



Consistency between the return on equity and the return on debt: Response to the DBP Draft Decision

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Executive Summary

1.1 Context

1 Frontier Economics (**Frontier**) has been retained by DBNGP (WA) Nominees Pty Ltd (**DBP**) to provide our opinions in relation to the DBP Draft Decision of the Economic Regulation Authority of Western Australia (**ERA**) insofar as it relates to the gamma parameter.

2 This report has been authored by Professor Stephen Gray, Professor of Finance at the UQ Business School, University of Queensland and Director of Frontier Economics, a specialist economics and corporate finance consultancy. I have Honours degrees in Commerce and Law from the University of Queensland and a PhD in Financial Economics from Stanford University. I teach graduate level courses with a focus on cost of capital issues, I have published widely in high-level academic journals, and I have more than 15 years' experience advising regulators, government agencies and regulated businesses on cost of capital issues. A copy of my curriculum vitae is attached as Appendix 2 to this report.

3 My opinions set out in this report are based on the specialist knowledge acquired from my training and experience set out above. I have been provided with a copy of the Federal Court's Practice Note CM 7, entitled "Expert Witnesses in Proceedings in the Federal Court of Australia", which comprises the guidelines for expert witnesses in the Federal Court of Australia (Expert Witness Guidelines). I have read, understood and complied with the Expert Witness Guidelines.

4 I have previously provided a report on this issue to the ERA:

- a. SFG Consulting, 2014 DBP, *The relationship between the required return on debt and equity*, 31 December.

5 Since preparing that reports, I have joined Frontier Economics and provide this report on that basis.

1.2 Summary of conclusions

6 Our primary conclusions are set out below.

7 The ERA has decided to place no material weight on the evidence of an interrelationship between the required return on debt and equity in the same benchmark firm for three reasons. We do not consider that any of these reasons are valid for the reasons set out below:

- a. The ERA concludes that the literature that develops a framework for the interrelationship between the required return on equity and the required return on debt is not relevant to its regulatory task.

In our view, it is unreasonable to conclude that the large literature that has followed the seminal work of Merton (1974) is not relevant to a regulatory task that requires consideration of all

relevant evidence,¹ consistent application of financial parameters that are common to the return on equity and the return on debt,² and consideration of any interrelationships between estimates of financial parameters that are relevant to the estimates of the return on equity and the return on debt.³

- b. The ERA reviews a number dated reports that are tangentially relevant in that they generally consider debt and equity returns. The ERA concludes from this that even if the evidence suggests that estimates of the required return on debt and equity are internally inconsistent, there is no problem because investors might set required returns for debt and equity in the same firm independently in segmented markets.

Our view is that it would be wrong to set the allowed return for the benchmark firm on the basis that debt and equity in that firm are priced independently and inconsistently in segmented markets. As Campello, Chen and Zhang (2008) observe:

...debt and equity are contingent claims written on the same productive assets and thus must share similar common risk factors.⁴

- c. The ERA concludes that the evidence suggests that, for a given estimate of the required return on debt, the required return on equity should be even higher than the SFG (2014) report suggests, which:

...produces a very nonsensible outcome.⁵

The conclusion from SFG (2014) is that the ERA's allowed return on equity is unreasonably low relative to the return on debt in the same firm. The ERA suggests that this consistency test is too easy to satisfy and should be even higher. In our view, the fact that the test might be "too easy" provides even more reason for the ERA to examine its approach to setting the allowed return on equity.

Applying the internal consistency test to the latest market data and to the contemporaneous return on debt estimates provided to us by DBP produces a *lower bound* for the equity risk premium⁶ of 7.76% to 8.17%. This test would be applied by comparing a proposed equity risk premium with this lower bound, and rejecting any estimates that fell below the lower bound.

¹ NGR 87(5)(a).

² National Gas Rules, clause 87(5)(b).

³ National Gas Rules, clause 87(5)(c).

⁴ Campello, Chen and Zhang (2008), p. 1298.

⁵ DBP Draft Decision, Appendix 4, Paragraph 1113.

⁶ Under the CAPM, this is given by the product of the equity beta and the market risk premium.

2 Summary of the SFG (2014) report

2.1 Overview

8 In our December 2014 report to the ERA,⁷ we examined a framework for evaluating the consistency between the required return on debt and the required return on equity in the Australian regulatory setting.

