

Estimating gamma

Report for ATCO Gas Australia

13 March 2014

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1. Background and conclusions

Overview and instructions

1. SFG Consulting (**SFG**) has been retained by ATCO Gas Australia Ltd (**ATCO**) to provide our views on the estimation of the gamma parameter under the National Gas Rules (**Rules**). In particular, we have been asked to provide:
 - a) A review of the ERA's analysis of theta in the Rate of Return Guidelines, the methodologies it relies on and its finding that the permissible range is 0.35 to 0.55.
 - b) Your opinion on whether the ERA's range for theta provides the best estimate of theta and the cost of corporate income tax possible in the circumstances, which is consistent with the requirements of the NGO and the RPP.
 - c) If you do not consider the ERA's approach to the estimate of theta meets the requirements of the Rules identified above, what method(s) should be used to estimate theta in order to produce the best estimate possible in the circumstances which is consistent with the NGO and RPP and what is the resulting estimate of theta?
2. This report has been authored by Professor Stephen Gray, Professor of Finance at the UQ Business School, University of Queensland and Director of SFG Consulting, a specialist 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.
3. My opinions set out in this report are based on the specialist knowledge acquired from my training and experience set out above.
4. I have read, understood and complied with the Federal Court of Australia Practice Note CM7 *Expert Witnesses in Proceedings in the Federal Court of Australia*.
5. A copy of my instructions is attached as Appendix 1 to this report and a copy of my curriculum vitae is attached as Appendix 2.

Summary of conclusions

6. Our main conclusions are set out below.

Estimation approach

7. We agree with the ERA's approach (which is consistent with regulatory practice and the submissions of stakeholders) of estimating gamma as the product of:
 - a) The imputation credit distribution rate, F ; and
 - b) The value of distributed imputation credits, θ or "theta";
8. We agree with the ERA's estimate of the imputation credit distribution rate of 70%, and we note that this value is consistent with regulatory practice, the submissions of stakeholders and the available empirical evidence;

9. We agree with the ERA that the Rules require theta to be estimated as a market value using empirical methodologies. In particular, we agree with the ERA that:
- a) Tax statistic redemption rates cannot be used to estimate theta;
 - b) It is appropriate to use dividend drop-off analysis to estimate theta; and
 - c) It is appropriate to use the simultaneous price method to estimate theta;

Dividend drop-off analysis

10. The ERA considers two dividend drop-off estimates:
- a) A point estimate of 0.35 from SFG (2011) and SFG (2013); and
 - b) A range of 0.35 to 0.55 from its own study, Vo et al (2013).

In adopting the mid-point of the range from its own study, the ERA has effectively disregarded the SFG studies.

11. In our view, there are a number of reasons to prefer the SFG studies to the ERA study:
- a) The SFG approach has been subjected to intense scrutiny. All data and computer code was supplied to the AER. All issues that the AER has identified have been considered by the Tribunal. And the Tribunal has endorsed and adopted the results. By contrast, the ERA study has not been subjected to such scrutiny;¹
 - b) The SFG studies employ the standard, Tribunal-approved and AER-approved approach of correcting prices for market movements over the ex-dividend day; and
 - c) The SFG theta estimates have been shown to be stable and reliable in the face of a battery of stability and robustness checks, whereas the ERA expresses concerns about the stability and reliability of its own results.
12. In any event, there is little evidence to support the ERA's mid-point estimate of 0.45 from within its range of 0.35 to 0.55:
- a) The ERA's own estimates are overwhelmingly below 0.45 (see Figure 1 and Figure 3 above), and a significant proportion of those estimates are below 0.35;
 - b) The ERA study reports a theta estimate of 0.34 when the standard ex-day market correction is applied;
 - c) The ERA estimate increases only to 0.4 when the standard ex-day market correction is removed;
 - d) The SFG (2013) estimates indicate that, if anything, the 0.35 estimate is towards the upper end of the reasonable range.

¹ We understand that the ERA study has been submitted to an academic journal for publication. If this is the case, the ERA could release the referee report and editorial decision to document the degree of scrutiny to which its study has been subjected.

13. In our view, there is no reasonable basis for adopting a dividend drop-off estimate of theta above 0.35.

Alternative methodologies

14. The contemporaneous evidence from alternative empirical methods (including futures price studies and rate of return studies) suggests that the dividend drop-off estimate of 0.35 is, if anything, conservatively high.

Questions posed in our instructions

15. In response to the specific questions posed in our Instructions, we conclude that the ERA's range for theta does not provide the best estimate of theta and the cost of corporate income tax possible in the circumstances, and consequently that the ERA's range is not consistent with the requirements of the NGO and the RPP.
16. The reason for this conclusion is that the ERA has, in effect, adopted a theta estimate from its own study giving no real weight to other evidence in circumstances where that other evidence is more reliable and more accepted. In particular, a comparison of the ERA and SFG dividend drop-off studies reveals that:
 - a) The SFG study, and the methodology used in it, has been accepted and endorsed by the Australian Competition Tribunal, whereas the ERA study has not;
 - b) The SFG study employs the standard market correction approach that is used in published studies and which has been approved by the Tribunal and the AER. The ERA study (to the extent that its results differ from those of the SFG study) omits this standard market correction for no sound reason;
 - c) The SFG study produces stable estimates that are robust to the removal of influential outliers, whereas the authors of the ERA study question the reliability of their own results on this basis.
17. We agree with the ERA that gamma should be estimated as the product of F and theta, we agree with the ERA's estimate of F (70%), and we agree that theta must be estimated empirically. Our point of disagreement relates to what represents the best empirical estimate of theta. In effect, the ERA has rejected the SFG (2011, 2013) estimate of theta in favour of its own estimate. In our view, there are many reasons to prefer the SFG estimate to the ERA estimate, as set out above. Replacing the ERA estimate with the SFG estimate results in a theta value of 0.35, which produces a gamma value of 0.25. In our view, 0.25 is the best estimate possible of gamma in the circumstances which is consistent with the NGO and RPP.

2. ERA approach

Gamma to be estimated as the product of two components

18. In its Final Guideline, the ERA proposes to estimate gamma as the product of:
- a) The imputation credit distribution rate, F ; and
 - b) The value of distributed imputation credits, θ or “theta.”²
19. This approach is consistent with prior regulatory practice, with stakeholder submissions, and with the approach that has been adopted by the AER. In our view, this approach is uncontroversial and we agree with it.

Distribution rate set to 70%

20. In its Final Guideline, the ERA proposes to use an estimate of 70% for the distribution rate, or “payout ratio” as the ERA refers to it.³ The ERA notes that this estimate has been adopted by the Australian Competition Tribunal and is consistent with the most recent empirical evidence.⁴ We also note that the AER has also recently adopted a distribution rate of 70% based on its assessment of the relevant empirical evidence.⁵
21. We agree that 70% is the best estimate of the distribution rate that is currently available.

Market value of distributed credits to be estimated using empirical methods

22. In its Final Guideline materials, the ERA concludes that the market value of distributed credits (theta) must be estimated as a market value on the basis of empirical evidence.⁶ We agree with that conclusion.
23. In particular, the ERA concludes that imputation credit redemption rates, estimated using what the ERA calls “the tax statistics methodology,” cannot be used to estimate theta under the Rules:

The Authority considers that tax statistics, while not suffering methodology issues, are irrelevant for the direct estimation of theta because they fail to take into account the costs investors incur in obtaining franking credits...As a result, tax statistics cannot provide an accurate measure of the market value of franking credits. Tax statistics can only provide a theoretical upper bound in a situation where franking credits are costless to obtain. The Tribunal has recently addressed the use of tax statistics studies. The Tribunal ruled that aggregate tax statistics should not be used to produce an estimate of theta. The Tribunal was of the view that tax statistics can only be used to produce an upper bound that can be used as a cross-check of the reasonableness of an estimate produced by some other means. The Tribunal noted that the correct approach to estimating theta is through the use of market data rather than tax statistics.⁷

24. We agree that redemption rates cannot be used to estimate theta.

² ERA, Final Guideline, p. 9.

³ ERA, Final Guideline, p. 9.

⁴ ERA, Explanatory Statement, Paragraphs 926-928.

⁵ AER, Final Guideline, p. 23.

⁶ ERA, Explanatory Statement, Section 14.2.3.

⁷ ERA, Explanatory Statement, Paragraph 932.

25. The Guideline materials set out the ERA's view that two types of empirical methodology can potentially be used to estimate theta – dividend drop-off analysis and simultaneous price studies. In particular, the ERA concludes that:

The Authority agrees that simultaneous price studies may be useful for the purpose of estimating the appropriate value for theta. This is a consequence of the simultaneous price methodology having the advantage of providing a market based estimate for the value of franking credits, without the methodological issues associated with the dividend drop off technique.⁸

and

The Authority considers that dividend drop off studies offer a key advantage in that they calculate an observed market value of franking credits.⁹

26. We agree that theta must be empirically estimated as a market value and that the two methods that are available for this purpose are dividend drop-off analysis and the simultaneous price approach. We consider each of these two approaches in detail below.

⁸ ERA, Explanatory Statement, Paragraph 937.

⁹ ERA, Explanatory Statement, Paragraph 959.

