

Jemena Gas Networks (NSW) Ltd - Initial response to the draft decision

Appendix 6.3H

SFG (13 Jan 10, ETSA) Response to AER Draft Determination in relation to gamma

19 March 2010



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Response to AER Draft Determination in relation to gamma

Report prepared for ETSA Utilities

13 January 2010

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Context, overview and executive summary

Instructions

1. This report has been prepared by Professor Stephen Gray, Professor of Finance at the University of Queensland Business School and Managing Director of Strategic Finance Group: SFG Consulting, a corporate finance consultancy specialising in valuation, regulatory and litigation support advice. I have attached a copy of my CV as an appendix to this report.
2. I have been assisted in preparing this report by Dr Jason Hall, David Costello and Alexandra Dwyer of SFG Consulting.
3. For the purposes of preparing this report I was provided with a copy of the Federal Court guidelines *Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia* dated 5 May 2008. I have reviewed those guidelines and this report has been prepared consistently with the form of expert evidence required by those guidelines. In preparing this report, 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.
4. Strategic Finance Group: SFG Consulting (SFG) has been engaged by ETSA Utilities to provide a response, in relation to the gamma parameter, to:
 - a. the AER South Australia Draft Distribution Determination 2010-11 to 2014-15 (the *Draft Determination*); and
 - b. the AER's responses to ETSA's information requests.
5. We have been provided with a set of formal instructions from Gilbert and Tobin, which are attached as an appendix to this report. The specific questions we have been asked to address are as follows:
 - a. Please address the AER's concerns listed in this brief and any other matters arising from the Draft Determination that SFG Consulting considers relevant.
 - b. Please review the attached expert report from Dr Field. Can SFG Consulting investigate the 150 random observations identified by Dr Field and assess whether there are any economic grounds to exclude these observations?
 - c. If there are grounds to exclude any of these observations please state the observation and the basis for its exclusion.
 - d. If any observations are excluded, please re-run the previous dividend drop-off analysis conducted by SFG Consulting. Identify whether the exclusion of these observations has an impact on the results obtained in the dividend drop off analysis and explain the basis for this difference.

Summary of findings

6. Our main conclusions are as follows:
 - a. The AER questions whether the tax rate at which dividends are franked should be changed from 34% to 30% for those observations with ex-dividend dates in the September quarter

in 2001. This is a relatively small change to be applied to a relatively small proportion of the sample observations. It has an inconsequential effect on the estimates;

- b. The best way to quantify and examine the effects of multicollinearity in the dividend drop-off setting is via a joint probability region. This analysis shows that the estimate of theta that is conditional on cash dividends being valued at 100 cents per dollar fits the data just as well as an “unconstrained” estimate that values cash dividends at less than 100 cents and ascribes positive value to franking credits. This CAPM-consistent estimate of theta (that is conditional on cash dividends being valued at 100 cents) is 0.079. The “unconstrained” SFG estimate is 0.98 for dividends and 0.23 for franking credits. The Beggs and Skeels (1996) post-2000 estimate is 0.80 for dividends and 0.57 for franking credits. All of these combinations of (a) the value of cash dividends, and (b) theta fit the data equally well. One can choose any of these combinations and fit the data just as well as any other combination. The usual criterion of statistical significance cannot discriminate between any of these combinations. What can discriminate between them is that some of them are consistent with the standard CAPM and some are not. Those points for which the value of cash dividends is 1.00 are consistent with the CAPM (which is based on this value) and others are not;
- c. The AER has suggested that some observations may need to be removed from the analysis. We conclude that there is no reason to remove special dividends from the sample, and that the AER’s description of “Black Friday” does not pertain to actual market data;
- d. In accordance with our instructions, we have examined 150 specified data points in detail for any announcement over a five day period around the ex-dividend day. We have been conservative in determining whether there is any possibility that the announcement could have affected stock prices and we have corrected observations where there is any suggestion of error. Having done this, our parameter estimates change only in the third decimal point. Hence, after an individual review of 4.7% of our 3,201 observations, including the review of 236 stock exchange announcements, there is negligible change to the results. In part, this is due to our previous work in identifying and separately analysing the most influential data points in order to minimise the chance that the results are contaminated by invalid data or the release of contemporaneous price-sensitive information; and
- e. The AER’s assumption that 100% of franking credits created during a year are distributed in that same year is inconsistent with observed empirical data. Moreover, so long as the firm continues to exist and to pay dividends out of profits earned each year, there are substantial limitations on the ability of the firm to distribute any stored franking credits.

1. Response to Draft Determination

Context and overview

AER Review of WACC Parameters

7. The AER has recently conducted a Review of WACC Parameters and issued a Statement of Regulatory Intent in the form of a Final Decision (*WACC Parameter review Final Decision*). In that Final Decision, the AER concluded that the appropriate value of the gamma parameter is 0.65. This estimate was based, in part, on the results of a dividend drop-off analysis reported by Beggs and Skeels (2006).
8. As part of the Review of WACC Parameters, the Joint Industries Associations (JIA) submitted the results of an updated dividend drop-off analysis performed by SFG. That analysis used the Beggs-Skeels methodology, but updated the data set to include more firms and to extend the sample period to incorporate more recent observations.
9. In its Final Decision, the AER determined that the SFG study should be given zero weight and that the Beggs and Skeels study should be the only dividend drop-off estimate that is used when estimating gamma for regulatory purposes.

South Australian Distribution Price Reviews

10. As part of its submissions in the South Australian Distribution Price review, ETSA submitted a report prepared by Associate Professor Skeels, one of the authors of the Beggs and Skeels (2006) study. In that report, Assoc. Prof. Skeels examined the SFG study and the AER's criticisms of it in considerable detail and concluded that:

Many of the criticisms raised by the AER were little more than allusions to potential problems with the SFG analysis. In some cases I found that these allusions were ill-founded and readily dismissed. In other instances the appropriate response was to rework the model and to actually establish whether the concern was valid or not. This latter class of concerns was incorporated into the questions posed to SFG. I found their responses to be convincing in as much as the potential problems were demonstrated to have little or no material impact upon the results.¹

11. Associate Professor Skeels also concludes that:

I find that the results presented in Appendix I constitute an empirically valid study of the dividend drop-off problem for Australia and that the SFG estimate of theta of 0.23 represents the most accurate estimate currently available.²

12. In the SA Distribution Draft Determination, the AER indicates that it prefers to place zero weight on the empirical evidence set out in the SFG dividend drop-off report and to continue to

¹ Skeels (2009), p. 5.

² Skeels (2009), p. 5.

use the Beggs-Skeels estimate for this purpose, notwithstanding the report from Assoc. Prof. Skeels.

13. The Draft Decision sets out a number of reasons for the AER's outright rejection of the SFG study as follows:
 - a. Incorrect corporate tax rates used;
 - b. No test or adjustment for multicollinearity;
 - c. Concerns about the reliability of some data;
 - d. Filtering, outliers and the stability of estimates;
 - e. Failure to remove "Black Friday" like observations from the data set.
14. Subsequent to the Draft Determination, ETSA requested further detail and information from the AER in relation to its reasons for placing zero weight on the results of the SFG study. The AER has provided some information in relation to these requests. In the remainder of this section of the report, we address the AER's reasons for rejecting the results of the SFG study.

Corporate tax rates

15. The AER concludes in its Draft Determination that:

contrary to Skeels' claim, there continues to be an issue with the appropriate use of the corporate tax rates as there remains a three-month lag for the adoption of the 34 and 30 per cent tax rates.³

16. In the SFG study, franked dividends paid within three months of a tax rate change were assessed using the corporate tax rate that applied before the change. In the post-2000 sample this affects only those observations with ex-dividend dates in the September quarter of 2001 – following the change in the corporate tax rate from 34% to 30% on July 1 2001.
17. Under dividend imputation legislation, franking credits are created by the payment of corporate tax. The amount of franking credits created depends on the corporate tax rate that was applicable over the period during which the income was earned. Suppose, for example, that a firm earns \$100 profit in the 2001 tax year. It would pay \$34 corporate tax and consequently \$34 of franking credits would be created. However, if the firm then paid the remaining \$66 as a dividend in (say) August 2001, that dividend could only be franked at the rate of 30% (the new corporate tax rate). In this case, the \$66 dividend would have \$28.29 of franking credits attached to it and the remaining \$5.71 of franking credits would have to be stored in the firm's franking account balance.⁴

³ Draft Determination, p. 269.