9 In that report, we began by considering the **allowed rate of return objective**: that is set out in the National Gas Rules:

...[t]he rate of return for a [Service Provider] is to be commensurate 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].⁸

10 The National Gas Rules also provide guidance on the implementation of the allowed rate of return objective. The Rules refer to the desirability of using an approach that leads to the consistent application of financial parameters that are common to the return on equity and the return on debt,⁹ and to consideration of any interrelationships between estimates of financial parameters that are relevant to the estimates of the return on equity and the return on debt.¹⁰

11 In our previous report, we noted that there is an interrelationship between the return on equity and the return on debt because both equity and debt securities depend on the assets of the same benchmark firm. Debt and equity simply represent different claims over the *same* assets. Consequently, there is an interrelationship between the return on equity and the return on debt, the estimate of one is relevant to the estimate of the other, and the two estimates must be consistent with each other.

12 In our view, the linkage between the required returns on debt and equity in the same benchmark firm appears to be central to the NGR 87(5) requirements to have regard to all relevant evidence, consistency, and interrelationships between parameters for equity and debt.

13 In our 2014 report, we considered the standard framework for modelling the linkage between the required returns on debt and equity in the same firm. We explained the basis for the standard modelling framework, the implications for the relationship between the return on equity and the return on debt in the same firm, and we summarised the relevant literature on the development and application of that modelling framework.

⁷ SFG Consulting, 2014, *The relationship between the required return on debt and equity*, Submission to the ERA, December.

⁸ For example, see NGR 87(2)(3).

⁹ National Gas Rules, clause 87(5)(b).

¹⁰ National Gas Rules, clause 87(5)(c).

2.2 Main conclusions from SFG (2014)

14 The SFG (2014) report was based upon the framework developed by Nobel Prize winning economist Robert Merton in 1974. Merton (1974) noted the simple fact that equity and debt are contingent claims over the assets of the same firm. Both become less valuable as the assets of the firm decline in value and both become more valuable as the assets of the firm rise in value. Both are linked to the value of the assets of the firm. Thus, if there are certain factors that drive changes in the value of the assets of the firm, those same factors will drive the returns to debt and equity in that firm. This means that there is a positive relationship between the return on debt and the return on equity in the same firm.

15 The original framework developed by Merton (1974) has spawned a huge literature that has developed and refined the framework in a number of directions.¹¹ In all cases, the strong link between the required returns on debt and equity remains a central feature.

16 SFG (2014) also noted that current empirical applications of the Merton framework generate a number of important insights that are relevant to the regulatory setting:

- a. There is a positive relationship between the expected return on equity and the expected return on debt;
- b. The expected return on debt is equal to the yield on debt, but for the chance of default. Consequently, the expected return on debt is closely approximated by the yield when the probability of default is low;
- c. If a regulator considers that their regulatory allowance will be sufficient to ensure the solvency of the regulated firm, there must be a positive relationship between the allowed return on equity and the allowed return on debt. It would be inconsistent for a regulator to materially increase the allowed risk premium on debt, but to make no change to the allowed risk premium on equity. The evolution of the allowed risk premium on debt is relevant evidence to consider when determining the risk premium to be allowed on equity;
- d. A high DRP (yield less risk-free rate) need not imply a high default probability – where defaults are systematically more likely to occur during recessions and financial crises (which they are); and
- e. If the regulator considers that there *is* a material chance of default, the allowed return on equity would need to be grossed-up

¹¹ Merton (1974) is the ninth most cited *Journal of Finance* paper of all time. Other top-10 papers includes the CAPM paper of Sharpe (1964), the diversification paper of Markowitz (1952), and Fama and French (1992). See [http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1540-6261/homepage/top_cited_articles_of_all_time.htm](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1540-6261/homepage/top_cited_articles_of_all_time.htm).

to ensure that the *expected* return to equity is consistent with the regulator's estimate of the required return.

- 17 SFG (2014) also noted that the modern application of the Merton (1974) contingent claims framework focuses on the relationship between the required return on equity and the required return on debt. In particular, one of the key insights of the Merton framework is that the equity risk premium and the debt risk premium must be linked by the following equation:

$$E[r_e] - r_f = \Omega_{e,d}(E[r_d] - r_f) \quad (1)$$

where the key term is the elasticity of equity relative to debt:

$$\Omega_{e,d} = \frac{\partial E/E}{\partial D/D}$$

- 18 For example, Campello, Chen and Zhang (2008), which is published in the top-ranking *Review of Financial Studies*, explain that:

