of the parameters of the foundation model.

### Guideline example: Using Black CAPM evidence to inform the estimate of equity beta

378. To illustrate the implementation of the foundation model approach, note that the Guideline concludes that the Black CAPM is a relevant financial model and that it will be used to inform the estimate of equity beta in the Sharpe-Lintner CAPM foundation model.

379. The Guideline materials set out a series of numerical examples of how Sharpe-Lintner beta estimates can be adjusted such that the Sharpe-Lintner CAPM (with the adjusted beta estimate) would produce an estimate of the required return on equity that is commensurate with the Black CAPM. These examples are set out in the AER Guideline, Appendix C, Table C.11, p. 71.

380. The first row of that table considers a case where the risk-free rate is 4%, market risk premium is 6%, and zero beta premium is 3%. In this case, the required return on the market is 10%<sup>245</sup> and the intercept for the Black CAPM line is 7%<sup>246</sup> as illustrated in Figure 27 below.

381. Figure 27 also shows that when a beta of 0.4 is inserted into the Sharpe-Lintner CAPM, it produces an estimate of the required return on equity of 6.4%.<sup>247</sup> The Black CAPM suggests that the required return on equity for a firm with beta of 0.4 is 8.2%.<sup>248</sup>

382. The Guideline materials then ask the question: What beta estimate, when inserted into the Sharpe-Lintner CAPM, would produce the Black CAPM estimate of required return of 8.2%? Figure 27 shows that the relevant beta estimate is 0.7. That is, the beta estimate would be revised upwards from 0.4 to 0.7 in order to produce an estimate of the required return on equity that is consistent with the Black CAPM.

383. The logic behind these calculations can be summarised as follows:

- a) Beta is estimated to be 0.4;
- b) It is recognised that the theoretical and empirical evidence establishes that if this beta estimate is inserted into the Sharpe-Lintner CAPM, the resulting estimate of the required return on equity (6.4%) will be under-stated compared to the prevailing cost of funds;

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<sup>245</sup>  $4\% + 6\% = 10\%$ .

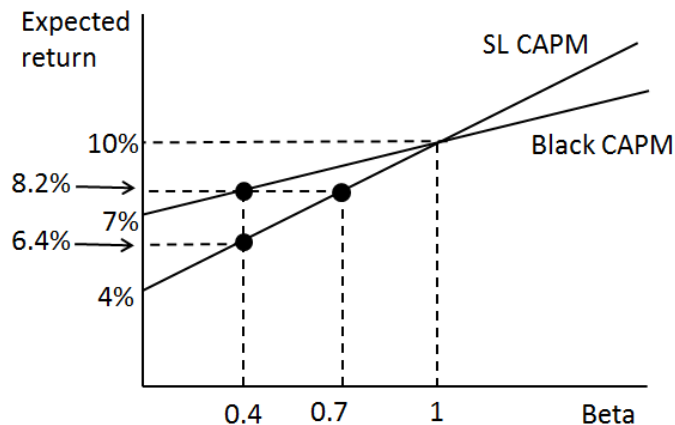
<sup>246</sup>  $4\% + 3\% = 7\%$ .

<sup>247</sup>  $4\% + 0.4 \times 6\% = 6.4\%$ .

<sup>248</sup> The slope of the Black CAPM line is given by  $(10\% - 7\%) / (1 - 0) = 3\%$ . Consequently, the required return for a firm with beta of 0.4 is  $r_e = \beta \times (r_m - r_f) + r_f = 7\% + 0.4 \times 3\% = 8.2\%$ .

- c) Inserting that beta estimate into the Black CAPM equation would produce an estimate of the required return on equity of 8.2%; and
- d) Rather than insert the estimated beta into the Black CAPM, we adjust the beta from 0.4 to 0.7 and insert back into the Sharpe-Lintner CAPM. This also produces an estimate of the required return on equity of 8.2%.