⁴ Technically, where franking credits arose after 30 June 2001 which related to tax payments based on an underlying rate of 34% (rather than the 30% rate), those franking credits were converted to equivalent credits based on the new rate of 30%. This example is for illustrative purposes only in that, the final income tax liability for the year ended 30 June 2001 would not generally have been paid by August 2001. We also note that the calculations of franking credits in this simple example are based on current law which uses the "tax paid" basis of recording franking credits – this is simply for ease of exposition.

18. Consequently, we have altered the corporate tax rate from 34% to 30% for those observations in our sample with ex-dividend dates that fall in the September quarter of 2001. This is a relatively small change (from 0.34 to 0.30) for a relatively small proportion of the observations in our sample, and is therefore not expected to have a material impact on the results. Indeed for the post-2000 sample, the point estimate of the value of cash dividends changes from 0.9827 to 0.9822 and the point estimate of the value of franking credits changes from 0.2308 to 0.2340. In all of the further analysis in this report, we use the 30% franking rate for all observations in the September quarter of 2001.

Tests and adjustments for multicollinearity

Description of the issue of multicollinearity

19. Multicollinearity refers to the case where two or more independent variables are significantly correlated. In the case of dividend drop-off regression analysis, the dependent variable is the change in stock price over the ex-dividend day and the independent variables are the cash dividend and the amount of franking credits. Mathematically, this relationship is expressed as:

$$\Delta P = aD + \theta FC + \varepsilon$$

where ΔP represents the change in stock price, D represents the amount of the cash dividend, FC represents the amount of franking credits, a is the estimated value of a \$1.00 dividend, θ (theta) is the estimated value of a \$1.00 franking credit, and ε is the regression residual.

20. Under the Australian imputation system a fully franked dividend has franking credits equal to $D \frac{\tau}{1-\tau}$ where D represents the cash dividend and τ represents the corporate tax rate. For a \$1.00 dividend and a 30% corporate tax rate, we have $D \frac{\tau}{1-\tau} = 1 \times \frac{0.3}{1-0.3} = 0.43$. That is, one of the independent variables (FC) is equal to 0.43 times the other (D). Consequently, if the corporate tax rate was constant over a sample period and all dividends were fully franked, we would have perfect multicollinearity.
21. The consequence of multicollinearity is that even though the combined value of the dividend plus franking credit can be reliably estimated, disaggregating this combined value into the separate contributions from the dividend and franking credit can be difficult.

AER recognition of the issue

22. In its Draft Determination, the AER notes that:

dividend drop-off studies are likely to suffer from multi-collinearity as it is difficult to separate the value investors imply from cash dividends and the imputation credits attached to those cash dividends,⁵

and that:

⁵ Draft Determination, p. 262.

there have been no tests conducted to examine the extent of multicollinearity, as the AER has previously recognised that dividend drop-off studies are likely to be prone to multicollinearity given the high correlation between cash dividends and the associated franking credits.⁶

Detailed submissions on the issue of multicollinearity

23. The original SFG Report for the JIA discussed the issue of multicollinearity in some detail and cited Bellamy and Gray (2004), which deals extensively with the issue. Indeed the issue of multicollinearity was first raised in the original SFG Report, which noted that this is an important reason why one must *jointly* consider the estimates of theta *and* the value of cash dividends. The original SFG Report made the important point that the estimate of theta is *conditional* on the estimated value of a dollar of cash dividends being less than a dollar.
24. This in turn leads to a series of points in relation to the inconsistency between assuming that cash dividends are fully valued when using CAPM to estimate the required return on equity, but assuming that a one dollar cash dividend is worth only 80 cents when employing the Beggs-Skeels estimate of theta. These points have all been set out for the AER in some detail in the SFG Report for the JIA titled *The consistency of estimates of the value of cash dividends*.⁷

Relevance of multicollinearity

25. In summary, dividend drop-off analysis seeks to estimate two things:
 - a. The value of a one dollar cash dividend; and
 - b. The value of the associated franking credit.
26. In the presence of multicollinearity, it is difficult to separately estimate values for each of these two things. It is, however, quite possible to reliably estimate the combined value of the dividend plus the associated franking credit. That is, the combined value can be reliably estimated, but it is difficult to reliably separate this combined value into its component pieces. This is because there are many different combinations of values of the component pieces that produce the same combined value.⁸
27. The original SFG Report noted that a very consistent finding among dividend drop-off studies is that the combined value of a one dollar cash dividend and the associated franking credit is one dollar. This result holds over a number of different studies, using different variations of the methodology, different time periods, different sample sizes, and different subsets of data (small vs. large firms, resources vs. industrial stocks).⁹
28. The question then becomes one of how best to separately attribute the one dollar combined value among the cash dividend and the associated franking credit – in light of the multicollinearity issue.

⁶ Draft Determination, p. 269-70.

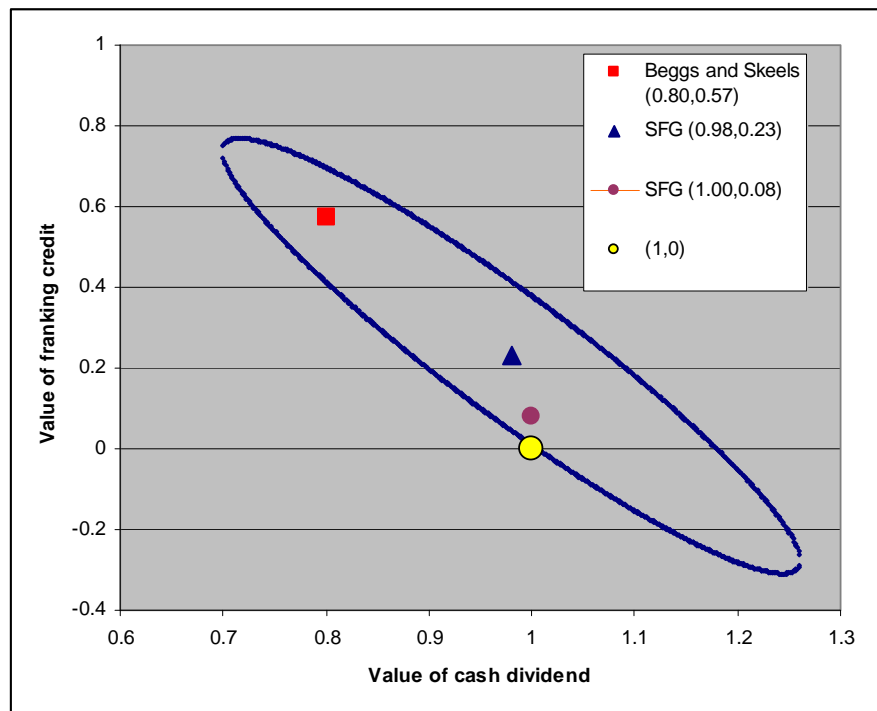
⁷ 1 February, 2009.

⁸ For example, 0.8 and 0.2 add to 1.0, as do 0.7 and 0.3, or 1.0 and 0.

⁹ Beggs and Skeels (2006), Hathaway and Officer (2000, 2004), Bellamy and Gray (2004).

Statistical approach to address multicollinearity

29. One approach that can be used to address the issue of multicollinearity is a joint confidence region as described in Greene (1993) pp. 190-191.¹⁰ This joint confidence region shows the pairs of parameter estimates (value of cash dividends and value of franking credits) that fit the observable market data equally well. Specifically, any pair of parameter estimates inside the joint confidence region fit the data equally well – there is no statistically significant difference in their ability to fit the data. Figure 1 below can be used to summarise the results.

Figure 1. Joint confidence interval

30. Figure 1 shows that the SFG estimates of theta and the value of cash dividends fits the data just as well as the Beggs-Skeels estimates and some constrained “CAPM consistent” estimates where the value of cash dividends is fixed at 100%. The use of a joint confidence region avoids the problems of multicollinearity in that it examines the joint significance of the two parameters, rather than seeking to separately examine each.

Consistency with CAPM

31. In previous submissions to the AER,¹¹ we have noted that inconsistent estimates of the value of cash dividends are used in two places in the AER’s reasoning:
- a. The AER’s empirical estimates of theta (and consequently gamma) are conditional on an estimated value of cash dividends of 75-80 cents per dollar; and

¹⁰ Greene shows that the joint confidence region is that set of values $\beta = (\beta_1, \beta_2)'$ for which $\frac{1}{2}(b - \beta)' \Omega^{-1}(b - \beta)$ is

less than the critical value of $F[2, n - K]$, where b represents the parameter estimates, Ω is the estimated covariance matrix of the relevant parameters, n is the number of observations in the sample, and K is the number of parameters being estimated.