Because both equity and debt are contingent claims written on the same productive assets, a firm's equity risk premium is naturally tied to its debt risk premium. [The equation above] formalizes this argument: the equity risk premium equals the debt risk premium multiplied by the elasticity of the equity value with respect to the bond value...the equity value and the bond value are driven only by the asset value. Our framework still allows multiple common factors, but they affect equity and bond values through the firm value.¹²

- 19 That is, the key insight from the Merton framework is that equity and debt are contingent claims over the assets of the same firm. These two investor classes will share the payoffs from the same firm between them. Consequently there must be some relationship between the returns to each. As Campello, Chen and Zhang (2008) explain above, the Merton framework is agnostic about how assets are valued. Merton takes no view about whether assets are valued in accordance with the CAPM or a multi-factor model. Rather, the Merton framework takes the value of the firm's assets as given, and focuses on the relativity of the return that those assets are expected to provide to equity holders and the return that those same assets are expected to provide to debt holders.

- 20 An important conclusion from our earlier (SFG, 2014) report is as follows:

We do not suggest that this framework can be used to obtain a single point estimate of the required return on equity from the analysis of primary data. Estimating the required return on equity is a complex task that requires consideration of a whole range of models, estimation methods, data and other evidence. Rather, our point is that the Merton framework is very useful when considering the relationship between the required return on equity and the required return on debt for the same firm. The Merton framework provides valuable insights into the *relativity* between these two quantities. The Merton framework has been shown to perform well empirically in explaining the relative returns on equity on debt and it is for that purpose that we consider in this report. The relativity between the required return on equity and the required return on debt takes on new importance under NGR 87(5) which

¹² Campello, Chen and Zhang (2008), p. 1302.

requires stakeholders to have regard to the consistency of parameter estimates and to the interrelationships between parameters.

2.3 Estimates in SFG (2014)

21 SFG (2014) then considered lower bound estimates for elasticity, Ω_{min} , and the expected excess return on debt, $(E[r_d] - r_f)_{min}$, noting that under the Merton framework that establishes a lower bound on the internally consistent equity risk premium:

$$E[r_e] - r_f > \Omega_{min}(E[r_d] - r_f)_{min}.$$

22 Using data available at the time, SFG (2014) adopted a lower bound of 6 for the elasticity parameter and a lower bound of 1% for the expected excess return on debt. This produced a lower bound of 6% for the equity risk premium:

$$E[r_e] - r_f > 6.0 \times 1.0\% = 6.0\%.$$

23 SFG (2014) then compared this lower bound equity risk premium with the equity risk premium proposed in the ERA's ATCO Gas Draft Decision of 3.8%, being the product of an equity beta of 0.7 and a market risk premium of 5.5%.

24 Since the allowed equity risk premium of 3.8% was materially below the lower bound figure of 6.0%, the conclusion was that the allowed equity risk premium was inconsistent with the allowed return on debt.

3 Response to the DBP Draft Decision

3.1 Overview

25 In its DBP Draft Decision, the ERA begins its response to SFG (2014) by stating that:

The Authority is not in the position to provide response to the three key studies, Merton (1974); Campello, Chen and Zhang (2008); and Schaefer and Strebulaev (2008), which SFG has relied on to support its analysis.¹³

26 The ERA does not explain:

- a. Why it is unable to respond to the three key pieces of published research on which the SFG (2014) report is based; or
- b. How it is able to reject the relevance of the link between the return on debt and the return on equity in the same firm without a proper consideration of the key papers that develop the framework for understanding that link.

27 Nevertheless, in its DBP Draft Decision, the ERA raises a number of issues which we address in turn in the remainder of this section. These issues fall under three general headings:

- a. The ERA concludes that the literature that develops a framework for the interrelationship between the required return on equity and the required return on debt is not relevant to its regulatory task;
- b. The ERA then reviews a number dated reports that are tangentially relevant in that they generally consider debt and equity returns. The ERA concludes from this that even if the evidence suggests that estimates of the required return on debt and equity are internally inconsistent, there is no problem because investors might set required returns for debt and equity in the same firm independently in segmented markets; and
- c. The ERA concludes that the evidence suggests that, for a given estimate of the required return on debt, the required return on equity should be even higher than the SFG (2014) report suggests.

3.2 Lack of relevance to the ERA's task

28 In its DBP Draft Decision, the ERA concludes that the published literature that establishes an internal consistency interrelationship between the return on debt and equity in the same firm (which the ERA is not in a position to respond to) is not relevant to its task:

¹³ DBP Draft Decision, Appendix 4, Paragraph 1087.