Figure 27. Black CAPM example from the Guideline materials



Source: AER Guideline Appendix C, Table C.11, Row 1.

384. The Guideline materials then examine a number of different estimates of the zero beta premium, concluding that a range from 1.5% to 3% appears to be reasonable:

the size of the zero beta premium is between 150 basis points and 300 basis points (under a variety of scenarios for the risk free rate and market risk premium). This does not seem implausible, since zero beta premiums of this magnitude are below the market risk premium as required by the definition of the Black CAPM. Further, although the borrowing rates for the representative investor are not readily discernible, these magnitudes appear reasonable,<sup>249</sup>

and:

this magnitude of adjustment appears open to us.<sup>250</sup>

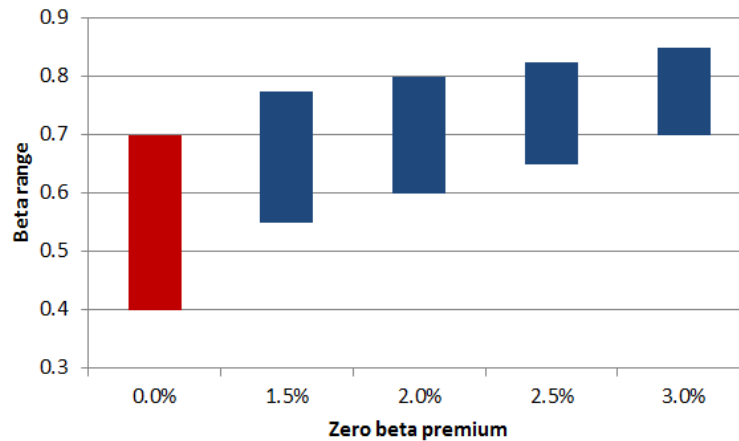
385. In Figure 28 below, the Guideline range for equity beta of 0.4 to 0.7 is displayed in red. The figure then shows the adjusted range for equity beta for different estimates of the Black CAPM zero-beta premium. For example, we have shown above that an equity beta of 0.4 would be adjusted upward to 0.7 if the zero beta premium was set to 3% (i.e., the calculation in the first row of Table C.11 in Appendix C to the Guideline). Similarly, a raw beta of 0.7 would be adjusted upward to 0.85. Thus the raw range of 0.4 to 0.7 corresponds to an adjusted range of 0.7 to 0.85.

<sup>249</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix C, p. 71.

<sup>250</sup> AER Rate of Return Guideline, Explanatory Statement, Appendix C, p. 71.



**Figure 28. Black CAPM beta ranges based on Guideline materials**



Source: SFG calculations.

386. The Guideline proposes that the required return on equity will be estimated using the Sharpe-Lintner CAPM only (as the foundation model), but that the estimate of beta will be adjusted (as set out above) to reflect the evidence in relation to the Black CAPM.

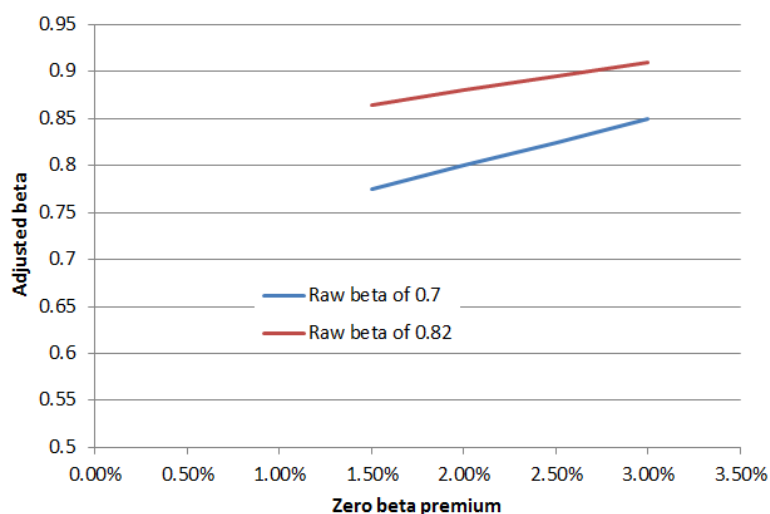
387. In general, if the foundation model approach is to be used, the equity beta estimate must be adjusted to reflect the relevant evidence from all relevant financial models. In the remainder of this section, we demonstrate how to construct such a composite beta estimate for use in the foundation model approach.