¹¹ See our report of 1 February 2009, titled *The consistency of estimates of the value of cash dividends*.

- b. The AER's estimate of the required return on equity using the CAPM is conditional on cash dividends being valued at 100 cents per dollar.
32. In our view, the estimate of 100 cents per dollar should be used consistently throughout the WACC estimation process. This is because:
- a. Dividend yield studies are consistent with an estimate of 100 cents;
 - b. The relevant and important dividend drop-off studies that examine unfranked dividends (and thus seek specifically to estimate the value of cash dividends only) find that cash dividends are valued by the market at 100 cents per dollar;
 - c. As set out in Figure 1 above, an estimate of 100 cents (and the corresponding estimate of the value of franking credits) fits the Australian data just as well as the 80 cent estimate (and its corresponding estimate of the value of franking credits) reported by Beggs and Skeels (2006); and
 - d. The standard market practice of setting the value of cash dividends at 100 cents per dollar and making no adjustment for franking credits also fits the Australian data just as well as the 80 cent estimate (and its corresponding estimate of the value of franking credits) reported by Beggs and Skeels (2006).

Summary

33. Figure 1 above shows that the estimate of theta that is conditional on cash dividends being valued at 100 cents per dollar fits the data just as well as an "unconstrained" estimate that values cash dividends at less than 100 cents and ascribes positive value to franking credits. This CAPM-consistent estimate of theta (that is conditional on cash dividends being valued at 100 cents) is 0.079. This estimate has co-ordinates (1.00, 0.08) above.¹² The "unconstrained" SFG estimate is (0.98, 0.23). The Beggs and Skeels (1996) post-2000 estimate is (0.80, 0.57). All of these points are shown in Figure 1 and all are within the joint confidence region. That is, all of these combinations of (a) the value of cash dividends, and (b) theta fit the data equally well. One can choose any of these combinations and fit the data just as well as any other combination. The usual criterion of statistical significance cannot discriminate between any of these combinations. What can discriminate between them is that some of them are consistent with the standard CAPM and some are not. Those points for which the value of cash dividends is 1.00 are consistent with the CAPM (which is based on this value) and others are not.
34. We also note that an estimate of 100 cents for cash dividends and zero for franking credits fits the data just as well as any of the other combinations in the joint confidence region. That is, the market practice approach adopted by valuation professionals fits the data just as well as the Beggs and Skeels estimate or any other unconstrained estimate. In other words, restricting the value of cash dividends to be 100 cents (to be consistent with the use of the standard CAPM and with the empirical evidence set out above) has an insignificant effect on the ability of the dividend drop-off model to fit the data. This CAPM-consistent estimate fits the data just as well, so nothing is being given up by using it. What is gained by using it is consistency with the use of the standard CAPM.

¹² We have rounded co-ordinates to two decimal places.

Reliability of data

“Historically consistent” data series

35. The Draft Decision suggests that the SFG study “appears not to use historically consistent price and dividend data.”¹³ ETSA has requested further explanation from the AER on this point. The AER has replied with the following response:

The share price and dividend data are not adjusted to smooth out the effect of bonus issues, right issues, share splits and other events that may change the number of shares on issues. It is desirable to use adjusted series to reflect the same basis of quotation for shares of a company.¹⁴

36. The AER has apparently used Bloomberg to identify ex-dividend dates, stock prices, capitalisation changes such as stock splits and bonus issues and so on. We note that Bloomberg reports a “total return” or “adjusted” series that makes adjustments for stock splits and bonus issues etc. For example, if a company makes a 2:1 stock split, this series would simply double the stock price after the split. The result is that after several capitalization changes, the reported “stock price” may differ very substantially from the actual traded share price. This would be important if one were calculating the total return or capital gain that had been earned on a stock over a period of some years.
37. However, dividend drop-off analysis examines stock price changes over one day. Our approach is to examine how the *actual* share price changes over the ex-dividend day and to compare this with the *actual* dividend and the *actual* franking credit. In our view, this is clearly the correct approach. If one examined an “adjusted” series, one would also have to adjust the dividend and franking credit by the same ratio. If the adjustments were all performed correctly, the results would be the same as under our approach. But there is no reason to do this as it achieves no benefit, but makes errors more likely.

Special dividends

38. The Draft Determination does not specifically refer to special dividends, but the AER’s response to ETSA’s information request notes the AER’s concern that:

Observations on special cash dividend payments are not excluded from the sample or properly controlled in the analysis.¹⁵

39. The AER suggests that special dividends should be excluded or “controlled” but does not set out what type of control it thinks might be required. However, there is no reason at all to exclude special dividends from a dividend drop-off analysis. There is no reason why the stock price change over the ex-dividend date would differ for special dividends relative to ordinary dividends. Special dividends may have a different announcement effect than ordinary dividends (i.e., the stock price reaction may be different at the time of announcement) but this pre-dates the cum-dividend price and is of no relevance to the price change over the ex-dividend date (which is some weeks after the announcement).

¹³ Draft Determination, p. 269.

¹⁴ AER response to ETSA information request.

¹⁵ AER response to ETSA information request.

40. That is, the dividend process begins with the announcement of the dividend. Many empirical studies show that the stock price changes to reflect the information conveyed to the market by this announcement. In particular, the announcement of dividend increases are (on average) associated with abnormal positive stock returns and the announcement of dividend decreases are (on average) associated with abnormal negative stock returns. Some weeks after this, the dividend separates from the share on the ex-dividend date. The price on the previous day (the cum-dividend day) reflects the entitlement to the dividend, and the price on the ex-day reflects the price of the stock after the dividend has separated from the share.
41. It is possible that the stock price reaction to the announcement may be different for a special dividend than for an ordinary dividend because a special dividend is a one-off payment whereas ordinary dividends are expected to be maintained indefinitely. However, this all happens some weeks before the ex day, which is the data used for a dividend drop-off study. A drop-off study seeks to estimate the value of cash dividends and franking credits by examining the stock price change over the ex-dividend day only. Special dividends should only be omitted from this analysis if there were some reason why the value of franking credits attached to special dividends differed from the value of franking credits attached to ordinary dividends. But since there is no such reason, there is no need to exclude or “control for” special dividends. Excluding special dividends would simply reduce the sample size, which would make the results less reliable.

Announcements “around” the ex-dividend day

42. The AER suggests that the SFG results may be contaminated by company announcements “around” the ex-dividend date. The AER’s response to ETSA’s information request notes the AER’s concern that:

Company-specific information (including the share split and bonus share issues) is announced around the ex-dividend days, the firm share price changes substantially, reflecting market reaction to both. For example, KAZ made several announcements around the ex-dividend day (10/04/2001) when it paid out a dividend of 0.0025, including: an announcement that it had signed a three-year IT outsourcing contract; and an announcement that it has successfully implemented a national contract with Elders.¹⁶

43. The AER provides another example of what it considers to be a potentially contaminating source of information, as follows:

Examples of such events include, but are not limited to, ongoing merger speculation (an example of this was Alinta AGL, which went on for a long period of time but did not affect the market), the issuing of new shares, signs of financial stress of a specific business over a period of time (e.g. Envestra, Timbercorp, Babcock and Brown, etc.), and other events which may affect the volatility of a stock’s prices over a prolonged period of time but not the entire market.¹⁷

44. In responding to these claims, the first point to make is that the effect of other announcements is not unique to the SFG study (as the AER implies) but applies equally to all empirical studies in finance that use stock price data. A dividend drop-off analysis seeks to estimate the value of cash

¹⁶ AER response to ETSA information request.

¹⁷ AER response to ETSA information request.

dividends and franking credits by observing the stock price change on the ex-dividend day. But stock prices can change for reasons other than the dividend and franking credit separating from the share on the ex-dividend day. Standard empirical finance practice is to seek to employ a large sample so that the effects of these other factors will cancel each other out (i.e., some will have a positive effect on stock prices and others will have a negative effect) in which case the only systematic effect is the ex-dividend event. Standard practice then applies tests of statistical significance to the results obtained from the analysis of the largest possible sample of data.