The Authority is of the view that neither (sic) of the three papers used by SFG provides relevant and direct findings in relation to the investigation of the direct link between the cost of debt and the return on equity. All these papers focus on the term structure of interest rate or bond prices.¹⁴

29 In our view, this is not a reasonable characterisation of the relevant papers, all of which have been published in leading A* journals. For example, Campello, Chen and Zhang (2008) state that:

Motivated by Merton (1974), our basic approach recognizes that debt and equity are contingent claims written on the same productive assets and thus must share similar common risk factors. The upshot of this observation is that we can use corporate bond data to glean additional information about investors' required equity rates of returns.¹⁵

and that:

Our basic idea is that bond and equity risk premiums are intrinsically linked because equity and bonds are contingent claims written on the same productive assets, an insight that can be traced back to Merton (1974).¹⁶

and further that:

Because both equity and debt are contingent claims written on the same productive assets, a firm's equity risk premium is naturally tied to its debt risk premium. [Equation 1 above] formalizes this argument: the equity risk premium equals the debt risk premium multiplied by the elasticity of the equity value with respect to the bond value...the equity value and the bond value are driven only by the asset value. Our framework still allows multiple common factors, but they affect equity and bond values through the firm value.¹⁷

30 Campello, Chen and Zhang (2008), which is based on Merton (1974), is unquestionably a paper about the relationship between debt and equity returns in the same firm. It goes directly to the point of consistent application of financial parameters that are common to the return on equity and the return on debt,¹⁸ and to consideration of any interrelationships between estimates of financial parameters that are relevant to the estimates of the return on equity and the return on debt.¹⁹

31 The DBP Draft Decision also rejects the relevance of Schaefer and Strebulaev (2008), citing the first half of the first sentence in the abstract:

...structural models of credit risk provide poor predictions of bond prices.²⁰

32 However, the full sentence provides some insight into the purpose of that paper:

¹⁴ DBP Draft Decision, Appendix 4, Paragraph 1094.

¹⁵ Campello, Chen and Zhang (2008), p. 1298.

¹⁶ Campello, Chen and Zhang (2008), p. 1298.

¹⁷ Campello, Chen and Zhang (2008), p. 1302.

¹⁸ National Gas Rules, clause 87(5)(b).

¹⁹ National Gas Rules, clause 87(5)(c).

²⁰ DBP Draft Decision, Appendix 4, Paragraph 1093.

Structural models of credit risk provide poor predictions of bond prices. We show that, despite this, they provide quite accurate predictions of the sensitivity of corporate bond returns to changes in the value of equity (hedge ratios).²¹

33 That is, although the models cannot be used to estimate bond *prices*, they are useful in characterising the *interrelationship* between debt and equity *returns*. We propose to use these models only in considering the interrelationship between debt and equity returns.

34 In summary, our view is that it is unreasonable to conclude that these papers are not relevant to a regulatory task that requires consideration of all relevant evidence,²² consistent application of financial parameters that are common to the return on equity and the return on debt,²³ and consideration of any interrelationships between estimates of financial parameters that are relevant to the estimates of the return on equity and the return on debt.²⁴

3.3 The implications of failing the consistency test

35 SFG (2014) sets out a consistency test that derives a lower bound for the equity risk premium, given the debt risk premium for the same firm. As set out above, that test is based on the recent published papers of Campello, Chen and Zhang (2008) and Schaefer and Strebulaev (2008).

36 In its DBP Draft Decision, the ERA summarises three reports that were submitted to an AER process five years ago. None of those reports considers either Campello, Chen and Zhang (2008) or Schaefer and Strebulaev (2008), so their relevance to the DBP consistency test is limited to the fact that these old reports refer generally to the relative returns on debt and equity.

37 Indeed, only one of the three reports that the ERA cites, Handley (2011), considers a Merton-type framework. The ERA cites the key observation of the Handley report, as follows:

Stiglitz (1969), Rubinstein (1973), Merton (1974) and Galai and Masulis (1976) have all shown that (under certain assumptions) the Modigliani-Miller theorem holds in the presence of risky debt. An implicit assumption common to all four papers, is that both the equity and debt securities in the firm are priced according to the same relevant asset pricing framework – i.e. a general equilibrium state preference framework in the case of Stiglitz (1969), a mean-variance framework in the case of Rubinstein (1973), an option pricing framework in the case of Merton (1974) or a combined CAPM/option pricing framework in the case of Galai and Masulis (1976). In other words, the validity of the Modigliani-Miller theorem in the presence of risky debt is based on the implicit assumption that equity and debt are priced in the (same) integrated market rather than being priced in (separate) segmented markets.