3. Dividend drop-off analysis

ERA consideration of relevant estimates

27. Three dividend drop-off analyses are currently available for consideration:
- The SFG study that was accepted by the Tribunal in the *Gamma* case;¹⁰
 - An updated study performed by SFG and recently submitted to the AER;¹¹ and
 - A drop-off analysis performed by ERA staff.¹²
28. The SFG study that was accepted by the Tribunal and the updated version of that study both recommend a point estimate of 0.35 from within a range of point estimates around 0.35.
29. The ERA study performed by Vo et al (2013) concludes that:
- █ The appropriate range suggested by this study is between 0.35 and 0.55.¹³
30. In its Final Guideline the ERA concludes:
- █ The Authority considers that for the purposes of these guidelines the range of theta is 0.35 – 0.55.¹⁴
- on the basis that:
- █ The Authority considers the most relevant dividend drop off studies currently available are the Tribunal accepted SFG study and the analysis contained in Vo et al (2013). Based on this evidence, the Authority concludes that an acceptable range for theta is currently between 0.35 to 0.55.¹⁵
31. In effect, the ERA has given no weight to the SFG studies by simply adopting the range reported in its own study. If the ERA had disregarded the SFG studies entirely it would presumably have adopted a range of 0.35 to 0.55 based on its own study. That is, it appears that the ERA would have adopted the same range (that which is reported in its own study) whether or not the SFG studies even existed. In summary, the ERA has, in effect, given no weight to the SFG studies.
32. Further support for the view that the ERA has effectively disregarded the SFG studies comes from the ERA's final estimate of theta. The ERA considers two pieces of information:
- A range of 0.35 to 0.55 from its own study; and
 - A point estimate of 0.35 from the SFG studies,

¹⁰ Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 29.

¹¹ SFG (2013), Updated dividend drop-off estimate of theta, 7 June 2013.

¹² Vo et al (2013).

¹³ Vo et al (2013), Abstract.

¹⁴ Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 29.

¹⁵ Explanatory Statement, Paragraph 959.

and adopts a final point estimate from the middle of the range from its study. If any weight at all was applied to the SFG studies, the result would be a final point estimate in the bottom half of the range from the ERA study, not an estimate from the middle of that range.

33. In our view, the ERA has erred in effectively estimating theta on the basis of its own study, while giving no material weight to the SFG studies. For the reasons set out below, our view is that the SFG studies provide more reliable evidence than the ERA study. In particular, since these studies represent relevant evidence, it is inconsistent with the Rules to effectively disregard them.
34. Moreover, the ERA is inconsistent in forming its range from the aggregation of:
 - a) A range from its own study, and
 - b) A point estimate from the SFG studies.
35. The SFG studies report a range of estimates with a confidence interval around each estimate. The point estimate of 0.35 was selected from within a reasonable range. Since the ERA uses a reasonable range from its own study, consistency would require that it should combine that with a reasonable range from the SFG studies. Clearly, such a reasonable range would extend below 0.35.
36. In summary, the ERA has effectively disregarded the SFG studies in that the ERA's final estimate of theta (and consequently gamma) appears to be independent of whether or not the SFG studies even exist. In our view, this is an error because the SFG studies provide more reliable evidence than the ERA study – as set out in the remainder of this section of the report.

The merits of the SFG studies

37. The SFG studies arose out of a direction from the Australian Competition Tribunal in what has become known as the *Gamma Case*. In that case, the AER had sought to rely on a dividend drop-off study by Beggs and Skeels (2006)¹⁶. The Tribunal held¹⁷ that the AER was wrong to rely on an outdated and methodologically unsound dividend drop-off study. The Tribunal then directed that a “state-of-the-art” dividend drop-off study should be conducted to assist the Tribunal.¹⁸ The Tribunal also directed that the dividend drop-off study to be performed by SFG “should employ the approach that is agreed upon by SFG and the AER as best in the circumstances.”¹⁹
38. After agreement could not be reached between the parties, the Tribunal ruled that:
 - a) The four variations of the econometric specification of dividend drop-off analysis drawn by SFG from the literature should be used; and
 - b) The results for the full updated period should be used rather than a number of sub-periods.
39. SFG then conducted the dividend drop-off study and circulated a draft report to all parties. The AER and the regulated businesses that were parties to the *Gamma Case*²⁰ provided detailed comments on the draft report and these were taken into account in a revised report that was provided to all parties and to the Tribunal.

¹⁶ Beggs, D. J. and Skeels, C.L., (2006), “Market arbitrage of cash dividends and franking credits,” *Economic Record*, 82 (258), 239 – 252.

¹⁷ Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraphs 66, 145.

¹⁸ Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 146.

¹⁹ Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 147.

²⁰ Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010).

40. Although the AER submitted²¹ that the SFG study had departed from the Terms of Reference, the Tribunal disagreed and accepted the estimates from the SFG dividend drop-off study:

The Tribunal is satisfied that the procedures used to select and filter the data were appropriate and do not give rise to any significant bias in the results obtained from the analysis. Nor was that suggested by the AER.²²

In respect of the model specification and estimation procedure, the Tribunal is persuaded by SFG's reasoning in reaching its conclusions. Indeed, the careful scrutiny to which SFG's report has been subjected, and SFG's comprehensive response, gives the Tribunal confidence in those conclusions.²³

41. The Tribunal went on to conclude that:

The Tribunal is satisfied that SFG's March 2011 report is the best dividend drop-off study currently available for the purpose of estimating gamma in terms of the Rules.²⁴

and

The Tribunal finds itself in a position where it has one estimate of theta before it (the SFG's March 2011 report value of 0.35) in which it has confidence, given the dividend drop-off methodology. No other dividend drop-off study estimate has any claims to be given weight vis-à-vis the SFG report value.²⁵

42. The SFG study concluded that:

For the reasons set out in detail in this report, we conclude that the appropriate estimate of theta from the dividend drop-off analysis that we have performed is 0.35 and that this estimate is paired with an estimate of the value of cash dividends in the range of 0.85 to 0.90.²⁶

43. The SFG (2013) study employs the same methodology as the SFG (2011) study, but extends the data set through to the end of 2012. The conclusion from that study is that:

the conclusions from that earlier study remain valid when tested against the updated data set.²⁷

Problems with the ERA approach

44. Vo, Gellard and Mero (2013) from the Economic Regulation Authority of Western Australia (**ERA**) have recently produced a drop-off study that essentially follows the methodology of the SFG studies. One important deviation from the SFG methodology is that the ERA study also presents results that are based on analysis that omits the standard market adjustment. The standard approach in dividend drop-off studies is to assume that, but for the dividend, the stock price would have followed the

²¹ Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 16.

²² Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraphs 18-19.

²³ Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 22.

²⁴ Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 29.

²⁵ Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 38.

²⁶ SFG (2011), Paragraph 3.

²⁷ SFG (2013), Paragraph 6.

movement in the broad market over the ex-dividend day. That is, if the broad market index increases by 2% over the ex-dividend day, it is assumed that, but for the dividend, the particular stock would also have increased by 2%.

45. We are unaware of any recent paper in a peer-reviewed journal that does not make such an adjustment. It is not surprising, therefore, that the ERA would have to make the adjustment to “enable a comparison of results to those from other studies.”²⁸
46. However, the ERA study also reports results in the absence of this standard market adjustment on the basis that, but for the dividend, a particular stock price might have moved (over the ex-dividend day) by somewhat more or less than the market. For example, it is possible that when the broad market increases by 2%, a particular stock might have moved (but for the dividend) by 1.8% or by 2.2%.
47. Omitting the market adjustment entirely is certain to be an inferior estimate on average. Whereas individual stocks might have moved by somewhat more or less than the broad market, on average stocks will move exactly in accordance with the market index, by definition.²⁹ That is, the standard market adjustment produces estimates of “but for the dividend” stock price movements that are unbiased on average – in the sense that it is equally likely that (but for the dividend) the stock might have moved somewhat more or somewhat less than the broad market index. Omitting the market adjustment entirely is to assume that (but for the dividend) the stock price would not have moved at all. Such an omission creates a bias. If the broad market increased by 2% over the ex-dividend day, the assumption that the stock price would have been 0% is clearly likely to be a material underestimate, on average.
48. The reason the ERA authors provide for reporting results that omit the standard market correction is that “applying the market correction is an unnecessary complication to an already complex econometric task.”³⁰ However, the correction is necessary to produce unbiased and reliable estimates and it is *not* difficult to implement. Indeed the ERA has already implemented the standard approach in its own study. In fact, the only new information provided by the ERA study is to also show how the results would have looked if a non-standard and inferior methodology had been employed. For these reasons, our view is that the subset of the results in the ERA paper that are based on analysis that omits the standard market adjustment should receive no weight.
49. When the standard market adjustment is performed, the ERA study confirms the results from the SFG studies. In particular, the SFG studies conclude that an appropriate value for theta is 0.35. The ERA study reports that, when the standard market correction is applied, the average estimate of theta is 0.34. The estimate using robust regression and Model Specification 4 (which the ERA considers to be the most reliable estimate) is 0.33.³¹
50. Even when no market correction is applied, the ERA reports an average theta estimate of 0.40 and a robust regression estimate from Model Specification 4 of 0.32.
51. In fact, there is very little evidence to support the ERA’s mid-point estimate of 0.45 at all. The ERA’s estimates of theta are summarised in Figure 1 below. This figure summarises the ERA’s point estimates for all different model specifications and estimation methodologies (with and without the standard ex-day market correction) except for the OLS estimates, which the ERA deems to be

²⁸ Explanatory Statement, Paragraph 956.

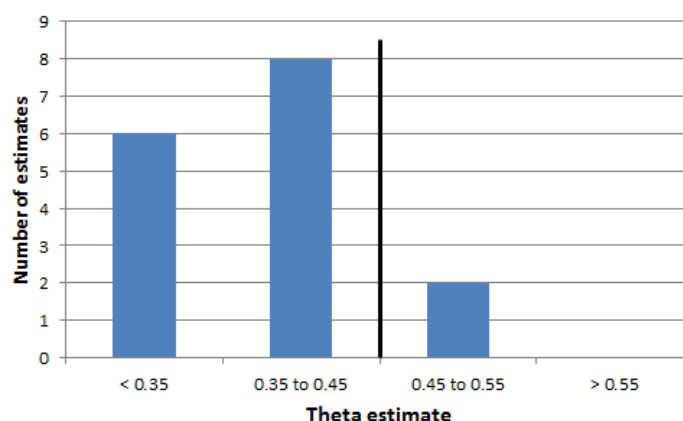
²⁹ This is because the market portfolio is an average taken over all stocks.