**Adjustments for evidence of low beta bias: Black CAPM**

388. As set out above, the Guideline materials Appendix C, Table C.11, p. 71 demonstrates how a raw Sharpe-Lintner CAPM beta estimate can be adjusted to reflect evidence from the Black CAPM.

389. Figure 29 below summarises the adjustments that are required to the raw empirical beta estimates for the sample calculations that are set out in the Guideline. For example, a raw empirical beta estimate of 0.7 would need to be adjusted to 0.85 to be consistent with a zero-beta premium of 3%. Similarly, a raw empirical beta estimate of 0.82 would need to be adjusted to 0.91 to be consistent with a zero beta premium of 3%.

**Figure 29. Adjustments required for Black CAPM evidence**



Source: SFG calculations.

390. In our view, as set out above, when populating the Sharpe-Lintner CAPM the best parameter estimates that are currently available are a beta estimate of 0.82, an MRP estimate of 7.21 and a zero-beta premium of 3.34%. In conjunction with a risk-free rate of 4.12%, this implies that when populating the Sharpe-Lintner CAPM foundation model, 0.90 is the best estimate of beta that is reflective of the evidence in relation to the Black CAPM (i.e., the evidence that the Sharpe-Lintner CAPM systematically understates the required return on low-beta stocks).<sup>251</sup>

### **Adjustments for evidence of a value premium: Fama-French model**

391. There is also evidence that the required return for high book-to-market (or “value”) stocks is consistently and materially higher than the Sharpe-Lintner CAPM would suggest. Indeed the evidence for the book-to-market effect is at least as extensive and comprehensive as the evidence of the low-beta/Black CAPM effect. A summary of that evidence is set out in SFG (2014 FFM).<sup>252</sup>

392. Consequently, our view is that – if the foundation model approach is to be used – the beta estimate should be informed by evidence about high book-to-market stocks requiring higher returns. The Guideline already demonstrates how a raw beta estimate can be adjusted to reflect the Black CAPM evidence of a low beta bias. The same approach can also be used to reflect the Fama-French evidence of a book-to-market bias (also known as the “value premium”).

393. An equity beta estimate of 0.94, when inserted into the Sharpe-Lintner CAPM, produces an estimate of the required return on equity that is consistent with the Fama-French evidence of a value premium.<sup>253</sup> We therefore adopt 0.94 as the estimate of beta that best corrects for the empirical evidence that the required return for high book-to-market stocks is consistently and materially higher than the Sharpe-Lintner CAPM would suggest.

### **Adjustments for dividend discount evidence**

394. The dividend discount model can be used as an alternative way of estimating the required return on equity for the benchmark firm. A detailed explanation and assessment of the dividend discount approach is set out in SFG (2014 DDM).<sup>254</sup> In that report, we estimate that the risk premium for the comparable firms (i.e., the difference between the dividend discount model estimate of the required return and the risk-free rate) averages 94% of the risk premium of the market. This implies that an equity beta estimate of 0.94 reflects the contemporaneous evidence in relation to the dividend discount model for use in the AER’s foundation model approach.

### **Conclusions and recommendations in relation to the foundation model approach**

395. Table 15 below summarises the estimates of equity beta that reflect the contemporaneous evidence in relation to each of the relevant financial models – for the purposes of the foundation model approach. Applying the weights set out in Table 14<sup>255</sup> produces an overall foundation model equity beta estimate of 0.91, as illustrated in Figure 30.