45. For example, the AER's estimates of beta are also based on stock price data. In that case, the goal is to estimate the relationship between stock returns and market returns. But stock prices can change for reasons other than market movements. Indeed the R-squared statistics in these regressions tend to be very small indeed, indicating that the very great majority of stock price movements are for reasons other than market movements. The AER's approach here was *not* to eliminate observations where the stock price movement may have been caused by something other than the market movement. Rather, the AER's approach was to use all available observations.
46. Second, this potential problem is really a non-issue for dividend drop-off analysis. This technique takes the price change between the cum-dividend date and the ex-dividend date. This is one day (perhaps slightly longer for small stocks that do not trade every single day.) An announcement made before the cum-dividend day is already incorporated into the cum-dividend stock price. An announcement made after the ex-dividend day is also irrelevant as it affects prices subsequent to the dividend drop-off. That is, the issue is constrained to announcements made on the ex-dividend day itself. These are so rare that it could not possibly have a material effect on the results. Moreover, even if there was an effect, there is no reason to suspect that there would be any bias – positive and negative announcements would be likely to offset one another. Note that in our data checking of 150 randomly-selected observations, discussed in Section 2 we reviewed all company announcements released up to two days before and two days after the ex-dividend date, to account for any residual risk that the market became aware of price-sensitive information on the ex-dividend date.
47. Third, the same reasoning applies to the AER's example about a company that is the subject of merger or acquisition speculation. Unless there is a major development that happens to occur exactly on the ex-dividend date, it is irrelevant to dividend drop-off analysis. By contrast, these issues will potentially seriously affect beta estimates, which rely on every monthly return over a period of at least 4-5 years. Such issues will affect beta estimates if they occur at any time during the 4-5 year or more estimation period. In this regard, the AER gives examples of AGL and Alinta, and that the same arguments apply in relation to financial distress considerations, where they provide the example of Envestra. This is cause for substantial concern about the reliability of beta estimates, but is irrelevant to dividend drop-off analysis.
48. Fourth, the only way announcements "around the time" of the ex-dividend date could affect dividend drop-off estimates is if markets are inefficient and do not properly reflect available information. However, even if the market's reaction to price-sensitive information occurred over more than one day, the issue for dividend drop-off studies is whether the sample is biased in a statistical sense. If there is an equal chance that ex-dividend day prices increase or decrease due to the release of price-sensitive information in the days prior to the ex-dividend date, there is no reason to think that parameter estimates will be affected. Furthermore, for this information to affect the estimated value of cash dividends versus imputation credits, there would need to be a systematic relationship between the level of franking and the release of positive or negative information around the announcement date. There is no reason to suspect that a bias of this type exists in our dividend drop-off study, given the large number of data points used and the detailed analysis of influential observations.

49. In summary, dividend drop-off analysis uses only stock price changes over the ex-dividend day. Unless a value-relevant announcement occurs on this very day, its effect will not be relevant for the dividend drop-off estimates. By contrast, beta estimates require a series of monthly or weekly returns over some years. Any value-relevant announcement that occurs at any point over this period will affect the beta estimate. Moreover, the AER's empirical analysis of beta estimates is based on only a few stocks, so the large sample effect (whereby positive and negative news may tend to cancel out) does not apply. Also, the AER has specifically identified two of those stocks (AGL and Alinta) as being particular examples of such contamination. By contrast, the dividend drop-off analysis uses a sample of hundreds of different stocks.
50. In our view, the only conclusion that can be drawn from this is that the AER's beta estimates are much more likely to be contaminated and unreliable as the result of announcements and takeover speculation than are any dividend drop-off estimates of theta.

Sample of dividend events

51. The AER's response to ETSA's information request also states that:

not all dividend-paying events for a firm paying regular interim and final dividends during the sample period are included.¹⁸

52. The data set for the SFG study was compiled from three data sources: SIRCA, FinAnalysis, and ETrade. Data was cross-referenced between databases and any inconsistencies that were identified were examined and reconciled. Under the process that was used to identify and reconcile ex-dividend events, it is possible that a small handful of observations (more likely to pertain to firms that are now de-listed) were omitted from the sample.
53. The AER has not provided information about which or how many such observations it has identified. In any event, any effect on the results will be immaterial for a number of reasons:
- a. The number of omitted observations will be tiny as a proportion of the data points included in the sample;
 - b. There is no reason to suspect that any omitted data points would systematically bias the results – random omission of even a large number of data points would likely see approximately equal numbers having a positive or negative effect on the final results;
 - c. The sampling analysis set out below shows that the exclusion of a relatively small number of events affects the final estimate of theta in only the third decimal point.
54. For these reasons, it is highly unlikely that any omitted ex-dividend events identified by the AER would have a noticeable effect on the final results of the SFG analysis. If the AER were to provide a list of any such observations it has identified, it would be a straightforward matter to re-compute the results to determine whether those observations did in fact have any material affect on any estimates.

¹⁸ AER response to ETSA information request.

Filtering, outliers, and the stability of estimates

55. In any kind of large-scale empirical analysis there will be outlier data points in the sample. If the analysis is run with the noisy influential outliers included, the results will tend to be unstable (i.e., parameter estimates may change substantially from period to period) and statistically unreliable. Consequently, it is common to apply recognised statistical techniques to remove the effect of a small number of influential outliers to improve the robustness and reliability of the results. The SFG analysis applies such techniques and notes that:
- a. Before the removal of a small number of influential outliers the results are unreliable and unstable and have large standard errors and should not be relied upon; but
 - b. After removal of a very small number of outliers the results are remarkably stable and consistent and economically reasonable.
56. The SFG report therefore concluded that it is the latter set of stable and consistent results that should be relied upon.
57. The Draft Determination criticizes SFG’s removal or “filtering” of data points.

The AER notes that although the results reported by Skeels appear to address a number of the AER’s earlier concerns identified in the WACC review, there are still a significant number of issues which demonstrate that estimates provided by SFG are likely to be unreliable. In particular, the AER maintains its concerns regarding the rigour of the filtering technique used by SFG.¹⁹

58. This seems to imply that the AER prefers to use the entire sample results. But then the Draft Determination criticises the large standard errors that come from a sample that includes outliers²⁰ (and of course the standard error must be large if outliers are included – by definition). That is, the AER would seem to be satisfied only if the SFG results included all outliers *and* had low standard errors. But this is inconsistent and impossible.
59. On this issue, the key point is that after the removal of outliers, the SFG results are stable and consistent across sub-samples and across variations of the dividend drop-off methodology. It is this more robust and reliable set of results that we believe should be most heavily weighted.
60. Moreover, we have hand-checked every data point that has been removed and believe that there are sound reasons to remove them. It seems that the only possible criticism remaining is that the final data set we use *may* contain some data points that *should* be removed. But neither the Draft Determination nor the AER’s response to ETSA’s information request identify any specific data points that should be removed, nor the reasons why they should be removed. To place zero weight on a study because of the possibility that there might be some (unspecified) data points that should be removed is quite inconsistent with any recognised standard of evaluating research. Rather, the recognised standard is that the outright rejection of empirical research requires the identification of the specific offending data points, an explanation of the reasons why they must be omitted, and an explanation of why the removal of those data points would materially affect the results.

¹⁹ Draft Determination, p. 272.

²⁰ Draft Determination, p. 266, 268.

Failure to remove Black-Friday like observations from the data set

61. The Draft Determination proposes that one of the reasons for rejecting the results of the SFG study is that the SFG results do not account for events such as the severe stock market crash that, according to the AER, occurred on Friday 24 September 1986:

The AER agrees that events which would affect a cluster of the results are likely to be known to market practitioners. However, the event need not be as extreme as event such as 'Black Friday', it could be an event that affected only part of the stocks or one stock within the sample. Given that the SFG study has not conducted a rigorous interrogation of the data, there may be jointly influential unreliable observations within the data.²¹

and that:

'Black Friday' refers to the stock market crash on 24 September 1986.²²

62. A simple check reveals that 24 September 1986 was a Wednesday, not a Friday, and the market rose. It is also a date that occurred prior to imputation being introduced.
63. Moreover, even if there were legitimate Black-Friday-like events that occurred during the SFG sample period, they would only affect the results to the extent that they occurred on the ex-dividend day. That is, under the dividend drop-off method, the ex-dividend price change is only potentially contaminated by events that affect the ex-dividend price but not the cum-dividend price. For any particular event, this would pertain to a very small fraction of the total sample. Also, there is no reason to expect that such events (even if they did exist) would have a systematic positive or negative effect on the results).
64. We are unaware of any such events that should cause observations to be removed from the data sample examined in the SFG study. If the AER were to provide a list of any such events it has identified, it would be a straightforward matter to re-compute the results to determine whether the affected observations did in fact have any material affect on any estimates.