³⁰ Vo, Gellard and Mero (2013), p. 32.

³¹ Vo, Gellard and Mero (2013), Table 5.

inappropriate.³² The figure shows that the vast majority of estimates falls below the ERA’s mid-point estimate (marked as a line). Moreover, whereas a material number of estimates fall below the bottom of the range (less than 0.35) there are no estimates above the top end of the range (0.55).

Figure 1. Distribution of ERA theta estimates



Source: Vo et al (2013), Table 5.

Stability of theta estimates

52. The ERA is concerned with the potential for estimates of theta to be unstable due to issues such as multicollinearity and the influence of outlying observations.³³ For example, in its explanatory statement the ERA explains that:

As a result of this study, the Authority considers that any estimate of theta is essentially a function of the most influential observations due to the extreme multicollinearity present in the data.³⁴

53. The ERA study variously refers to multicollinearity as being “strong,”³⁵ “extreme”³⁶ and “severe.”³⁷ However, no test for multicollinearity was ever performed.³⁸ The conclusions about multicollinearity are apparently drawn from informal observations about the correlation between dividends and imputation credits which is a necessary but insufficient condition for the estimates to have been affected by multicollinearity. Moreover, in the ERA’s Model Specification 2, there is only one independent variable, in which case multicollinearity is clearly impossible.

54. That is, any suggestion that there should be some a priori reason to have statistical concerns about the estimates appears to be unfounded.

55. Nevertheless, it is always useful to consider the stability of the estimates and to consider how the estimates might have been affected by influential observations.

³² Vo et al (2013), p. 9.

³³ See for example Explanatory Statement, Paragraph 957; Appendix 28, Paragraph 14, ERA Study, Appendix 1.

³⁴ Explanatory Statement, Paragraph 957.

³⁵ Vo et al (2013), p. 32.

³⁶ Vo et al (2013), p. 32.

³⁷ Vo et al (2013), p. 19.

³⁸ Vo et al (2013), p. 26.

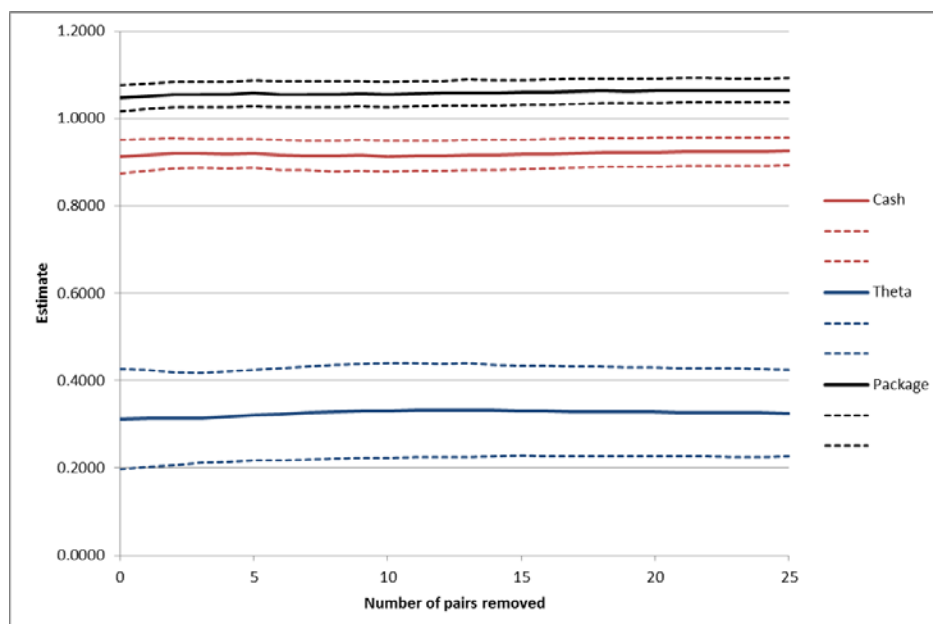
56. For example, the SFG (2011) contained an extensive section on stability analysis³⁹ whereby observations are removed in pairs consisting of the observations that have the most influential upward and downward effects on the estimate of theta, respectively. As pairs of observations are removed, theta is re-estimated to determine the sensitivity of the theta estimate to influential observations. The result is a figure such as that replicated below for Model Specification 4.⁴⁰

57. SFG (2011) conclude, on the basis of this stability analysis, that:

The stability analysis for Model 4, in Figure 8 above, shows that the estimates of the value of cash dividends, the value of theta, and the value of the combined package are very stable and robust to the removal of pairs of influential data points...In summary, the stability analyses demonstrate that the estimates of theta are either maintained or lowered when pairs of influential observations are removed from the data set.⁴¹

58. SFG (2013) conduct a similar stability analysis for the updated data set and reach the same conclusion.

Figure 2. SFG stability analysis



Source: SFG (2011), Figure 8, p. 31.

59. Vo et al (2013) implement a stability analysis known as the DFBETAS approach. This approach differs from the SFG stability analysis in two primary ways:

- a) Influential observations are removed one at a time, rather than in pairs; and
- b) The stability analysis is only applied in relation to the non-standard approach whereby prices are not corrected for market movements over the ex-dividend day.

³⁹ SFG (2011), pp. 28-32.

⁴⁰ This appeared as Figure 8, p. 31 in SFG (2011).

⁴¹ SFG (2011), p. 31.

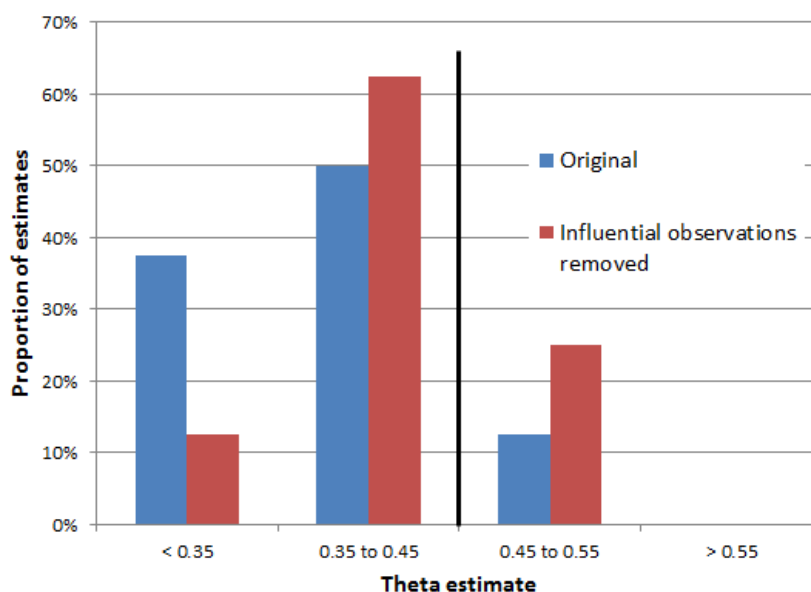
60. For the reasons set out the results based on the ERA’s non-standard approach are likely to be more variable and less reliable than standard estimates and this may in the stability analysis.

61. Indeed Vo et al (2013) report that:

The results of the DFBETAS analysis confirm that the estimate of theta is highly sensitive to the choice of the underlying sample of dividend events. Removing just 30 observations from a sample of 3309 can result in a dramatically different estimate of theta. In the course of this process, the value of theta can vary between 0.3 to 0.55. It is important to note that these points represent less than 1% of the entire dividend sample. Whilst by design the removed dividend event has the most extreme impact on the estimate of theta it is undesirable for the estimate to be vulnerable to the removal of observations.⁴²

62. Vo et al (2013) report the results of their stability analysis in their Table 8. In particular, Table 8 sets out the revised estimates of theta after the 30 most influential observations have been removed from the data set. The results reported in Table 8 do not support the conclusion that the ERA’s theta estimates are unstable. In particular, the average mean estimate of theta reported in Table 8 is 0.42 and the average median is 0.43. Indeed the distribution of theta estimates is not at all dissimilar to the distribution of the original theta estimates, as summarised in Figure 3 below.

Figure 3. ERA theta estimates before and after removal of influential observations



Source: Vo et al (2013), Table 5 and Table 8.

63. In Appendix 2 to their study, Vo et al (2013) graph the changes in their estimates of theta as influential observations are removed from the sample. The figures that demonstrate the most pronounced variation in theta estimates pertain to the OLS estimates. However, Vo et al have previously concluded that “OLS regression is not appropriate”⁴³ and the OLS estimates are not included in the averages that are computed when the results are tabulated. Consequently, it is not

⁴² Vo et al (2013), p. 30.

⁴³ Vo et al (2013), p. 9.

clear that anything can be made of the OLS stability analysis, or even why that analysis was performed on the OLS estimates.

64. In summary, Vo et al (2013) conclude that their estimates of theta lack stability and can vary materially if a relatively small number of influential observations are removed from the data set. In our view:
- a) This conclusion is not supported by the results that are reported in the study; and
 - b) If the ERA accepts that the Vo et al results are unstable and unreliable, there would be even more reason to place material weight on the SFG studies.