In this case, not only is it possible to derive a lower bound on the firm's equity risk premium relative to its debt risk premium but rather one can derive an

²¹ Schaefer and Strebulaev (2008), p. 1.

²² NGR 87(5)(a).

²³ National Gas Rules, clause 87(5)(b).

²⁴ National Gas Rules, clause 87(5)(c).

exact relationship between the firm's cost of debt and its return on equity and accordingly an exact relationship between the firm's equity risk premium and its debt risk premium.²⁵

38 The point being made here is that there is a literature that disaggregates the overall return generated by a firm into the return to equity holders and the return to debt holders. What Handley refers to as “the Modigliani-Miller theorem” above is the notion that the return to debt holders and the return to equity holders in the same firm must add up to equal the overall return to that firm. Handley notes that the literature shows that, if debt and equity returns are estimated within the same integrated framework (whatever that might be) it must be the case that there is an exact relationship between the firm's equity risk premium and its debt risk premium. We agree with all of this. Indeed, such an exact relationship is set out in Equation (1) above, which forms the basis of the DBP consistency test.

39 In its DBP Draft Decision, the ERA then goes on to consider the general implications of a violation of any sort of relative consistency test. In this regard, the ERA again cites Handley (2011), who sets out three scenarios for the case where the estimate of the required return on equity appears to be too low relative to the estimate of the required return on debt:

...this could imply either: (i) that the equity and debt are priced in an integrated market and the equity risk premium is too low; or (ii) that the equity and debt are priced in an integrated market and the debt risk premium is too high; or (iii) that the equity and debt are priced in segmented markets and so the Modigliani-Miller theorem cannot be used to infer that the equity is mispriced relative to the debt.²⁶

40 In our view, the second scenario is materially less likely than the first, given that debt yields are observable whereas the required return on equity must be estimated by parameterising some sort of asset pricing model.

41 In our view, the third scenario should also receive little weight as it seems implausible to suggest that the same investors would evaluate potential debt and equity investments in the same firm in an internally inconsistent manner. As Campello, Chen and Zhang (2008) observe:

...debt and equity are contingent claims written on the same productive assets and thus must share similar common risk factors.²⁷

42 That is, debt and equity investments in the same firm both depend on the prospects of that same firm. It follows that the required returns on debt and equity in the benchmark firm must be interrelated – it would be wrong to set the allowed return for the benchmark firm on the basis that debt and equity in that firm are priced independently and inconsistently in segmented markets. The above passage from Handley (2011) establishes that, if the strong “segmented

²⁵ J. Handley, *Peer Review of Draft Report by Davis on the Cost of Equity*, A Report for The Australian Energy Regulator, 18 January 2011, pp. 8-9, cited at DBP Draft Decision, Appendix 4, Paragraph 1107.

²⁶ J. Handley, *Peer Review of Draft Report by Davis on the Cost of Equity*, A Report for The Australian Energy Regulator, 18 January 2011, pp. 8-9, cited at DBP Draft Decision, Appendix 4, Paragraph 1108.

²⁷ Campello, Chen and Zhang (2008), p. 1298.

markets” assumption is ruled out, it must be the case that there is an interrelationship between the return on debt and the return on equity in the same firm.

43 In summary, our view is that if the estimated equity risk premium fails the DBP lower bound consistency test (that is based on a relativity with the debt risk premium for the same firm), the appropriate response would be to re-examine the derivation of that equity risk premium. An appropriate response would not be to reduce the (more directly observed) debt risk premium, or to conclude that equity and debt returns for the same firm are independent of one another.

44 On this point, the DBP Draft Decision concludes that:

...it would not be irrelevant whether a firm held debt or equity, if one was significantly cheaper than the other, given constant levels of risk of default,²⁸

What the ERA means by this conclusion remains unclear to us.

3.4 Empirical implementation of the consistency test

45 In our previous report on this consistency issue, SFG (2014), we implemented the test by applying a lower bound elasticity estimate of 6. In its DBP Draft Decision, the ERA concludes that:

...the Authority considers that the evidence assembled by SFG in its Figures 1, 2 and 3 suggests that the elasticity in the Australian context should be 7 or higher,²⁹

and that the use of that higher elasticity figure:

...produces a very nonsensible outcome.³⁰

46 The approach that we undertook in the SFG (2014) report was to estimate a *lower bound* for the elasticity parameter for the purposes of deriving a lower bound for the equity risk premium. In deriving the lower bound of 6, we were deliberately conservative at every point where the exercise of any judgment was required. The result of this process was a lower bound estimate of elasticity – such that no reasonable estimate of elasticity could be below that figure. This lower bound for elasticity was then used to construct a lower bound for the equity risk premium – a figure that sets a floor for all reasonable estimates of the equity risk premium.