²¹ Draft Determination, p. 271.

²² Draft Determination, Footnote 882, p.271.

2. Additional sampling and data checking

65. Our instructions state that:

ETSA Utilities notes that a primary concern of the AER is with respect to the reliability of the dataset used by SFG Consulting. ETSA Utilities has engaged Dr John Field, a statistician, to provide independent advice in relation to sampling techniques which may be used to further investigate the reliability of the results. A copy of Dr Field's report is attached.

Dr Field's report recommends that a random sample of 150 observations be investigated to assess the reliability of the SFG dataset. Also attached to this brief is a copy of an excel spreadsheet prepared by Dr Field containing 150 observations drawn at random from the dataset. For the purposes of sampling Dr Field has drawn the sample from a total of 3,201 observations.²³

66. For the 150 randomly-selected observations we individually checked the cum- and ex-dividend share prices, the amount of the dividend and the franking percentage. We confirmed the values for all share prices and franking percentages.

67. We identified two dividends which were in error: (1) APA (2 June 2002) declared a dividend of \$0.03 and a capital return of \$0.02 for a total distribution of \$0.05. Our original analysis only included the dividend of \$0.03; (2) GAS (7 March 2006) included a dividend of \$0.05 and a capital return of \$0.05 for a total distribution of \$0.10. Our original analysis only included the dividend of \$0.05.

68. We identified 12 instances in which the dividend was declared in a foreign currency. Our original dataset contains Australian dollar dividend estimates obtained from SIRCA who had already performed the currency conversion. For these 12 observations we performed our own conversion using the exchange rate for the ex-dividend date as reported by the Reserve Bank of Australia (RBA). This does not necessarily mean that the exchange rate used by SIRCA is incorrect, just different from the rate used by the RBA. The difference in the Australian dollar dividend estimates under the alternative exchange rates is unbiased. Five of the Australian dollar dividend estimates are higher when the RBA rate is used for conversion and seven of the estimates are lower. The mean difference in the dividend estimates is $-\$0.0003$ or -0.02% of the cum-dividend share price. These observations are summarised in the table below. In the analysis which follows we present results using both sets of dividend estimates.

²³ The number 3,201 was used because the entire SFG Consulting dataset contains 5,646 observations in total for the period 1 July 1997 to 30 September 2006. A filtering criteria was then applied to only include observations which related to shares which had a market capitalisation of more than 0.03% of the All Ordinaries Index, 3,221 observations satisfy this criteria. Within this 3,221 observations there are 20 known observations which warranted exclusion on economic grounds.

Sequence	Ob- servation	Code	Cum- dividend price (\$)	Ex- dividend price (\$)	SIRCA reported A\$ dividend estimate (\$)	A\$ estimate from the RBA reported exchange rate (\$)	Dividend difference (A\$)	Dividend difference relative to cum- dividend price (%)
6	150	PDG	21.10	21.00	0.0914	0.1074	0.0160	0.0758
16	336	TEL	7.40	7.30	0.0707	0.0687	-0.0021	-0.0277
46	883	AGG	86.00	85.80	2.8050	2.8021	-0.0029	0.0033
57	1185	TWR	4.08	3.95	0.0978	0.1113	0.0135	0.3301
79	1710	TEL	4.32	4.22	0.0975	0.0940	-0.0005	-0.0120
92	2002	WHS	4.95	4.90	0.0053	0.0063	-0.0035	-0.0707
98	2082	NEM	5.85	6.14	0.0372	0.0433	0.0010	0.0168
115	2520	AQP	6.70	6.75	0.0458	0.0453	0.0061	0.0904
119	2620	FPH	2.78	2.75	0.1791	0.1401	-0.0005	-0.0174
132	2746	FBU	6.88	6.60	0.0575	0.0681	-0.0389	-0.5657
141	2927	NWS	23.60	23.63	0.0914	0.1074	0.0106	0.0448
143	2991	WHS	3.35	3.34	0.0707	0.0687	-0.0021	-0.0614
Mean			14.75	14.70	0.3017	0.3015	-0.0003	-0.0167

69. For the random sample of 150 observations we reviewed all announcements released to the Australian Stock Exchange up to two business days prior to and two business days after the ex-dividend date. 95 firms made at least one announcement during this five-day window for a total of 236 announcements, or an average of 1.6 announcements per observation. The largest number of announcements for one particular observation was for Macquarie Bank Limited which made 25 announcements two business days either side of the ex-dividend date of 22 November 2004. We classified 14 observations as having at least one announcement made to the market which had a reasonable chance of conveying price-sensitive information to the market. These observations are summarised in the table below. In performing this analysis we have been conservative in the sense that, at the margin, we were more likely to classify an announcement as conveying price-sensitive information to the market. In the following analysis we present results both including and excluding these data points.

Seq	Obs	Code	Cum-div price (\$)	Ex-div price (\$)	SIRCA reported A\$ div	Franking	Date	Announcement
1	29	LLC	30.40	29.90	0.500	100	27Aug97	LLC sells 50 percent interest in Ord Hydro Project
30	594	CPU	11.19	11.25	0.020	100	15Mar99	1. Half yearly report. 2. Major contract with NZX and expansion in NZ
31	613	AMP	17.88	17.80	0.180	100	22Mar99	AMP announces entry into India.
44	829	ILU	3.76	3.67	0.090	100	25Oct99	ILU plans USA expansion
71	1550	KAZ	0.76	0.79	0.003	100	04Mar02	Kaz signs global outsourcing contract with Xantic for satellite services
97	2081	KCN	3.85	3.85	0.125	0	28Aug03	Implementation of new growth initiative and issue of 10.8 m new shares
98	2082	NEM	5.85	6.14	0.005	0	28Aug03	NEM sells 30 percent interest in Mount Woods JV to Minotaur.
102	2153	COA	2.75	2.64	0.060	100	22Sep03	Acquisition of WA Advanced Hire
109	2366	TLS	4.82	4.66	0.130	100	22Mar04	ACCC issues competition notice over broadband pricing
119	2620	FPH	2.78	2.75	0.046	0	17Nov04	Investor & Analyst Briefing Materials
126	2676	RIO	44.40	45.30	0.583	100	23Feb05	Iron Ore Price Settlement
128	2707	CPU	5.76	5.67	0.050	10	02Mar05	Investor & Analyst Briefing Materials
142	2963	BPT	1.22	1.21	0.005	0	27Mar06	Increases interest in offshore Otway Basin permit
150	3200	IGO	4.05	4.00	0.070	100	29Sep06	Investor & Analyst Briefing Materials

70. The table below updates the analysis previously performed under a number of different iterations of the data, to account for the verification process discussed above. We show results from (1) the prior analysis of 3,201 observations; (2) the analysis after correcting for two dividends found to be understated; and (3) a dataset of 3,187 observations which excludes the 14 announcements where there is a reasonable chance of conveying price-sensitive information to the market. We then repeated this analysis using alternative Australian dollar estimates for dividends, derived from RBA reported exchange rates on the ex-dividend date. Hence, there are six sets of results reported. Standard errors for parameter estimates are in brackets.
71. In all six sets of results, the estimated value for cash dividends and franking credits, under each of the three time periods examined, is changed only at the third decimal place. For the most recent time period from 1 July 2000 to 30 September 2006, the estimated value for cash dividends lies within the range of 0.9808 – 0.9826 and the estimated value for imputation credits lies within the range of 0.2333 – 0.2379. The adjusted R-squared estimates lie within the range of 44.37 – 44.46%.
72. Hence, after an individual review of 4.7% of our 3,201 observations, including the review of 236 stock exchange announcements, there is negligible change to the results. In part, this is due to our previous work in identifying and separately analysing the most influential data points in order to minimise the chance that the results are contaminated by invalid data or the release of contemporaneous price-sensitive information.