Additional SFG stability analyses

Overview

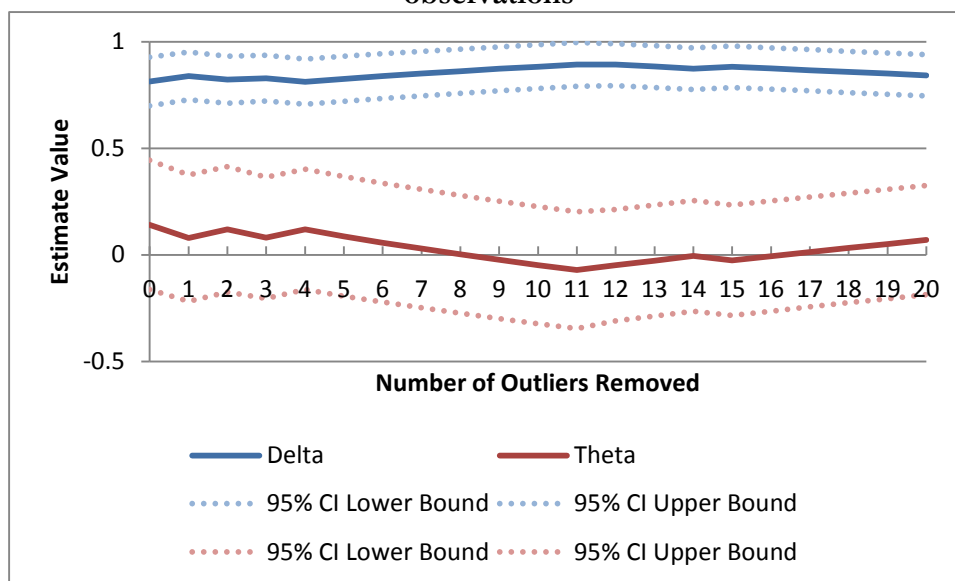
65. Given that:
- a) The stability of theta estimates is clearly a key issue for Vo et al (2013) and for the ERA; and
 - b) The only stability analysis performed by Vo et al (2013) is in relation to the non-standard approach of making no correction for market movements over the ex-dividend day,

we apply two additional types of stability analysis using the standard Tribunal-approved methodology and the updated SFG (2103) data set.

Application of the Vo et al (2013) stability analysis

66. First, we apply the one-at-a-time influential observation (DFBETAS) approach that Vo et al (2013) employed, but using the standard ex-day market correction and our updated data set.
67. In general, we conclude that the estimates of theta are robust to the removal of influential observations – particularly in relation to Model Specification 4, which we consider to produce the most reliable estimates.
68. Figure 4 below shows that the estimates of delta (the market value of cash dividends) and theta from Model 1 (basic model estimated via OLS) are relatively insensitive to the removal of influential observations. Even with the removal of the twenty most influential observations the estimates do not deviate markedly from their original values.

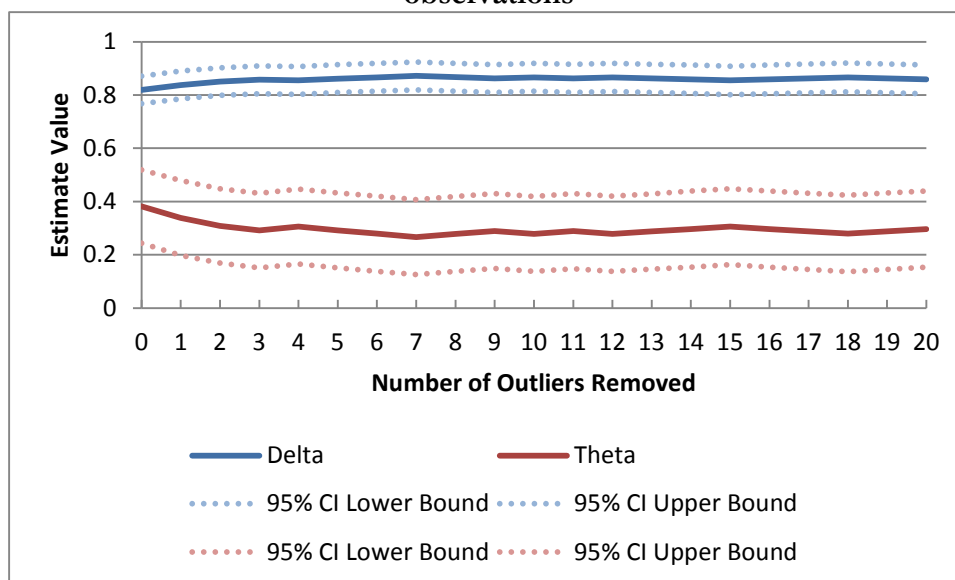
Figure 4. Sensitivity of Model 1 Delta and Theta estimates to the removal of influential observations



Source: SFG Consulting.

69. Next we examine the sensitivity of Model 2 (basic model estimated with GLS with dividend yield as the weighting variable) to the removal of the most influential observations. Again, we remove the most influential observation one at a time. Figure 5 below shows that the estimate of theta does not alter materially, although it does decline slightly.

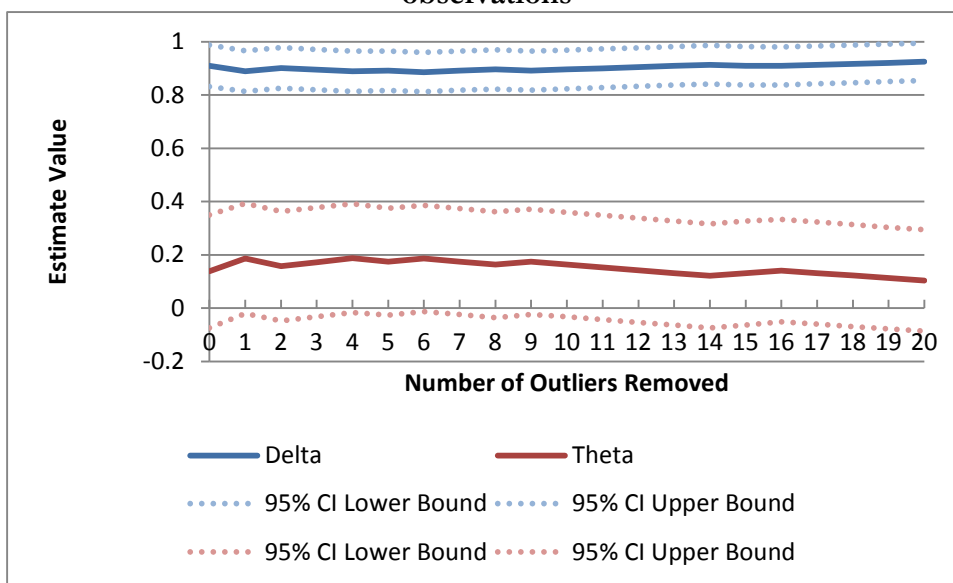
Figure 5. Sensitivity of Model 2 Delta and Theta estimates to the removal of influential observations



Source: SFG Consulting.

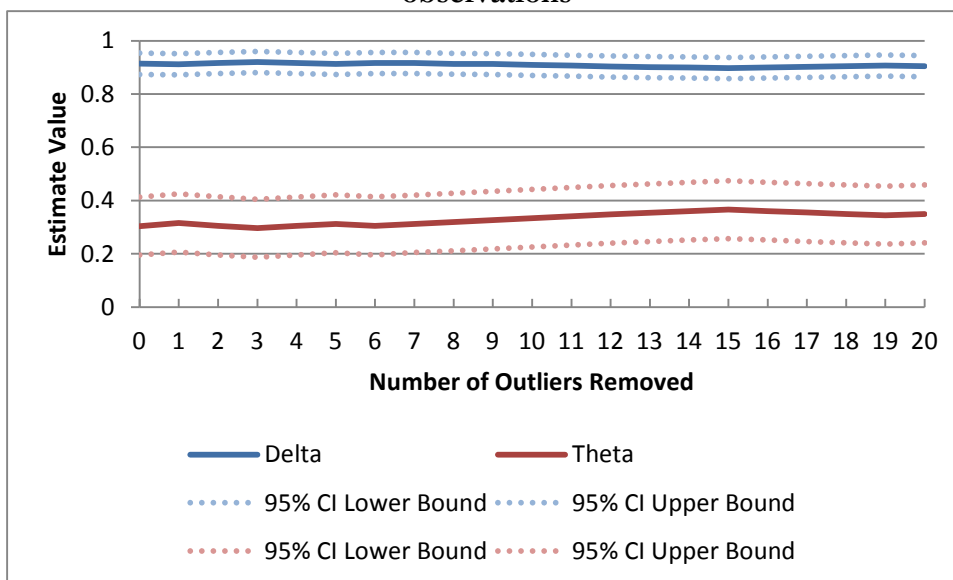
70. Next we examine the sensitivity of Model 3 (the basic model estimated with GLS with inverse stock return volatility used as the weighting variable) estimates to the removal of influential observations using the same procedure as before. Figure 6 shows, consistent with the findings for the other models, that the estimates of theta remain relatively stable.

Figure 6. Sensitivity of Model 3 Delta and Theta estimates to the removal of influential observations



71. Finally, we examine the sensitivity of Model 4 (the basic model estimated with GLS with dividend yield and inverse stock return volatility used as the weighting variables) to the removal of the influential observations. Again, we find that the estimates are not materially affected by the removal of the influential observations, as illustrated in Figure 7.

Figure 7. Sensitivity of Model 4 Delta and Theta estimates to the removal of influential observations



72. One important result that comes from the sensitivity analysis is that none of the theta estimates (for any model specification or for any number of outliers removed) reaches the 0.45 mid-point of the ERA range of 0.35-0.55. Overall, the estimates are stable and do not deviate markedly from the estimates prior to the removal of any influential observations. In our view, these results confirm our earlier conclusion that 0.35 represents the best available dividend drop-off estimate of theta.