47 The ERA correctly points out that if a higher figure is used for the elasticity lower bound, the result will be a higher figure for the equity risk premium lower bound. The ERA then argues that the higher implied equity risk premiums that it derives by using higher estimates are “very nonsensible.”³¹ This leads the ERA to reject entirely the notion that the return on debt has any relevance to the estimation of the required return on equity in the same firm. The ERA then

²⁸ DBP Draft Decision, Appendix 4, Paragraph 1109.

²⁹ DBP Draft Decision, Appendix 4, Paragraph 1112.

³⁰ DBP Draft Decision, Appendix 4, Paragraph 1113.

³¹ DBP Draft Decision, Appendix 4, Paragraph 1113.

proceeds to estimate the required return on equity without regard to its estimate of the required return on debt in the same firm. Specifically, the ERA has maintained its approach of setting the allowed return on equity by inserting the three SL-CAPM parameters into the SL-CAPM formula and adopting the output without modification.

48 In our view, such a conclusion has no logic to it. The conclusion from SFG (2014) is that the ERA's allowed return on equity is unreasonably low relative to the return on debt in the same firm. The ERA suggests that this consistency test is too easy to satisfy and should be even higher. In our view, the fact that the test might be "too easy" provides even more reason for the ERA to examine its approach to setting the allowed return on equity.

49 Finally, we note that in Table 43 of the DBP Draft Decision, the ERA derives various implied estimates of the MRP, all of which the ERA considers to be unreasonably high. These calculations are disingenuous in that they fix the equity beta to 0.7, which we consider to be unreasonably low, and therefore inflate the implied MRP. The consistency test derives a lower bound for the equity risk premium, which is the product of two parameters: beta and MRP. At the time of writing the SFG (2014) report, our view was that the ERA had materially underestimated both parameters. For example, in our contemporaneous report for ATCO Gas³² we concluded that if the SL-CAPM was to be used, the appropriate parameter estimates to use would be 0.91 for beta and 7.61% for the MRP, which produces an equity risk premium of 6.93% that passes the consistency test.

50 The DBP Draft Decision also considers a higher debt risk premium:

The Authority notes that the spread was 2.041 per cent adopted in the Authority's Final Decision on ATCO, not 1.80 per cent as adopted in SFG's analysis.³³

51 In our SFG (2014) report, we used the figures from the ATCO Gas Draft Decision, which were the latest figures available at the time. The passage above uses a higher figure for the debt risk premium from a decision published by the ERA some six months after the SFG (2014) report. It is, of course, unreasonable to compare a return on equity figure from one point in time with a return on debt figure from another point in time, which is the basis for the figures in Table 43 of the DBP Draft Decision. Any meaningful test requires the comparison of contemporaneous returns.

³² SFG (2014 ATCO).

³³ DBP Draft Decision, Appendix 4, Paragraph 1115.

4 Current application of the consistency test

52 Since our 2014 report, market conditions have changed in that government bond yields have declined and estimates of the contemporaneous market risk premium have increased. For example:

- a. At the time of our 2014 report, the 10-year government bond yield was 3.4%,³⁴ whereas the current DBP submission adopts a base rate of 2.98% set according to the contemporaneous 10-year swap rate; and
- b. At the time of our 2014 report, the most recent MRP estimate from the ERA was 5.5% in the ATCO Gas Draft Decision. The ERA's current MRP estimate from the DBP Draft Decision is 7.6%.

53 Consequently, we update our calculations for the consistency test that was applied in SFG (2014). Specifically, the most recent estimates for the three components of the expected return on 10-year BBB-rated corporate debt are as follows:

- a. A 10-year base rate of 2.98%, estimated as the contemporaneous yield on 10-year swaps, supplied to us by DBP as being commensurate with market conditions over the relevant averaging period;
- b. A 10-year BBB corporate debt risk premium (relative to the 10-year swap rate) range of 2.50% to 2.57%, being the 10-year DRP proposed by DBP; and
- c. A one-year default probability of 0.24% for generic BBB-rated corporate debt, as most recently reported by Standard and Poor's³⁵

54 The figures above imply:

- a. A total yield on BBB-rated corporate debt of 5.48% to 5.55%;³⁶
- b. A probability of default on a generic BBB-rated corporate bond within the next 10 years of 2.37%;³⁷ and
- c. An expected debt risk premium (relative to the 10-year government bond yield of 2.87%) of 1.29%³⁸ to 1.36%.³⁹

³⁴ ERA ATCO Gas Draft Decision, Paragraph 892.