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<sup>251</sup> Under the Black CAPM,  $r_e = r_f + \beta_e \times (r_m - r_f) = (0.0412 + 0.0334) + 0.8172 \times (0.0412 + 0.0721 - 0.0412 - 0.0334) = 10.62\%$ . Under the Sharpe-Lintner CAPM, to match the same cost of equity,  $\beta_e = (r_e - r_f) \div (r_m - r_f) = (0.1062 - 0.0412) \div 0.0721 = 0.90$ .

<sup>252</sup> SFG (2014 FFM), *Using the Fama-French model to estimate the required return on equity for the benchmark efficient entity*, May.

<sup>253</sup> Under the Fama-French model, the estimated cost of equity is 10.87%. Under the Sharpe-Lintner CAPM, to match the same cost of equity,  $\beta_e = (r_e - r_f) \div (r_m - r_f) = (0.1087 - 0.0412) \div 0.0721 = 0.94$ .

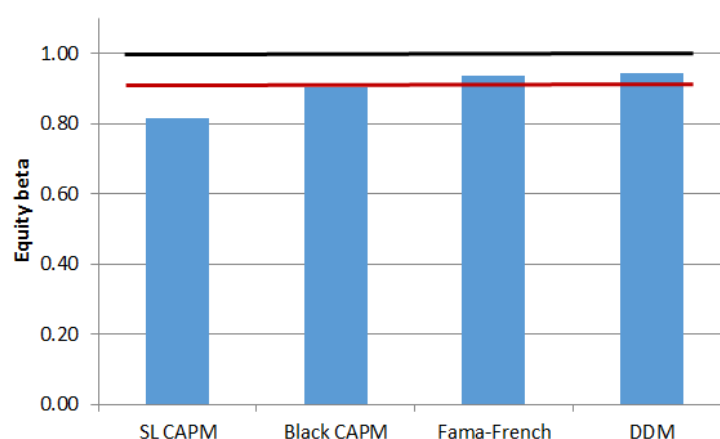
<sup>254</sup> SFG (2014 DDM), *Alternative versions of the dividend discount model and the implied cost of equity*, May.

<sup>255</sup> We apply the same weights to the various models whether they are being used to compute a composite estimate of the required return on equity or a composite estimate of beta.

**Table 15**  
**Estimates of equity beta to reflect evidence from relevant financial models**

Model	Required return on equity	Calculation	Equity beta
SL CAPM	10.01%	$(0.1001-0.0412)\div 0.0721$	0.82
Black CAPM	10.62%	$(0.1062-0.0412)\div 0.0721$	0.90
Fama-French	10.87%	$(0.1087-0.0412)\div 0.0721$	0.94
DDM	10.92%	$(0.1092-0.0412)\div 0.0721$	0.94
<b>Weighted average</b>			<b>0.91</b>

**Figure 30. Foundation model equity beta estimates**



396. The composite foundation model equity beta estimate of 0.91 produces an estimate of the required return on equity of 10.71%:

$$\begin{aligned}
 r_e &= r_f + \beta \times MRP \\
 &= 4.12\% + 0.91 \times 7.21\% = 10.71\%.
 \end{aligned}$$

397. We note that this foundation model estimate of the required return on equity (10.71%) is identical to the estimate that is obtained in Table 14 above. This is because both approaches combine information from the same four relevant financial models and both approaches apply the same weighting scheme. Indeed, the foundation model approach can only produce a different estimate of the required return on equity if it is implemented in such a way as to either (a) omit evidence that would otherwise have been considered, or (b) change the relative weights that would otherwise have been applied to some evidence.

## 6. Declaration

### Declaration

398. 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.



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Professor Stephen Gray.



---

Dr Jason Hall.