Bootstrap removal of 5% of data set

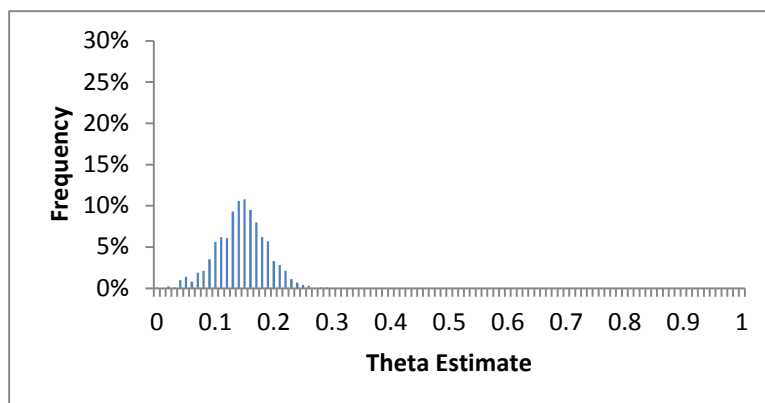
- 73. To further test the stability of the SFG (2013) theta estimates, we conduct a randomised bootstrapping analysis. To do this, we randomly eliminate five per cent of the sample and re-estimate each of the models using the remaining data. We then repeat this procedure (on the original full sample) another 999 times, yielding 1,000 estimates of theta – each computed after a different 5% of the sample has been removed. This analysis is designed to show how sensitive the estimate of theta might be to removal of 5% of the sample observations.
- 74. The results from this procedure also lead us to conclude that the SFG estimates of theta are stable and robust to the removal of even 5% of the sample observations. In all cases, the 90% confidence interval is relatively narrow and close to, or below, the SFG point estimate of 0.35. Again, this is particularly the case for model specification 4, which we consider to be the most reliable.
- 75. The results of this bootstrap test for Model 1 are set out in Table 1 below. The average theta estimate of 0.14 is consistent with the estimate when model specification 1 is applied to the full sample. The 90% confidence interval is from 0.7 to 0.21.

Table 1. Bootstrap re-sampling summary statistics for Model 1

Statistic	Theta Estimate
Average	0.140
Minimum	-0.018
Maximum	0.288
5 th Percentile	0.067
95 th Percentile	0.208

Source: SFG calculations

Figure 8. Histogram of theta estimates from simulation of Model 1



Source: SFG calculations

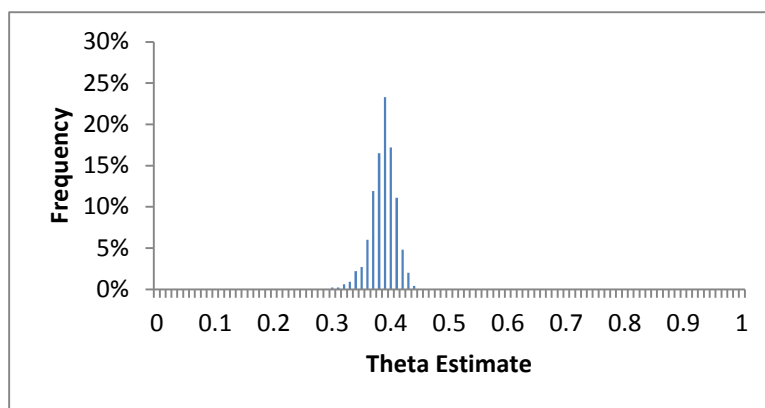
- 76. Figure 8 above shows that even under the relative extreme procedure of removing 5% of the sample there tends to be relatively little deviation from the mean theta estimate of 0.14.
- 77. The results from running the bootstrap analysis for Model 2 are set out in Table 2 below. The mean estimate is 0.38 within a narrow 90% confidence interval of 0.35 to 0.41.

Table 2. Bootstrap re-sampling summary statistics for Model 2

Statistic	Theta Estimate
Average	0.382
Minimum	0.293
Maximum	0.440
5 th Percentile	0.346
95 th Percentile	0.413

Source: SFG calculations

Figure 9. Histogram of theta estimates from simulation of Model 2



Source: SFG calculations

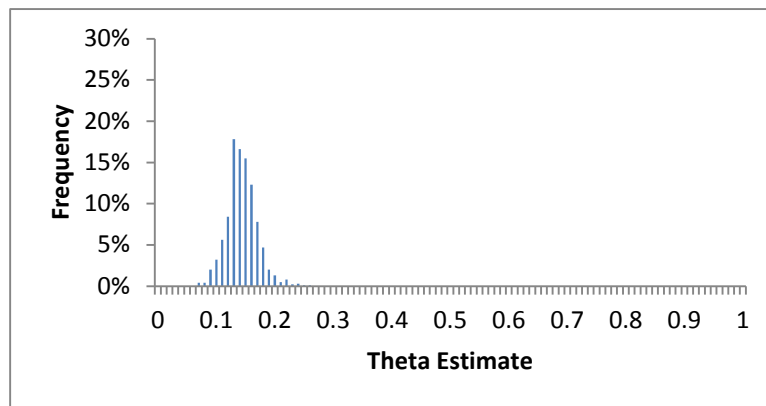
- 78. Figure 9 above shows the narrow distribution of theta estimates for Model Specification 2.
- 79. The results of the bootstrap re-sampling procedure for Model 3 are set out in Table 3 below. The mean estimate of 0.14 is from a 90% confidence interval of 0.10 to 0.18.

Table 3. Bootstrap re-sampling summary statistics for Model 3

Statistic	Theta Estimate
Average	0.139
Minimum	0.062
Maximum	0.252
5 th Percentile	0.097
95 th Percentile	0.181

Source: SFG calculations

Figure 10. Histogram of theta estimates from simulation of Model 3



Source: SFG calculations

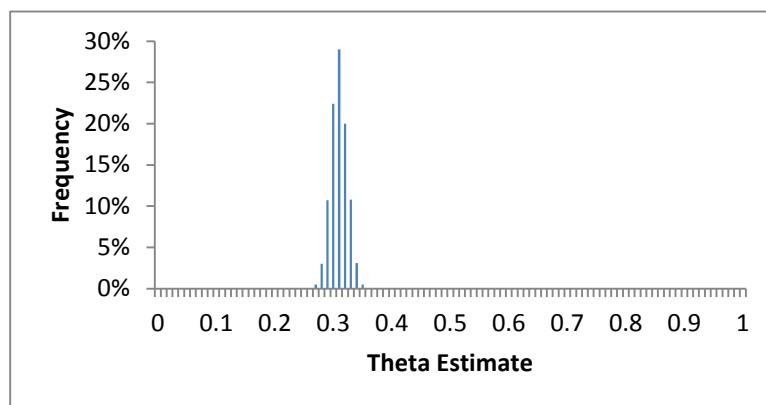
- 80. Figure 10 above shows that the range of estimates is similar to that for Model Specification 1, which is similar in its specification to Model 3.
- 81. The results of the bootstrap re-sampling procedure for Model 4 are set out in Table 4 below. The mean estimate of 0.31 is from a 90% confidence interval of 0.28 to 0.33.

Table 4. Bootstrap re-sampling summary statistics for Model 4

Statistic	Theta Estimate
Average	0.305
Minimum	0.262
Maximum	0.344
5 th Percentile	0.282
95 th Percentile	0.328

Source: SFG calculations

Figure 11. Histogram of theta estimates from simulation of Model 4



Source: SFG calculations

- 82. Figure 11 above shows a tightly clustered group of theta estimates centred on 0.30. The simulations provide evidence that the theta estimate from Model Specification 4 is insensitive to the removal of even 5% of the data sample.

83. As with the results obtained from the one-at-a-time removal of the most influential observations, the estimates from the resampling procedure are very stable and do not deviate materially from the estimates from the full sample. Again, as with the one-at-a-time removal, *none* of the models has an estimate value for *any* of the 1,000 simulations that is above the 0.45 mid-point of the ERA range of 0.35-0.55.

Conclusions in relation to SFG stability analysis

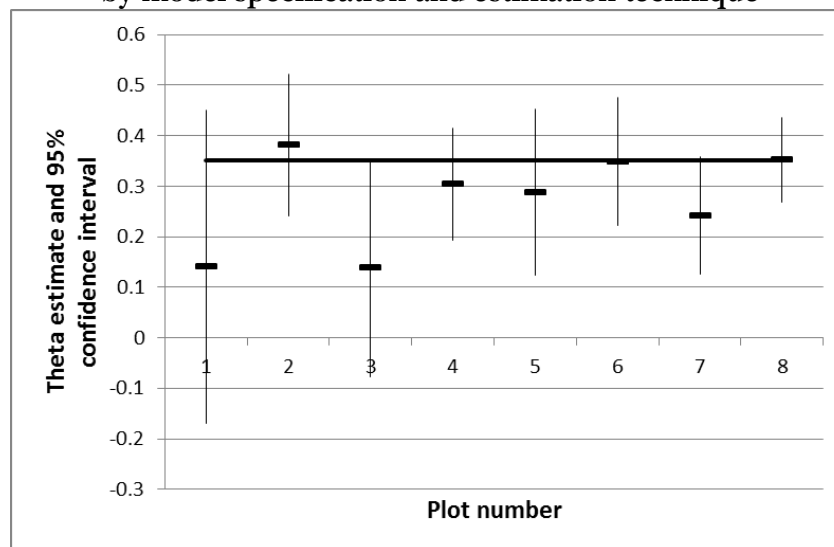
84. The additional stability analyses corroborate the results from SFG (2011) and SFG (2013) – the SFG estimates of theta are stable and robust to the removal of influential outliers and even to the removal of up to 5% of the data sample.