	Prior dataset with tax rate corrected			Correction to two dividends (APA and GAS)			Elimination of 14 observations due to contemporaneous announcements		
	Cash	Franking	N	Cash	Franking	N	Cash	Franking	N
Panel A: SIRCA reported A\$ dividend estimates									
1 Jul 97 –	0.9311	0.2395	698	0.9325	0.2378	698	0.9337	0.2351	695
30 Jun 99	(0.0740)	(0.1707)		(0.0737)	(0.1703)		(0.0729)	(0.1707)	
1 Jul 99 –	0.8254	0.3604	328	0.8264	0.3591	328	0.8262	0.3550	327
30 Jun 00	(0.1090)	(0.2409)		(0.1091)	(0.2411)		(0.1093)	(0.2420)	
1 Jul 00 –	0.9826	0.2333	2,175	0.9812	0.2372	2,175	0.9819	0.2345	2,165
30 Sep 06	(0.0313)	(0.0832)		(0.0313)	(0.0832)		(0.0315)	(0.0835)	
	Adj-R ²	44.46%	3,201	Adj-R ²	44.45%	3,201	Adj-R ²	44.39%	3,187
Panel B: A\$ dividend estimates derived from RBA reported exchange rates									
1 Jul 97 –	0.9304	0.2403	698	0.9319	0.2385	698	0.9325	0.2367	695
30 Jun 99	(0.0743)	(0.1710)		(0.0739)	(0.1705)		(0.0733)	(0.1711)	
1 Jul 99 –	0.8250	0.3609	328	0.8262	0.3594	328	0.8260	0.3552	327
30 Jun 00	(0.1089)	(0.2409)		(0.1091)	(0.2411)		(0.1093)	(0.2420)	
1 Jul 00 –	0.9822	0.2340	2,175	0.9808	0.2379	2,175	0.9815	0.2351	2,165
30 Sep 06	(0.0313)	(0.0832)		(0.0313)	(0.0832)		(0.0315)	(0.0835)	
	Adj-R ²	44.44%	3,201	Adj-R ²	44.44%	3,201	Adj-R ²	44.37%	3,187

3. Assumption of 100% payout ratio

Handley analysis and recommendation to the AER

73. In the review of WACC parameters, the AER concluded that, on average, the distribution rate of franking credits is 71% but that gamma should be estimated *as though* the distribution rate were 100%:

...the adoption of a payout ratio of 1.0 does not imply an expectation that all credits will be paid out in each period. Rather as Handley advised, the full distribution of free cash flows is the standard assumption for valuation purposes, therefore for consistency, a 100 per cent payout of imputation credits is appropriate.²⁴

74. This approach has also been adopted in the Draft Determination, where the AER notes that it recognises that, on average, the distribution rate of franking credits is 71% but that gamma should be estimated *as though* the distribution rate were 100%, or alternatively as though franking credits that are not distributed are just as valuable as those that are. In particular, the Draft Determination follows the advice of Associate Professor Handley in concluding that:

the Officer framework assumes a perpetuity framework (as a simplifying assumption) and therefore assumes no growth and the full distribution of cash flows at the end of each period

it would be inconsistent to assume there is a full distribution of free cash flow but less than full distribution of the imputation credits associated with that free cash flow

standard tax valuation classical frameworks assume there is either a 100 per cent payout of free cash flows each period or a settling up at maturity—anything less would be irrational.²⁵

75. The AER notes that Associate Professor Handley claims that it would be “irrational” for a firm to generate some earnings that were never paid out – that all earnings are ultimately paid out by the firm, either as a “payout of free cash flows each period or by a settling up at maturity.”
76. The more likely case is somewhere between these two extremes, whereby a firm reinvests some of its earnings one period to finance growth and thereby increase the earnings that are available in all successive periods. This scenario is more realistic than Associate Professor Handley’s two theoretical extremes, whereby earnings are either paid out in full every period, or reinvested to generate a single balloon payout at “maturity” when the firm is presumably eventually dissolved.
77. Nevertheless, the general point that all free cash flows will eventually be paid out by the firm is true. But this payout will occur at some unspecified time in the future and is likely to be many years into the future. Indeed the commonly used perpetual growth assumption used in practice for valuation is based upon the idea that the firm continues as a going concern indefinitely, implying that some credits will never be distributed. Even if the firm eventually reverts to a zero growth state, or ceases operations and pays a liquidating dividend, there is a time value of money loss associated with the retention of franking credits.

²⁴ Final Decision, p. 410.

²⁵ Draft determination, p. 259.

78. To see this, consider the following example. Suppose a firm generates pre-tax profit of \$100 each year, pays \$30 of corporate tax each year, and distributes the remaining \$70 as a dividend each year. As a flat perpetuity, the firm could pay a \$70 dividend and a \$30 franking credit every year in perpetuity.
79. Now suppose that instead of distributing all earnings as a dividend in the first year, the firm retains \$20 of profits. Also suppose that the return on equity (after corporate tax) is 10%. This means that the \$20 of retained profits generates additional after-tax returns of \$2 per year – in perpetuity. Now, as far as earnings and the value of the firm goes, this is irrelevant. The firm has reduced the present dividend by \$20 and replaced it with an extra \$2 dividend in perpetuity. The present value of that \$2 perpetual dividend (at 10%) is \$20. That is, whether the firm retains funds to reinvest them at the required return, or pays out the \$20 as a current dividend, the outcome is the same.²⁶
80. In this case, in that first year, the firm pays out a \$50 fully-franked dividend with \$21.5 of franking credits (i.e., the standard 0.43 of franking credits for every dollar of dividends). That means that \$8.5 of the franking credits that are created that year are stored and not distributed.
81. Now suppose that the firm never retains another dollar of franking credits – that all earnings are distributed every year thereafter. In each year, after-tax profits will be \$72, pre-tax profits will be \$102.9, and tax paid (and franking credits created) will be \$30.9. Every year the firm will generate \$30.9 of franking credits, pay a \$72 dividend and distribute all \$30.9 of franking credits that it generated that year. Unless the firm subsequently decides to reduce its assets to generate cash to pay a dividend above \$74, there is no way of distributing the \$8.5 of franking credits that was stored from the first year.
82. Associate Professor Handley has simply claimed that all earnings must be eventually distributed and therefore all franking credits must be eventually distributed as well. The problem is that the retained franking credits do not generate a return on investment in the same manner that retained earnings does. When the firm retains \$1.00 of earnings for investment, and if this reinvestment earns a return equal to its cost of capital, there is a zero valuation impact. From a present value perspective, lower dividends in the first period are exactly offset by higher dividends in subsequent period. When the firm retains the attached \$0.43 of franking credits, in the subsequent period this still has a nominal value of \$0.43, and therefore a lower present value.
83. The eventual distribution of this credit would never occur in the case of a firm which grows in perpetuity and where that growth is funded by the reinvestment of earnings. If growth does not continue into perpetuity, the eventual distribution of the credit could still occur at an extended time in the future – but only when the firm liquidates, in which case the liquidation value of the assets could be used to pay a liquidating dividend. In either case, the stored franking credit has zero or negligible value, even though the firm's policy of distributing earnings is entirely rational.

²⁶ In reality, a firm may only retain profits if it were of the view that they could be reinvested at a rate higher than the required return of 10% (at least for some period). Obviously, this makes no difference to the point being made in this example.

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Appendices

Appendix 1: CV of Prof. Stephen Gray

Appendix 2: Formal instructions from Gilbert and Tobin

Appendix 3: Expert Report of Dr. John Field

Appendix 4: Random sample of observations provided by Dr. John Field

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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.

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- 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 8 years.
 - Corporate Finance Honours: Average 6.9 over 8 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.

BRIEF of SFG CONSULTING
RESPONSE TO DRAFT DETERMINATION

Background

The Australian Energy Regulator (**AER**) is currently considering ETSA's Regulatory Proposal for 2010-2015, and has published its Draft Determination on 25 November 2009. As part of this process, the AER must determine an appropriate return on capital, which is a function of (inter alia) the valuation of dividend imputation credits.

SFG Consulting have prepared dividend drop-off analysis to infer a value for theta which ETSA had filed in support of its Regulatory Proposal.

The AER has identified a number of outstanding concerns with in relation to the dividend drop-off analysis, including:¹

- 1 Use of incorrect corporate tax rates
- 2 No test or adjustment for multicollinearity
- 3 Concerns about the reliability of some data
- 4 Filtering, outliers and stability of estimates

ETSA Utilities requests that SFG Consulting address the above and any other points arising out of Draft Determination that SFG Consulting considers relevant.

ETSA Utilities notes that a primary concern of the AER is with respect to the reliability of the dataset used by SFG Consulting. ETSA Utilities has engaged Dr John Field, a statistician, to provide independent advice in relation to sampling techniques which may be used to further investigate the reliability of the results. A copy of Dr Field's report is attached.