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## **Appendix 1: Instructions**



## **Expert Terms of Reference**

# **Relevant models for estimating the return on equity**

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

**AA15-570-0051**

**Version B – 7 May 2014**

**Contact Person**

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A	Draft	04/02/14	E Grace-Webb		
B	Final	07/02/14	E Grace-Webb		E Grace-Webb



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# 1 Background

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

JGN is currently preparing its revised Access Arrangement proposal (**Project**) with supporting information for the consideration of the Australian Energy Regulator (**AER**). The revised access arrangement will cover the period 1 July 2015 to 30 June 2020 (July to June financial years).

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.

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).

Accordingly, the independent opinion of SFG Consulting, as a suitably qualified independent expert (**Expert**), is sought on use of relevant financial models to estimate the return on equity component of the rate of return, in a way that that complies with the requirements of the National Gas Law and Rules and National Electricity Law and Rules, including as highlighted above. JGN seeks this opinion on behalf of itself, ActewAGL, Ergon, and Transend.

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## 2 Scope of Work

In its Rate of Return Guideline, the AER identifies four models which it consider relevant to estimating the return on equity:

- Sharpe-Lintner CAPM;
- Black CAPM;
- Dividend growth models; and
- Fama-French three factor model.

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

1. describes each of the methods and models that are identified by the AER as being relevant to estimating the return on equity, including how they were developed, the theoretical and empirical basis for their development, and how they relate to each other if at all;
2. provides the Expert's opinion on whether each model is relevant to estimating the return on equity, insofar as the Expert considers that the models provide information that is useful in undertaking the task of estimating the cost of equity;



3. compares the merits of the methods and models, in terms of their ability to estimate of the return on equity that is:
  - (a) commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to a regulated gas or electricity in respect of the provision of reference services; and
  - (b) reflective of prevailing conditions in the market for equity funds;
4. recommends a method or model, or combination of methods and models, to be used in estimating the return on equity, having regard to the relative merits of the available methods and models, and the requirements of the National Gas Law and Rules for the return on equity to be:
  - (a) commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to a regulated gas or electricity network in respect of the provision of reference services; and
  - (b) reflective of prevailing conditions in the market for equity funds.
5. estimates the return on equity using this method, model or combination of methods and models that is:
  - (a) commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to a regulated gas or electricity network in respect of the provision of reference services; and
  - (b) reflective of prevailing conditions in the market for equity funds.

In preparing the report, the Expert will:

- A. consider different approaches to applying each of the financial models, including any theoretical restrictions on empirical estimates;
- B. consider the theoretical and empirical support for each of the financial models;
- C. consider any comments raised by the AER and other regulators, including on (but not limited) to (a) whether each of the financial models applies in Australia and (b) the statistical reliability of the parameter estimates produced by those models; and
- D. use the sample averaging period of the 20 business days to 12 February 2014 (inclusive) to estimate any prevailing parameter estimates needed to estimate the return on equity.

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### 3 Information Provided by JGN

The Expert is encouraged to draw upon the following information which JGN will make available:

- an expert report by NERA Economic Consulting titled “The Fama-French Three Factor Model, a report for the Energy Networks Association”, dated October 2013;

- an expert report by NERA Economic Consulting titled “Cost of Equity – Fama-French Three-Factor Model”, dated 12 August 2009;
- an expert report by NERA Economic Consulting titled “Jemena Access Arrangement for the NSW Gas Networks: AER Draft Decision”, dated 19 March 2010;
- an expert report by Oxera Consulting titled “Estimating the cost of equity from the Fama-French model”, dated 28 April 2010;
- an expert report by NERA Economic Consulting titled “Estimates of the Zero-Beta Premium”, dated June 2013; and
- other relevant expert reports on the Black CAPM and Fama-French model.

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## 4 Other 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.

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## 5 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 guidelines<sup>1</sup>;
- contains a section summarising the Expert’s experience and qualifications, and attaches the Expert’s curriculum vitae (preferably in a schedule or annexure);

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<sup>1</sup> Available at: <http://www.federalcourt.gov.au/law-and-practice/practice-documents/practice-notes/cm7>.