Conclusions in relation to dividend drop-off analysis

85. As set out above, the ERA has effectively disregarded the results of the SFG studies by adopting the mid-point estimate from its own study.
86. In our view, there are a number of reasons to prefer the SFG studies to the ERA study:
- a) The SFG approach has been subjected to intense scrutiny. All data and computer code was supplied to the AER. All issues that the AER has identified have been considered by the Tribunal. And the Tribunal has endorsed and adopted the results. By contrast, the ERA study has not been subjected to such scrutiny;⁴⁴
 - b) The SFG studies employ the standard, Tribunal-approved and AER-approved approach of correcting prices for market movements over the ex-dividend day; and
 - c) The SFG theta estimates have been shown to be stable and reliable in the face of a battery of stability and robustness checks, whereas the ERA expresses concerns about the stability and reliability of its own results.
87. In any event, there is little evidence to support the ERA's mid-point estimate of 0.45 from within its range of 0.35 to 0.55:
- a) The ERA's own estimates are overwhelmingly below 0.45 (see Figure 1 and Figure 3 above), and a significant proportion of those estimates are below 0.35;
 - b) The ERA study reports a theta estimate of 0.34 when the standard ex-day market correction is applied;
 - c) The ERA estimate increases only to 0.4 when the standard ex-day market correction is removed; and
 - d) The SFG (2013) estimates indicate that, if anything, the 0.35 estimate is towards the upper end of the reasonable range. See for example Figure 12 below, which is reproduced from SFG (2013), Figure 5.

⁴⁴ We understand that the ERA study has been submitted to an academic journal for publication. If this is the case, the ERA could release the referee report and editorial decision to document the degree of scrutiny to which its study has been subjected.

Figure 12
Summary of point estimates and confidence intervals for theta
by model specification and estimation technique



For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35.

- | | |
|--|--|
| Plot 1: Model specification 1, OLS estimation; | Plot 2: Model specification 2, OLS estimation; |
| Plot 3: Model specification 3, OLS estimation; | Plot 4: Model specification 4, OLS estimation; |
| Plot 5: Model specification 1, RR estimation; | Plot 6: Model specification 2, RR estimation; |
| Plot 7: Model specification 3, RR estimation; | Plot 8: Model specification 4, RR estimation. |

88. In our view, there is no reasonable basis for adopting a dividend drop-off estimate of theta above 0.35.

4. Alternative methodologies

Overview

89. The Guideline materials state the ERA's view that methods other than dividend drop-off analysis can also be used to estimate theta, so long as the method produces an empirical estimate of the market value of theta.⁴⁵ The Guideline materials also state that the ERA has not employed any alternative methods at this point as it is aware of only one such study – Cannavan, Finn and Gray (2004).⁴⁶
90. In this section of the report, we review the evidence that is available from alternative methodologies.

Contemporaneous evidence from futures contracts

91. Cannavan, Finn and Gray (2004) examine ordinary shares (which entitle the holder to dividends and imputation credits) and futures contracts on those ordinary shares (which do not entitle the holder to dividends or imputation credits). The implied value of dividends and imputation credits can be estimated by comparing the simultaneous prices of the two securities. In particular, for futures contracts there is a well-known “cost of carry” or “fair value” relationship that stems from the fact that the futures payoff can be exactly replicated by a dynamic strategy of borrowing money to buy the physical shares.
92. An investor who purchases a futures contract effectively receives a payoff of $S_T - F$ at maturity of the contract where S_T is the stock price at maturity and F is the futures price. An investor who borrows money to buy the stock today and then repays the borrowed funds at maturity receives a payoff of $S_T - S_0(1+r)^T$ where S_0 is the current stock price, r is the interest rate, and T is the time to maturity. Since both of these strategies require no initial investment and because all terms other than S_T are known constants, it must be the case that $F = S_0(1+r)^T$. This relationship does not require any assumptions other than the absence of easy arbitrage opportunities – the most fundamental assumption that is required before market prices can be used for *any* purpose. Cannavan, Finn and Gray (2004) show that this pricing relation holds to within a fraction of a per cent for the data in their sample.⁴⁷
93. Cannavan, Finn and Gray (2004) then use this no arbitrage condition to estimate the implied value of dividends and imputation credits using a sample of firms that paid a dividend prior to the maturity of the futures contract.
94. Since this study uses pre-2000 data, the specific results are assumed to be irrelevant for current purposes. However, it is relevant that the methodology and approach was approved by the peer review process of the *Journal of Financial Economics* (JFE), which is one of the top three finance journals world-wide.
95. SFG (2013)⁴⁸ update the Cannavan, Finn and Gray (2004) study using data from July 2000 to December 2012. They employ the same methodology as was used for the earlier JFE study – they simply apply it to an updated post-2000 data set. They conclude that:⁴⁹

⁴⁵ ERA, Explanatory Statement, Paragraph 937.

⁴⁶ ERA, Explanatory Statement, Paragraph 937.

⁴⁷ Cannavan, Finn and Gray (2004), Figure 2.

⁴⁸ SFG (2013), “Using market data to estimate the equilibrium value of distributed imputation tax credits.”

⁴⁹ SFG (2013), “Using market data to estimate the equilibrium value of distributed imputation tax credits,” p. 3.

This report has been prepared by two of the authors of the Cannavan, Finn and Gray (2004) study. We have used the same data source and applied the same methodology to data from July 2000 to February 2013. The data set consists of 52,041 observations. The simultaneous prices of ordinary shares and matching futures contracts imply that:

- a) The combined value of a \$1 cash dividend and the associated imputation credit is \$0.99;
- b) Cash dividends are valued at 94% of face value; and
- c) Imputation credits are valued at 12% of face value.

Rate of return studies

96. Two recent studies test whether (other things being equal) firms with higher imputation credit yields are valued more highly by investors. Both find that they are not. This implies that equilibrium stock prices are independent of the amount of imputation credits that they generate, which leads the authors to conclude that theta is not materially different from zero, in equilibrium.
97. Lajbcygier and Wheatley (2012)⁵⁰ summarise their results as follows:

The provision of imputation tax credits can in principle lower the returns that investors require on equity. Whether in practice imputation credits lower the returns that investors require depends in large part on the impact of foreign investors on equity prices. This is because foreign investors in general cannot use the credits that domestic equities provide. We use a range of pricing models and monthly data from July 1987 to December 2009 to test whether, holding risk constant, equity returns are related to credit yields. We find no evidence that the provision of imputation tax credits lowers the returns investors require on equity.⁵¹

98. They conclude that:

If a representative long-term investor assigns no value to the credits that firms distribute, and our results cannot reject that hypothesis, then in assigning a value to credits regulators are likely to underestimate the cost of equity for these firms.⁵²

99. NERA (2013) have recently updated the results of Lajbcygier and Wheatley (2012). They note that a positive value of theta implies that:

there will be a negative relation, holding a firm's equity beta constant, between the firm's cost of equity, exclusive of a value assigned to imputation credits distributed, and the firm's credit yield.⁵³

100. However the results suggest that:

⁵⁰ Paul Lajbcygier and Simon Wheatley (2012), Imputation credits and equity returns, *The Economic Record*, 88, 283, 476-494.

⁵¹ Lajbcygier and Wheatley (2012), p. 476.

⁵² Lajbcygier and Wheatley (2012), p. 491.

⁵³ NERA (2013), p. ii.

there is a positive, rather than a negative relation, holding a firm's equity beta or betas constant, between the firm's without-credit cost of equity and its credit yield,⁵⁴

in which case they conclude that:

there is no evidence to suggest that the market places a value on imputation credits distributed.⁵⁵

101. The results of Lajbcygier and Wheatley (2012) have recently been corroborated by Siau, Sault and Warren (2013)⁵⁶ who summarise their results as follows:

We investigate the value placed on imputation credits in the Australian stock market by examining whether they are capitalised into prices using two main methods. First, we relate stock prices to the present value of dividends and imputation credits under a discounted cash flow valuation model. Second, we regress earnings yields on imputation credit yields plus a range of control variables. We find no substantial evidence that the presence of imputations credits has any significant marginal influence on the overall level of share prices. Our results align with Lajbcygier and Wheatley (2012), who uncover no evidence of any negative relation between imputation credits and realised returns. Together these findings suggest that imputation credits are not priced from the perspective of longer-term buy-and-hold investors. The implications are that such investors might expect to fully benefit from their imputation credits, and that it may be inappropriate to incorporate imputation effects when estimating cost of capital.⁵⁷

102. In a recent report for the Energy Networks Association, NERA (2013)⁵⁸ updates the Lajbcygier and Wheatley (2012) study and summarises the results from this strand of the literature. This literature recognizes that the total required return on equity depends on systematic risk factors. Under the Sharpe-Lintner CAPM, for example, the total required return on equity depends on beta. Imputation credits are relevant only to the extent that the total required return is partitioned between imputation credits on the one hand and dividends and capital gains on the other. If imputation credits are highly valued by the representative investor, firms with high franking credit yields would require lower returns from dividends and capital gains, other things (including systematic risk) equal. However, NERA (2013) show there is *not* an inverse relationship between franking credit yield on the one hand and dividends and capital gains on the other. NERA (2013) conclude that this literature suggests that there is no evidence that a material value for imputation credits is factored into stock returns or capitalized into stock prices.

103. These studies are broadly based on the same methodology of the studies that the AER has previously used to support its use of the SL CAPM, rather than a version of the CAPM that allows for dividends and capital gains to be differentially valued.⁵⁹ In the 2009 WACC Review, the AER stated that:

⁵⁴ NERA (2013), p. iii.

⁵⁵ NERA (2013), p. iv.