Dr Field's report recommends that a random sample of 150 observations be investigated to assess the reliability of the SFG dataset. Also attached to this brief is a copy of an excel spreadsheet prepared by Dr Field containing 150 observations drawn at random from the dataset. For the purposes of sampling Dr Field has drawn the sample from a total of 3,201 observations.²

Questions

- 1 Please address the AER's concerns listed in this brief and any other matters arising from the Draft Determination that SFG Consulting considers relevant.
- 2 Please review the attached expert report from Dr Field. Can SFG Consulting investigate the 150 random observations identified by Dr Field and assess whether there are any economic grounds to exclude these observations?
- 3 If there are grounds to exclude any of these observations please state the observation and the basis for its exclusion.
- 4 If any observations are excluded, please re-run the previous dividend drop-off analysis conducted by SFG Consulting. Identify whether the exclusion of these observations has an

¹ See, AER, *Draft Decision: South Australia Draft distribution determination decision 2010-11 to 2014-15* (25 November 2009) 270-273.

² The number 3,201 was used because the entire SFG Consulting dataset contains 5,646 observations in total for the period 1 July 1997 to 30 September 2006. A filtering criteria was then applied to only include observations which related to shares which had a market capitalisation of more than 0.03% of the All Ordinaries Index, 3,221 observations satisfy this criteria. Within this 3,221 observations there are 20 known observations which warranted exclusion on economic grounds

impact on the results obtained in the dividend drop off analysis and explain the basis for this difference.

Guidelines in preparing your report

Attached are Expert Witness Guidelines issued by the Federal Court of Australia. Although this brief is not in the context of litigation, ETSA Utilities seeks a rigorously prepared independent view for use in the context of regulatory decision making and you are requested to follow the Guidelines to the extent reasonably possible in the context.

In particular, please:

- (a) identify your relevant area of expertise and provide a curriculum vitae setting out the details of that expertise;
- (b) only address matters that are within your expertise;
- (c) where you have used factual or data inputs please identify those inputs and the sources;
- (d) if you make assumptions, please identify them as such and confirm that they are in your opinion reasonable assumptions to make;
- (e) if you undertake empirical work, please identify and explain the methods used by you in a manner that is accessible to a person not expert in your field;
- (f) confirm 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 from your report; and
- (g) please do not provide legal advocacy or argument and please do not use an argumentative tone.

Attachment A: Expert Witness Guidelines issued by the Federal Court of Australia

1 General Duty to the Court³

- 1.1 An expert witness has an overriding duty to assist the Court on matters relevant to the expert's area of expertise.
- 1.2 An expert witness is not an advocate for a party even when giving testimony that is necessarily evaluative rather than inferential.⁴
- 1.3 An expert witness's paramount duty is to the Court and not to the person retaining the expert.

2 The Form of the Expert Evidence⁵

- 2.1 An expert's written report must give details of the expert's qualifications and of the literature or other material used in making the report.
- 2.2 All assumptions of fact made by the expert should be clearly and fully stated.
- 2.3 The report should identify and state the qualifications of each person who carried out any tests or experiments upon which the expert relied in compiling the report.
- 2.4 Where several opinions are provided in the report, the expert should summarise them.
- 2.5 The expert should give the reasons for each opinion.
- 2.6 At the end of the report the expert should declare that "[the expert] has made all the inquiries that [the expert] believes are desirable and appropriate and that no matters of significance that [the expert] regards as relevant have, to [the expert's] knowledge, been withheld from the Court."
- 2.7 There should be included in or attached to the report: (i) a statement of the questions or issues that the expert was asked to address; (ii) the factual premises upon which the report proceeds; and (iii) the documents and other materials that the expert has been instructed to consider.
- 2.8 If, after exchange of reports or at any other stage, an expert witness changes a material opinion, having read another expert's report or for any other reason, the change should be communicated in a timely manner (through legal representatives) to each party to whom the expert witness's report has been provided and, when appropriate, to the Court.⁶
- 2.9 If an expert's opinion is not fully researched because the expert considers that insufficient data are available, or for any other reason, this must be stated with an indication that the opinion is no more than a provisional one. Where an expert witness who has prepared a report believes that it may be incomplete or inaccurate without some qualification, that qualification must be stated in the report (see footnote 5).
- 2.10 The expert should make it clear when a particular question or issue falls outside the relevant field of expertise.

³ See rule 35.3 Civil Procedure Rules (UK); see also Lord Woolf "Medics, Lawyers and the Courts" [1997] 16 CJK 302 at 313

⁴ See [Sampi v State of Western Australia \[2005\] FCA 777](#) at [792]-[793], and [ACCC v Liquorland and Woolworths \[2006\] FCA 826](#) at [836]-[842]

⁵ See rule 35.10 Civil Procedure Rules (UK) and Practice Direction 35 – Experts and Assessors (UK); *HG v the Queen* (1999) 197 CLR 414 per Gleeson CJ at [39]-[43]; [Ocean Marine Mutual Insurance Association \(Europe\) OV v Jetopay Pty Ltd \[2000\] FCA 1463](#) (FC) at [17]-[23]

⁶ The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565

- 2.11 Where an expert's report refers to photographs, plans, calculations, analyses, measurements, survey reports or other extrinsic matter,⁷ these must be provided to the opposite party at the same time as the exchange of reports.

3 Experts' Conference

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

⁷ The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565-566. See also Ormrod *"Scientific Evidence in Court"* [1968] Crim LR 240

John Field Consulting Pty Ltd

ABN 62 096 615 235

10 High St, Burnside SA 5066
Telephone: (08) 8332 5294
Facsimile: (08) 8332 1229
Mobile: 0409 097 586
Email: JohnField@ozemail.com.au

Report for: ETSA Utilities

Date: 5 January 2010

Subject: **Reliability of data used in dividend drop-off study**

Summary

This report sets out a statistically sound basis on which to assess the reliability of a dataset used by Strategic Finance Group Consulting (SFG) in the analysis of a dividend drop-off analysis.

It is suggested that a simple random sample of between 100 and 200 observations be assessed; each of these observations should be classified as either 'acceptable' or 'unacceptable' on an economic basis.

The report gives indicative confidence limits for the proportion of unacceptable observations in the entire dataset, given the results from the sample.

Introduction

This report sets out a statistically sound basis on which to assess the reliability of a dataset used by Strategic Finance Group Consulting (SFG) in the analysis of a dividend drop-off analysis.

Methodology

The SFG dataset contains 3201 relevant observations. It is assumed that it is possible to classify an individual observation as either 'acceptable' or 'unacceptable' on an economic basis.

It is assumed that the entire dataset contains some (unknown) proportion of unacceptable observations. The precision (or reliability) of this proportion is estimated as follows:

- a sample of observations from the dataset is examined, and each observation is classified as 'acceptable' or 'unacceptable'
- the results from the sample are then used to infer (a) the proportion of unacceptable observations in the entire dataset, and (b) the precision or reliability of this estimate of the proportion.

The precision of the estimate of the proportion of unacceptable observations is expressed as a confidence interval. This makes it possible to make statements such as: "We are 95% confident that the true value of the proportion of unacceptable observations in the entire dataset lies between x% and y%"¹. The larger the sample size, the closer x and y will be together, and so the more precisely the proportion of unacceptable observations will be specified.

To calculate the confidence interval we assume that the number of unacceptable observations has a binomial distribution. This is a standard statistical assumption.

All calculations in this report were carried out using the R statistical language², using exact binomial confidence limits.

Sampling method

My understanding is that there is no reason to suspect that any particular observations are more likely to be unacceptable than any others. Therefore a simple random sample from the entire dataset will be statistically sound.

Sample size

The size of the sample to be used is a matter of balance between practicality and precision. The greater the precision required in the estimate of the proportion, the larger the sample needed. Heuristically, if 10 observations from a sample of 100 are found to be unacceptable, we are more 'certain' about our estimate of a 10% unacceptability rate than if we had found one unacceptable observation out of a sample of 10 observations. This idea is encapsulated by the use of confidence intervals.

To illustrate the expected outcome of the sampling process, it is assumed that there is only a small proportion of unacceptable observations in the entire dataset. Shown below are the expected outcomes from samples of varying sizes when the proportion of unacceptable observations in the sample is 5%, 2% and 0%.