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

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

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## 6 Timetable

The Expert will deliver the final report to Jemena Regulation by **9 May 2014**.

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## 7 Terms of Engagement

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

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

# ATTACHMENT 1: FEDERAL COURT PRACTICE NOTE

## Practice Note CM 7

### EXPERT WITNESSES IN PROCEEDINGS IN THE FEDERAL COURT OF AUSTRALIA

#### Commencement

1. This Practice Note commences on 4 June 2013.

#### Introduction

2. Rule 23.12 of the Federal Court Rules 2011 requires a party to give a copy of the following guidelines to any witness they propose to retain for the purpose of preparing a report or giving evidence in a proceeding as to an opinion held by the witness that is wholly or substantially based on the specialised knowledge of the witness (see **Part 3.3 - Opinion** of the *Evidence Act 1995* (Cth)).
3. The guidelines are not intended to address all aspects of an expert witness's duties, but are intended to facilitate the admission of opinion evidence<sup>2</sup>, 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 Court<sup>3</sup>

- 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 Report<sup>4</sup>

- 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

<sup>2</sup> 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].

<sup>3</sup> The "*Ikarian Reefer*" (1993) 20 FSR 563 at 565-566.

<sup>4</sup> 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) above<sup>5</sup>; 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 Court<sup>6</sup>.
- 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 reports<sup>7</sup>.

### 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

<sup>5</sup> See also *Dasreef Pty Limited v Nawaf Hawchar* [2011] HCA 21.

<sup>6</sup> The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565

<sup>7</sup> The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565-566. See also Ormrod *"Scientific Evidence in Court"* [1968] Crim LR 240

**Appendix 2: Curriculum Vitas of Professor Stephen Gray and Dr Jason Hall**

## **Stephen F. Gray**

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### **Academic Qualifications**

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

### **Employment History**

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

### **Academic Awards**

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

### **Large Grants (over \$100, 000)**

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

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

### **Current Research Interests**

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

### **Publications**

- Chan, K-F., R. Brooks, S. Treepongkaruna and S. Gray, (2011), “Do Trading Hours Affect Volatility Links in the Foreign Exchange Market?” *Australian Journal of Management*, forthcoming.
- Chan, K-F., R. Brooks, S. Treepongkaruna and S. Gray, (2010), “Asset market linkages: Evidence from financial, commodity and real estate assets,” *Journal of Banking and Finance*, forthcoming.
- 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](http://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

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 Website: [sfgconsulting.com.au](http://sfgconsulting.com.au)  
 Skype: [jason.lance.hall](https://www.skype.com/people/jason.lance.hall)



### Experience

2013-14 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)  
 2000-14 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, undergoing revisions for re-submission to *Journal of Contemporary Accounting and Economics*.  
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  
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**

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 9<sup>th</sup> most successful entrant from 66 schools which have competed in any of the same years, finishing 3<sup>rd</sup> in 2010, 6<sup>th</sup> in 2007, 11<sup>th</sup> in 2009, 14<sup>th</sup> in 2011 and 18<sup>th</sup> 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.

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## **Industry engagement**

From 2000-13, I have provided consulting services as part of SFG Consulting and UQBS Commercial. Services have been provided in conjunction with Frontier Economics, ARENA Consulting, Parsons Brinckerhoff and Uniquist.

### **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

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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)

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#### **Interests**

I am interested in sport as a participant and spectator. I finished 3<sup>rd</sup> on three occasions in the Brisbane Half Marathon (2005 & 2009-10), 8<sup>th</sup> in the Toronto Half Marathon (2002) and 3<sup>rd</sup> in the Australian Universities Marathon Championships (2003). I have finished 17 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 1<sup>st</sup> at the Australian University Games in 1994.