³⁵ Standard and Poor's, 2015, Global Corporate Default Summary, Table 9, p. 28.

³⁶ 2.98%+ 2.50% to 2.98%+ 2.57%.

³⁷ $1-(1-0.24\%)^{10}$.

³⁸ $[(1-2.37\%)\times 5.48\%+2.37\%\times(-50\%)]-2.87\%$.

³⁹ $[(1-2.37\%)\times 5.25\%+2.37\%\times(-50\%)]-2.87\%$.

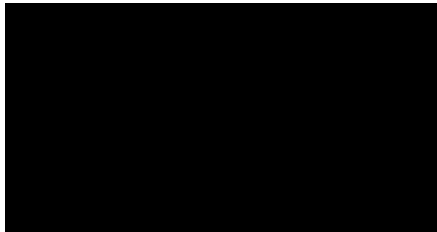
- 55 Even applying a lower bound⁴⁰ elasticity of 6 to the expected debt risk premium implies a lower bound of 7.76% to 8.17%⁴¹ for the equity risk premium. This, in turn, implies a lower bound for the required return on equity of 10.63% to 11.04% when paired with DBP's estimate of the yield on 10-year government bonds of 2.87%.
- 56 That is, estimates of the equity risk premium that are at, or above, this level would be reasonable given the debt risk premium to be applied to the same firm.
- 57 As set out above, we do not consider that the generic Merton framework is capable, in itself, of producing a definitive point estimate of the required return on equity. Although it is well-accepted and intuitive, the Merton framework is relatively simple and a degree of judgment required when implementing the model such that there is no consensus about the relevant parameter estimates. Nevertheless, for the reasons set out above, it is our view there is a clear interrelationship between the required return on debt and equity in the same firm.
- 58 For this reason, we suggest that the Merton framework should be used as one of a battery of reasonableness checks of the allowed return on equity. If the Merton debt/equity consistency evidence is consistent with other evidence in suggesting that a proposed allowed return on equity is unreasonably low, that combined body of evidence should lead to a reconsideration of the approach to determining that allowed return on equity.

⁴⁰ As above, we adopt this figure as a *lower bound* in the sense that no reasonable estimate of the elasticity would be below that figure.

⁴¹ $6 \times 1.29\%$ to $6 \times 1.36\%$.

5 Declaration

59 I confirm that I have made all the inquiries that I believe are desirable and appropriate and no matters of significance that I regard as relevant have, to my knowledge, been withheld from the Court.



Professor Stephen Gray

6 References

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7 Appendix 1: Instructions

In its AA Proposal of 31 December 2014, DBP presented a model developed by SFG Consulting based upon the options theory literature which seeks to ascertain consistent costs of debt and equity (*The relationship between the required return on debt and equity*, SFG Consulting, 23 December 2014) (**SFG Report**). That is, to uncover a mathematical relationship between the cost of debt and equity, such that the cost of debt can be used as a test of the consistency between the cost of debt and equity, as per Rule 87(5) and 87(11) of the National Gas Rules. This model is described [here](#).

In its *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 -2020*, dated 22 December 2015 (**Draft Decision**), the ERA rejects the "consistency test" approach advocated by DBP. The ERA's grounds for doing so are outlined on page 88 of Appendix 4, and in Appendix 4C (pp236-248 of Appendix 4) and may be summarised as follows on the grounds that:

- It is not based on any standard finance theory, is not well established and is untested (p 88 and 248 of Appendix 4 to the Draft Decision).
- The three papers that SFG use to inform their model appear to be about the structure of interest rates and not about the link between debt and equity (p241 and 242 of Appendix 4 to the Draft Decision).
- The approach is not empirically relevant because using a slightly different value for the elasticity between debt and equity would lead to very different results (p246 to 248 of Appendix 4 to the Draft Decision).

In respect to the above points, the consultant is asked to provide an expert opinion on:

1. whether the matters raised by the ERA in its Draft Decision represent a reasonable basis upon which to reject the evidence in the SFG Report and the submissions raised by DBP in support of its AA Proposal; and
2. further to 1, whether the ERA was correct (give the requirements of Rule 87(5) and 87(11) of the National Gas Rules) to reject the "consistency test" on the basis that it is unsound, having regard to the requirements of the National Gas Rules, including the allowed rate of return objective in rule 87.