⁵⁶ Shaun Siau, Stephen Sault and Geoffrey Warren, (2013), "Are imputation credits capitalised into stock prices?" Working Paper, Australian National University.

⁵⁷ Siau, Sault and Warren (2013), p. 1.

⁵⁸ NERA (2013), "Imputation credits and equity prices and returns."

⁵⁹ For example, the model of Lally and van Zijl (2003).

the evidence from US dividend yield studies indicates that cash dividends are fully valued in total equity returns. In turn, this implies that there is no clear evidence to replace the Sharpe CAPM with an alternative tax-adjusted CAPM (e.g. Brennan CAPM), even if this option were available to AER under the NER.⁶⁰

104. The “US dividend yield studies” on which the AER relies to support its assumption that cash dividends are fully valued (as per the assumption of the Sharpe-Lintner CAPM) compare the returns of companies with high dividend yields with the returns of companies with low dividend yields. Because there is no difference between the returns of each group, the authors conclude that returns are independent of dividend yields. If dividends were valued less than capital gains, high-dividend yield companies would require higher total returns.
105. The franking credit yield studies show that returns are independent of the imputation credit yield. If imputation credits were materially valued, firms with high imputation credit yields would require lower returns (from dividends and capital gains) – but this is not the case.

Summary of evidence from alternative methods

106. The contemporaneous evidence from alternative empirical methods suggests that the dividend drop-off estimate of 0.35 is, if anything, conservatively high.

⁶⁰ 2009 WACC Review Final Decision, pp. 461, 465.

5. Final conclusions and declaration

Conclusions

107. In response to the specific questions posed in our Instructions, we conclude that the ERA's range for theta does not provide the best estimate of theta and the cost of corporate income tax possible in the circumstances, and consequently that the ERA's range is not consistent with the requirements of the NGO and the RPP.
108. The reason for this conclusion is that the ERA has, in effect, adopted a theta estimate from its own study giving no real weight to other evidence in circumstances where that other evidence is more reliable and more accepted. In particular, a comparison of the ERA and SFG dividend drop-off studies reveals that:
- a) The SFG study has been accepted and endorsed by the Australian Competition Tribunal, whereas the ERA study has not;
 - b) The SFG study employs the standard market correction approach that is used in published studies and which has been approved by the Tribunal and the AER. The ERA study (to the extent that its results differ from those of the SFG study) omits this standard market correction for no sound reason;
 - c) The SFG study produces stable estimates that are robust to the removal of influential outliers, whereas the authors of the ERA study question the reliability of their own results on this basis.
109. We agree with the ERA that gamma should be estimated as the product of F and theta, we agree with the ERA's estimate of F (70%), and we agree that theta must be estimated empirically. Our point of disagreement relates to what represents the best empirical estimate of theta. In effect, the ERA has rejected the SFG (2011, 2013) estimate of theta in favour of its own estimate. In our view, there are many reasons to prefer the SFG estimate to the ERA estimate, as set out above. Replacing the ERA estimate with the SFG estimate results in a theta value of 0.35, which produces a gamma value of 0.25. In our view, 0.25 is the best estimate possible of gamma in the circumstances which is consistent with the NGO and RPP.

Declaration

110. 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

References

- Australian Competition Tribunal, 2010, Application by Energex Limited (Distribution Ratio (Gamma)) (No 3) [2010] ACompT 9, 24 December.
- Australian Competition Tribunal, 2010, Application by Energex Limited (No 2) [2010] ACompT 7, 13 October.
- Beggs, D.J., and C.L. Skeels, 2006, "Ownership of Australian equities and corporate bonds," *The Economic Record*, 82 (258), 239 – 252.
- Cannavan, D., Finn, F., and S. Gray, 2004, "The value of dividend imputation tax credits in Australia," *Journal of Financial Economics*, 73, 167-197.
- Economic Regulation Authority of Western Australia, 2013, *Final Rate of Return Guideline*, 16 December.
- Economic Regulation Authority of Western Australia, 2013, *Final Rate of Return Guideline: Explanatory Statement*, 16 December.
- Economic Regulation Authority of Western Australia, 2013, *Final Rate of Return Guideline: Appendices*, 16 December.
- Lajbcygier, P. and S. Wheatley, 2012, Imputation credits and equity returns, *The Economic Record*, 88, 283, 476-494.
- Shaun Siau, Stephen Sault and Geoffrey Warren, 2013, "Are imputation credits capitalised into stock prices?" Working Paper, Australian National University.
- SFG Consulting, 2013, *Updated dividend drop-off estimate of theta*, Report prepared for the Energy Networks Association, 7 June.
- SFG Consulting, 2011, *Dividend drop-off estimate of theta*, Report prepared for the Australian Competition Tribunal.
- Vo, D., B. Gellard and S. Mero, 2013, *Estimating the market value of franking credits: Empirical evidence from Australia*, Working paper.

Appendix 1: Instructions

JOHNSON WINTER & SLATTERY
L A W Y E R S

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Email: roxanne.smith@jws.com.au
Our Ref: B1299
Your Ref:
Doc ID: 65574808.1

6 February 2014

Professor Stephen Gray
SFG Consulting
PO Box 29
South Bank
Qld 4101

Dear Sir

ATCO GAS AUSTRALIA PTY LTD- ERA Price Determination

We act for ATCO Gas Australia Pty Ltd (ATCO Gas) in relation to the Economic Regulation Authority's review of the Gas Access Arrangement for ATCO Gas under the National Gas Law and Rules.

ATCO Gas owns and operates the Mid West and South West Gas Distribution System in WA. ATCO Gas wishes to engage you to prepare an expert report in connection with the ERA's review of the access arrangement for the period 2015-2020.

This letter sets out the matters which ATCO Gas wishes you to address in your report and the requirements with which the report must comply.

Terms of Reference

Legal Framework

The terms and conditions upon which ATCO Gas provides access to its gas network are subject to five yearly reviews by the ERA. The ERA undertakes that review by considering the terms and conditions proposed against criteria set out in the *National Gas Law* and *National Gas Rules*.

Rule 76 of the *National Gas Rules* provides that the total revenue for each regulatory year is determined using a building block approach, which building blocks include a return on the projected capital base (Rule 76(a)) and the estimated cost of corporate income tax (Rule 76(c)).

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Rule 87 provides for the determination of a rate of return on the projected capital base. The amended Rule 87 now in force requires a rate of return to be determined on a nominal vanilla basis that is consistent with the estimate of the value of imputation credits referred to in Rule 87A.

Rule 87A sets out the formula for the calculation of the estimated cost of corporate tax, which formula includes an estimate of the value of imputation credits (γ).

Rule 74(2) requires a forecast or estimate to be arrived at on a reasonable basis and must represent the best forecast or estimate possible in the circumstances.

As you are aware, Rule 87(13) also provides for the making of rate of return guidelines. Rule 87(14)(b) requires that the rate of return guidelines set out the estimation methods, financial models, market data and other evidence the AER proposes to take into account in estimating the value of imputation credits.

The ERA published its Final Rate of Return Guidelines on 16 December 2013. The ERA proposes to apply the approach set out in the Guidelines to ATCO Gas. The Guidelines are no mandatory but if there is a departure from the Guidelines, the reasons for the departure must be given in the ERA's decision (Rule 87(18)).

Also relevant is the overarching requirement that the ERA must, in performing or exercising its economic regulatory function or power perform or exercise that function or power in a manner that will or is likely to contribute to the achievement of the national gas objective (**NGO**).

The NGO 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.

You should also have regard to the Revenue and Pricing Principles (**RPP**) in section 24 of the National Gas Law.

In preparing your report you should consider the relevant sections of the National Gas Rules and Law and the ERA's Rate of Return Guidelines and Explanatory Statement.

Gamma

In respect of the estimate of γ , the ERA's Rate of Return Guidelines state that:

- 1 An estimate of the payout ratio of 70% is appropriate based on the empirical evidence currently available (paragraph 155).
- 2 The dividend drop-off methodology is the most appropriate for estimating θ , but as a result of known estimation issues, a range of post 2000 studies should be used (paragraph 157).
- 3 The permissible range for θ is 0.35-0.55.
- 4 Applying these estimates gives an estimated range for γ of 0.25 to 0.39.

This estimate differs from the Australian Competition Tribunal estimate in Application by Energex Limited (Distribution Ratio (γ)(No 5))¹ of θ of 0.35 and a payout ratio of 70%, giving a γ estimate of 0.25.

¹ No 5 [2011] ACompT 9 paragraph 42

Opinion

In this context ATCO Gas wishes to engage you to prepare an expert report which provides:

- 1 A review of the ERA's analysis of theta in the Rate of Return Guidelines, the methodologies it relies on and its finding that the permissible range is 0.35 to 0.55.
- 2 Your opinion on whether the ERA's range for theta provides the best estimate of theta and the cost of corporate income tax possible in the circumstances, which is consistent with the requirements of the NGO and the RPP.
- 3 If you do not consider the ERA's approach to the estimate of theta meets the requirements of the Rules identified above, what method(s) should be used to estimate theta in order to produce the best estimate possible in the circumstances which is consistent with the NGO and RPP and what is the resulting estimate of theta?

It is intended that your report will be submitted by ATCO Gas to the ERA with its Access Arrangement Proposal. The report may be provided by the ERA to its own advisers. The report must be expressed so that it may be relied upon both by ATCO Gas and by the ERA.

The ERA may ask queries in respect of the report and you will be required to assist in answering these queries. The ERA may choose to interview you and if so, you will be required to participate in any such interviews.

The report will be reviewed by ATCO Gas' legal advisers and will be used by them to provide legal advice as to its respective rights and obligations under the *National Gas Law* and *National Gas Rules*.