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### Appendix 3: Historical comparison of risk-free rates

399. In its Guideline materials, the ERA concludes that:

the Authority is of the view that it is unclear that the current level of the risk free rate is at an historical low. The Authority remains unpersuaded that the current level of the risk-free rate is at a historical low.<sup>256</sup>

400. This conclusion is based primarily on advice that McKenzie and Partington (2013)<sup>257</sup> provided to the AER. McKenzie and Partington seek to show that, whereas current government bond yields are materially lower than at any time in the previous 50 years, they are not materially lower than yields in the late 1800s and early 1900s. This has led the ERA to conclude that:

one conclusion that may be drawn is that the current level of interest rate is a return to the 'normal' long run interest rate regime.<sup>258</sup>

401. In a more recent report for the Queensland Resources Council (**QRC**), McKenzie and Partington (2013)<sup>259</sup> compare the current 10-year CGS yield with the average from the 1883-1972 period, noting that the current yield at the time of their report (4.02%) "is reasonably close to the long run average (4.23%)."<sup>260</sup> This leads McKenzie and Partington to conclude that:

The current environment is nothing more than a return to the 'normal' long run interest rate regime.<sup>261</sup>

402. In our view, there are a number of reasons to reject this conclusion. Generally, a comparison with the most recent 40 years would be more relevant than a comparison with a period that begins in the 1880s and ends more than 40 years ago. But this is particularly the case for CGS yields which were set on an entirely different basis during the historically dated period that McKenzie and Partington prefer. In particular, prior to August 1982, CGS yields were not market rates at all. Prior to 1982, the so-called TAP system was used whereby the Australian government fixed the yield and then issued as many government bonds as the market demanded at the set rate. Thus, the yields were not a market rate at all, but a number that was set from time to time by the government of the day. The current tender system (whereby government fixes the supply of bonds to be issued and a market clearing price is determined) was introduced in August 1982. The Australian Office of Financial Management (**AOFM**) notes that:

The Australian Government first introduced competitive price tenders for Treasury Bonds in August 1982. The key feature of this approach is that the issuer sets the volume of securities issued while the market determines the issuance yield.<sup>262</sup>

403. The AOFM explains the historical system as follows:

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<sup>256</sup> ERA, Explanatory Statement, Paragraph 686.

<sup>257</sup> McKenzie, M. and G. Partington, 2013, Review of the AER's overall approach to the Risk free rate and Market Risk Premium, A report to the AER, 28 February.

<sup>258</sup> ERA, Explanatory Statement, Paragraph 685.

<sup>259</sup> McKenzie, M. and G. Partington, 2013, Review of Aurizon Network's draft access undertaking, Report for the Queensland Resources Council, 5 October.

<sup>260</sup> McKenzie and Partington (2013), p. 16. The current yield on 10-year CGS at the time of this report was 3.97%.

<sup>261</sup> McKenzie and Partington (2013), p. 16.

<sup>262</sup> AOFM Annual Report 2010-2011, p. 1.



Prior to tenders, the Australian Government borrowed through individual cash loans and a more flexible continuous offer mechanism known as the TAP system. Under these arrangements the Government set the yield and the market would determine how much was purchased.

The financial environment in which the TAP system operated was very different to that of today.<sup>263</sup>

404. Moreover, the historical system was not compatible with the free and flexible interest rates that are available today and it caused the intertwining of monetary policy and government debt management:

The TAP mechanism was not sustainable with increasingly flexible interest rates. As a result, a tender system was first adopted for short-term Treasury Notes in December 1979 and for Treasury Bonds in August 1982. The move to a tender approach supported the Government moving to fully fund its Budget without recourse to central bank financing. This effectively separated monetary policy from debt management.<sup>264</sup>

405. The AOFM concludes that the key risk-free market yield was not “freed up” until the tender system was put in place in 1982:

The adoption of tenders for debt issuance was critical in freeing up the key risk-free market yield in the economy. This proved essential for the financial innovation that was to occur in the financial markets in the following years.<sup>265</sup>