The consultant is also asked to comment briefly upon the relevance of the material on pages 242 to 246, which appears very similar to the ERA's response to a different model presented by GGP in its access arrangement, to both the SFG model and to the ERA's rejection of it. Finally, the consultant will need to re-paramaterise the SFG model to reflect more recent data; DBP will provide a relevant date range during the course of the project.

Since it is possible that your expert report may be relied on in future proceedings before the Australian Competition Tribunal, we require that the work be undertaken in accordance with the Federal Court Guidelines for Expert Witnesses (attached). Further, your report should contain a declaration that you

have been given and have read, understood and complied with Practice Note CM7 issued by the Federal Court of Australia concerning guidelines for expert witnesses. It should also contain a declaration that you have made all the inquiries that you believe are desirable and appropriate and that no matters of significance that you regard as relevant have, to your knowledge, been withheld.

8 Curriculum vitae of Professor Stephen Gray

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

- 2014 E Yetton Prize for best paper in the Australian Journal of Management, Brailsford, T., S. Gray and S. Treepongkaruna, (2013), "Explaining the bid-ask spread in the foreign exchange market: A test of alternate models."
- 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)

- Institute of Teaching and Learning Innovation Grant 2016-17, Technology-enhanced Learning Grant (\$200,000), with K. Benson, B. Oliver and J. Birt.

- 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

- Faff, R., S. Gray, and H. Norton, (2015), “Yes, one-day international cricket ‘in-play’ strategies can be profitable!” *Journal of Banking and Finance*, forthcoming.
- Gray, S. and J. Nowland, (2015), “The Diversity of Expertise on Corporate Boards in Australia,” *Accounting and Finance*, forthcoming.
- Darat, A., S. Gray, J. C. Park and S. Wu, (2014), “Corporate governance and bankruptcy risk” *Journal of Accounting, Auditing and Finance*, forthcoming.
- Gray, S., I. Harymawan and J. Nowland, (2014), “Political and government connections on corporate boards in Australia: Good for business?” *Australian Journal of Management*, forthcoming.
- Brailsford, T., S. Gray and S. Treepongkaruna, (2014), “Explaining the bid-ask spread in the foreign exchange market: A test of alternate models,” *Australian Journal of Management*, 39, 4, 573-591.
- Faff, R., S. Gray and M. Poulsen, (2014), “Financial inflexibility and the value premium,” *International Review of Finance*, 13, 3, 327-344.
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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

2012 - Present: Director, Children's Hospital Foundation, Queensland.

2002 - Present: Director, Financial Management Association of Australia Ltd.

2003 - 2012: Director, Moreton Bay Boys College Ltd. (Chairman from 2007).

2002 - 2007: External Risk Advisor to Board of Enertrade (Queensland Power Trading Corporation Ltd.)

Consulting

SFG Consulting: 1997-2014.

Frontier Economics: 2014-Present.

Twenty years' experience in consulting to companies, government-owned corporations, government and regulatory agencies. Examples include:

- *Regulatory cost of capital:* Preparation of submissions in regulatory determinations. Clients include all Australian energy transmission and distribution businesses, FOXTEL, Telstra, BBI, ACCC, IPART, ERA.
- *Corporate cost of capital reviews:* Review of cost of capital estimates for project evaluation and impairment testing purposes. Clients include QANTAS, Stanwell Corporation, Ecowise.
- *Executive stock option valuation:* Clients include Collins Foods Group, Ground Probe, Crater Gold Mining, Beach Petroleum.
- *New Project Evaluation:* Assisting companies and GOCs to evaluate proposed new projects. Particular focus is on quantifying risk and uncertainty and presenting possible outcomes in a probabilistic framework. Clients include Queensland Treasury Corporation, Queensland Accommodation Group, Stanwell, EnerTrade.
- *Financial modelling and forecasting:* Clients include ATO (forecasting delinquent payments), ASX (forecasting trading volumes), Compass Resources (integrated mine valuation model).

Retained as a valuation expert in many litigation cases; produced many expert witness reports; appeared in Court for cross examination many times including:

- *Macquarie Generation:* Witness for AGL in competition case.
- *Telstra v. ACCC:* Witness for Telstra in rate of return regulation case.
- *C7 Case:* Witness for PBL, NewsCorp, Telstra re valuation of Seven's failed cable TV network.
- *Alcan v. NT Commissioner of Revenue:* Witness for Alcan re valuation of combined bauxite mine and alumina refinery for stamp duty purposes.

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