If ATCO Gas was to challenge any decision ultimately made by the ERA, that appeal will be made to the Australian Competition Tribunal and your report will be considered by the Tribunal. ATCO Gas may also seek review by a court and the report would be subject to consideration by such court. You should therefore be conscious that the report may be used in the resolution of a dispute between the ERA and ATCO Gas. Due to this, the report will need to comply with the Federal Court requirements for expert reports, which are outlined below.

Timeframe

ATCO Gas's Access Arrangement proposal must be submitted by **16 March 2014**. Your report will need to be finalised by the end of February 2014.

Compliance with the Code of Conduct for Expert Witnesses

Attached is 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**).

Please read and familiarise yourself with the Expert Witness Guidelines and comply with them at all times in the course of your engagement by the Gas Businesses.

In particular, your report prepared for the Gas Businesses should contain a statement at the beginning of the report to the effect that the author of the report has read, understood and complied with the Expert Witness Guidelines.

Your report must also:

- 1 contain particulars of the training, study or experience by which the expert has acquired specialised knowledge;
- 2 identify the questions that the expert has been asked to address;
- 3 set out separately each of the factual findings or assumptions on which the expert's opinion is based;
- 4 set out each of the expert's opinions separately from the factual findings or assumptions;
- 5 set out the reasons for each of the expert's opinions; and
- 6 otherwise comply with the Expert Witness Guidelines.

The expert is also required to state that each of the expert's opinions is wholly or substantially based on the expert's specialised knowledge.

It is also a requirement that the report be signed by the expert and include a declaration 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 report*".

Please also attach a copy of these terms of reference to the report.

Terms of Engagement

Your contract for the provision of the report will be directly with ATCO Gas. You should forward ATCO Gas any terms you propose govern that contract as well as your fee proposal.

Please sign a counterpart of this letter and return it to us to confirm your acceptance of the engagement.

Johnson Winter & Slattery

Yours faithfully

Enc: Federal Court of Australia Practice Note CM 7, "Expert Witnesses in Proceedings in the Federal Court of Australia"

.....
Signed and acknowledged by Professor Stephen Gray

Date

Appendix 2: Curriculum Vitae of Professor Stephen Gray

Stephen F. Gray

University of Queensland
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Academic Qualifications

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

Employment History

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

Academic Awards

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

Large Grants (over \$100, 000)

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

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

Current Research Interests

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

Publications

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

- Gray, S. and S. Treepongkaruna, (2006), "Are there non-linearities in short-term interest rates?" *Accounting and Finance*, 46(1), 149-167.
- Gray, P., S. Gray and T. Roche, (2005), "A Note on the Efficiency in Football Betting Markets: The Economic Significance of Trading Strategies," *Accounting and Finance*, 45(2) 269-281.
- Duffie, D., S. Gray and P. Hoang, (2004), "Volatility in Energy Prices. In V. Kaminski," (Ed.), *Managing Energy Price Risk: The New Challenges and Solutions* (3rd ed.). London: Risk Books.
- Cannavan, D., F. Finn and S. Gray, (2004), "The Value of Dividend Imputation Tax Credits in Australia," *Journal of Financial Economics*, 73, 167-197.
- Gray, S. and S. Treepongkaruna, (2003), "Valuing Interest Rate Derivatives Using a Monte-Carlo Approach," *Accounting and Finance*, 43(2), 231-259.
- Gray, S., T. Smith and R. Whaley, (2003), "Stock Splits: Implications for Investor Trading Costs," *Journal of Empirical Finance*, 10, 271-303.
- Gray, S. and S. Treepongkaruna, (2003), "On the Robustness of Short-term Interest Rate Models," *Accounting and Finance*, 43(1), 87-121.
- Gray, S. and S. Treepongkaruna, (2002), "How to Value Interest Rate Derivatives in a No-Arbitrage Setting," *Accounting Research Journal* (15), 1.
- Gray, P. and S. Gray, (2001), "A Framework for Valuing Derivative Securities," *Financial Markets Institutions & Instruments*, 10(5), 253-276.
- Gray, P. and S. Gray, (2001), "Option Pricing: A Synthesis of Alternate Approaches," *Accounting Research Journal*, 14(1), 75-83.
- Dahlquist, M. and S. Gray, (2000), "Regime-Switching and Interest Rates in the European Monetary System," *Journal of International Economics*, 50(2), 399-419.
- Bollen, N., S. Gray and R. Whaley, (2000), "Regime-Switching in Foreign Exchange Rates: Evidence from Currency Options," *Journal of Econometrics*, 94, 239-276.
- Duffie, D., S. Gray and P. Hoang, (1999), "Volatility in Energy Prices. In R. Jameson," (Ed.), *Managing Energy Price Risk* (2nd ed.). London: Risk Publications.
- Gray, S. and R. Whaley, (1999), "Reset Put Options: Valuation, Risk Characteristics, and an Example," *Australian Journal of Management*, 24(1), 1-21.
- Bekaert, G. and S. Gray, (1998), "Target Zones and Exchange Rates: An Empirical Investigation," *Journal of International Economics*, 45(1), 1-35.
- Gray, S. and R. Whaley, (1997), "Valuing S&P 500 Bear Market Warrants with a Periodic Reset," *Journal of Derivatives*, 5(1), 99-106.
- Gray, S. and P. Gray, (1997), "Testing Market Efficiency: Evidence from the NFL Sports Betting Market," *The Journal of Finance*, 52(4), 1725-1737.
- Gray, S. (1996), "Modeling the Conditional Distribution of Interest Rates as a Regime- Switching Process," *Journal of Financial Economics*, 42, 27-62.
- Gray, S. (1996), "Regime-Switching in Australian Interest Rates," *Accounting and Finance*, 36(1), 65-88.
- Brailsford, T., S. Easton, P. Gray and S. Gray, (1995), "The Efficiency of Australian Football Betting Markets," *Australian Journal of Management*, 20(2), 167-196.
- Duffie, D. and S. Gray, (1995), "Volatility in Energy Prices," In R. Jameson (Ed.), *Managing Energy Price Risk*, London: Risk Publications.
- Gray, S. and A. Lynch, (1990), "An Alternative Explanation of the January Anomaly," *Accounting Research Journal*, 3(1), 19-27.
- Gray, S. (1989), "Put Call Parity: An Extension of Boundary Conditions," *Australian Journal of Management*, 14(2), 151-170.
- Gray, S. (1988), "The Straddle and the Efficiency of the Australian Exchange Traded Options Market," *Accounting Research Journal*, 1(2), 15-27.

Teaching

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

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

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

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

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

2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).

2000 University of Queensland Award for Excellence in Teaching.

1999 Department of Commerce KPMG Teaching Prize, University of Queensland.

1998 Faculty Teaching Prize, Faculty of Business Economics and Law, University of Queensland.

1998 Commendation for Excellence in Teaching, University-wide Teaching Awards, University of Queensland.

1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.

Board Positions

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

2003 - Present: Director, Moreton Bay Boys College Ltd. (Chairman since 2007).

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

Consulting

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

Consulting interests and specialties, with recent examples, include:

- **Corporate finance**
 - ⇒ **Listed multi-business corporation:** Detailed financial modeling of each business unit, analysis of corporate strategy, estimation of effects of alternate strategies, development of capital allocation framework.
- **Capital management and optimal capital structure**
 - ⇒ **State-owned electricity generator:** Built detailed financial model to analyze effects of increased leverage on cost of capital, entity value, credit rating, and stability of dividends. Debt of \$500 million issued.
- **Cost of capital**
 - ⇒ **Cost of Capital in the Public Sector:** Provided advice to a government enterprise on how to estimate an appropriate cost of capital and benchmark return for Government-owned enterprises. Appearance as **expert witness** in legal proceedings that followed a regulatory determination.
 - ⇒ **Expert Witness:** Produced a written report and provided court testimony on issues relating to the cost of capital of a cable TV business.
 - ⇒ **Regulatory Cost of Capital:** Extensive work for regulators and regulated entities on all matters relating to estimation of weighted-average cost of capital.
- **Valuation**

- ⇒ **Expert Witness:** Produced a written report and provided court testimony. The issue was whether, during a takeover offer, the shares of the bidding firm were affected by a liquidity premium due to its incorporation in the major stock market index.
- ⇒ **Expert Witness:** Produced a written report and provided court testimony in relation to valuation issues involving an integrated mine and refinery.
- **Capital Raising**
 - ⇒ Produced comprehensive valuation models in the context of capital raisings for a range of businesses in a range of industries including manufacturing, film production, and biotechnology.
- **Asset pricing and empirical finance**
 - ⇒ **Expert Witness:** Produced a written report on whether the client's arbitrage-driven trading strategy caused undue movements in the prices of certain shares.
- **Application of econometric techniques to applied problems in finance**
 - ⇒ **Debt Structure Review:** Provided advice to a large City Council on restructuring their debt portfolio. The issues involved optimisation of a range of performance measures for each business unit in the Council while simultaneously minimizing the volatility of the Council's equity in each business unit.
 - ⇒ **Superannuation Fund Performance Benchmarking:** Conducted an analysis of the techniques used by a large superannuation fund to benchmark its performance against competing funds.
- **Valuation of derivative securities**
 - ⇒ **Stochastic Volatility Models in Interest Rate Futures Markets:** Estimated and implemented a number of models designed to predict volatility in interest rate futures markets.
- **Application of option-pricing techniques to real project evaluation**
 - ⇒ **Real Option Valuation:** Developed a framework for valuing an option on a large office building. Acted as arbitrator between the various parties involved and reached a consensus valuation.
 - ⇒ **Real Option Valuation:** Used real options framework in the valuation of a bio-tech company in the context of an M&A transaction.