406. McCray (2000) notes that under the TAP system, the majority of government bonds were issued to institutions that were effectively forced (by government regulation) to buy and hold:

The market was essentially ‘buy and hold’ in its orientation and distinguished by a variety of ‘captive market’ arrangements, which obliged financial institutions to hold specified proportions of their assets in the form of government securities. In like manner, life insurance offices and pension funds were provided with significant tax concessions in return for holding 30 per cent of their assets in public securities.<sup>266</sup>

407. The captive market had two effects. First, it resulted in there being no effective secondary market, since the institutions that bought at issuance were required to hold through to maturity:

One consequence of these captive market arrangements was that there was only a very limited secondary market in government securities. Derivatives markets as they are known today did not exist...In summary, captive investor arrangements discourage the taking of positions in the market and, in doing so, act to inhibit liquidity and secondary market development.<sup>267</sup>

408. The captive market also had the effect of artificially reducing the yield:

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<sup>263</sup> AOFM Annual Report 2010-2011, p. 1.

<sup>264</sup> AOFM Annual Report 2010-2011, p. 1.

<sup>265</sup> AOFM Annual Report 2010-2011, p. 1.

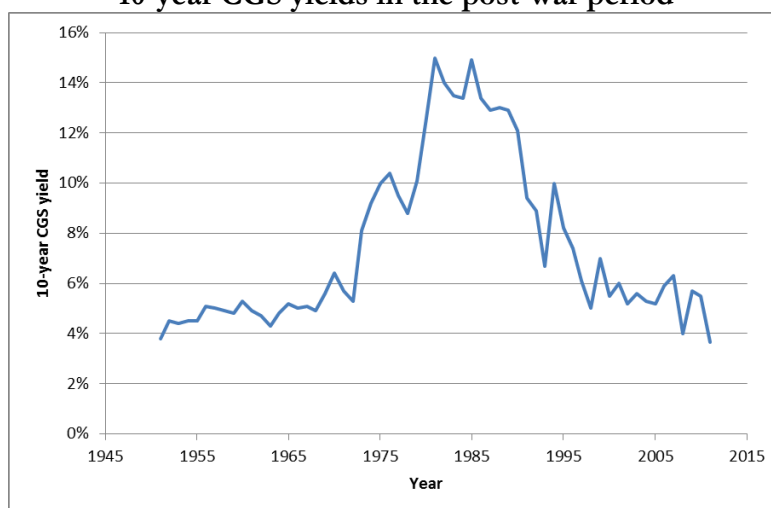
<sup>266</sup> McCray (2000), p. 5.

<sup>267</sup> McCray (2000), p. 9.

...the arrangements also ensured a continued demand from growing financial institutions for government securities and doubtless assisted the authorities to issue government bonds at lower interest rates than would otherwise have been the case.<sup>268</sup>

409. McKenzie and Partington (2013) now conclude that the current low CGS yields may be “nothing more than a return to the ‘normal’ long run interest rate regime.”<sup>269</sup> In summary, McKenzie and Partington now conclude that, although current CGS yields are lower than at any time in the last 40 years, they are “reasonably close” to the yields that were artificially set by government 50 or more years ago.
410. Our view is that a more careful and appropriate interpretation of the relevant evidence is that CGS yields have not been this low since governments ceased artificially fixing them and allowed them to become market prices.
411. Even setting aside the McKenzie and Partington (2013) comparison of apples and oranges, the fact remains that CGS yields in the period since the onset of the GFC have been lower than at any time since World War Two, as illustrated in Figure 31 below.

**Figure 31**  
**10-year CGS yields in the post-war period**



Source: RBA

412. Consequently, it is a fact that the approach of estimating the required return on equity by using the SL-CAPM with a fixed MRP of 6% leads inevitably to the conclusion that equity capital has been cheaper since the onset of the GFC than at any other time since WWII.

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<sup>268</sup> McCray (2000), p. 9.

<sup>269</sup> McKenzie and Partington (2013), p. 16.