¹ This is an heuristic interpretation of the confidence interval. A strict definition is that if we were to draw many samples of the same size from the dataset and calculate a confidence interval each time, then 95% of the confidence intervals would include the 'true' proportion of unacceptable observations. We calculate just one of these intervals.

² R Development Core Team (2009). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL <http://www.R-project.org>.

**Table 1: 95% confidence intervals for various sample sizes:
5% unacceptable obsns**

Sample size	No. of unacceptable observations	Unacceptability rate in sample	95% confident that unacceptability rate in whole dataset lies between
60	3	5%	1.0% – 13.9%
100	5	5%	1.6% – 11.3%
160	8	5%	2.2% – 9.6%
200	10	5%	2.4% – 9.0%

Table 1 shows that, for example, if examination of a sample of 60 observations yields 3 unacceptable observations, there is an ‘unacceptability rate’ of 5% in the sample. Then we can be 95% confident that the level of unacceptable observations in the entire sample lies between 1.0% and 13.9%. As the sample size increases, the estimate of unacceptable observations in the sample remains at 5%, but the confidence limits for the proportion in the entire dataset become narrower; that is we can be more precise about the likely proportion of unacceptable observations in the entire dataset.

**Figure 1: Variation in confidence limits with sample size:
5% unacceptable observations**

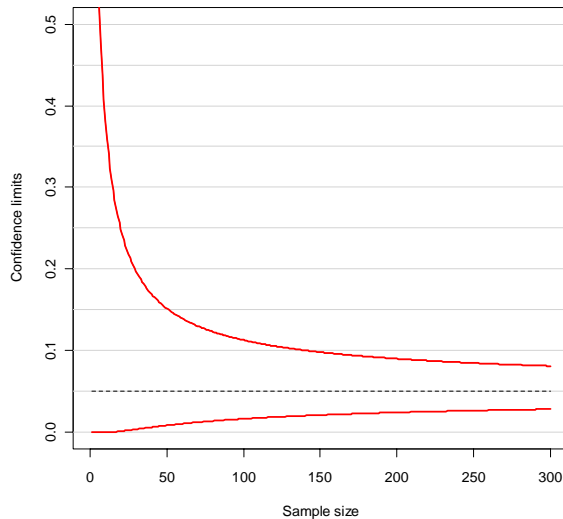


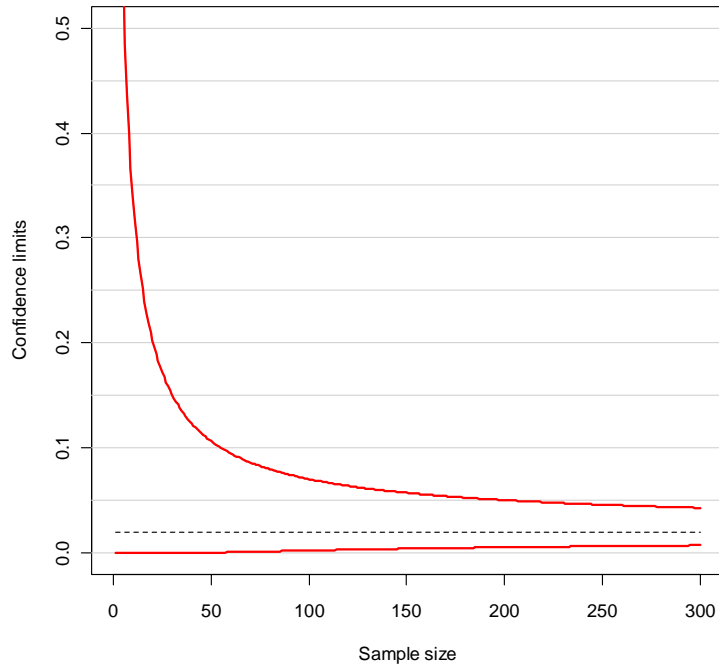
Figure 1 extends Table 1 to a range of sample sizes up to 300. It shows clearly that as the sample size increases, the width of the confidence interval (the vertical distance between the two lines) decreases. The decrease is rapid up until a sample size of about 100, and more gradual after that.

Table 2 and Figure 2 show similar information for the case of samples with 2% unacceptable observations. Again similar patterns are seen.

**Table 2: 95% confidence intervals for various sample sizes:
2% unacceptable observations**

Sample size	No. of unacceptable observations	Unacceptability rate in sample	95% confident that unacceptability rate in whole dataset lies between
50	1	2%	0.1% – 10.6%
100	2	2%	0.2% – 7.0%
150	3	2%	0.4% – 5.7%
200	4	2%	0.5% – 5.0%

**Figure 2: Variation in confidence limits with sample size:
2% unacceptable observations**

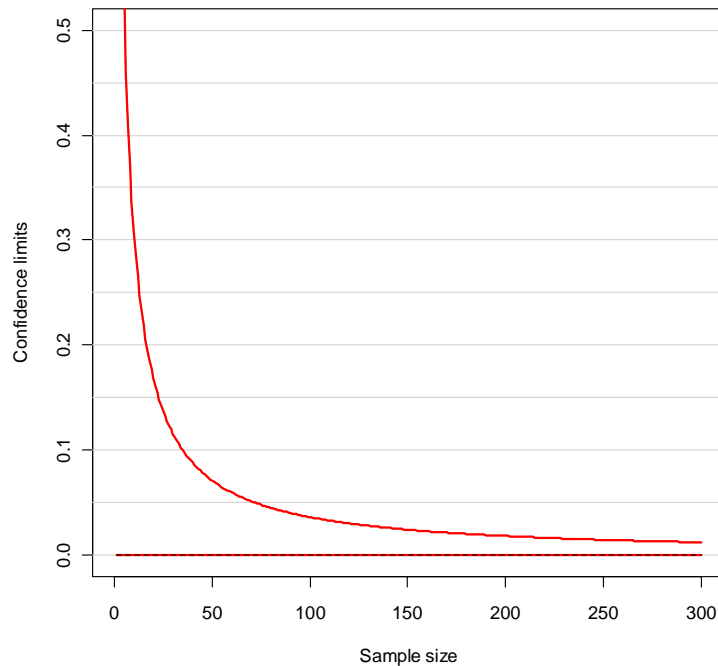


Finally, Table 3 and Figure 3 show results for the case when there are no unacceptable observations in the sample.

**Table 3: 95% confidence intervals for various sample sizes:
0% unacceptable observations**

Sample size	No. of unacceptable observations	Unacceptability rate in sample	95% confident that unacceptability rate in whole dataset lies between
50	0	0%	0% – 7.1%
100	0	0%	0% – 3.6%
150	0	0%	0% – 2.4%
200	0	0%	0% – 1.8%

**Figure 3: Variation in confidence limits with sample size:
0% unacceptable observations**



In this case, while no unacceptable observations were found in the sample, as the sample size increases, the lower confidence limit remains at zero while the upper confidence limit becomes closer to zero, ie the width of the interval is again decreasing and the estimate is becoming more precise.

A consideration of the tables and plots above suggests that a sample size of between 100 and 200 would provide reasonable precision in the estimate of the proportion of unacceptable observations in the dataset. Below 100 the precision changes fairly quickly with sample size, and beyond 200, the gains in precision are unlikely to be worth the increased effort.

The actual choice of sample size within the range of 100 to 200 should be made on the basis of (1) the expected proportion of the unacceptable observations, (2) the resulting precision as shown in the tables and graphs above, and (3) the relative effort in examining extra observations.

Once the sample has been selected and evaluated, 95% confidence limits for the proportion of unacceptable observations in the entire dataset can be calculated.

Sample selection

Once the sample size has been decided, a listing of observation numbers to be examined can be provided as an Excel spreadsheet. These will be selected at random from the 1386 observations in the dataset.

Qualifications and experience

My full name is John Benjamin Francis Field. I am a statistical consultant. I have a Bsc(Hons) which I obtained in 1967, and a PhD in Statistics from the University of Adelaide, which I obtained in 1986. I am an Accredited Statistician.

I worked with the CSIRO (now) Division of Mathematics, Informatics and Statistics for over 33 years, and for the last eight years I have worked as a private consultant through my own company, John Field Consulting Pty Ltd.

A CV is appended to this report.

Questions to be addressed

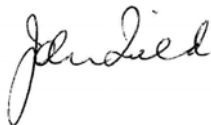
The following questions were posed in a Brief from ETSA Utilities dated 18 December 2009:

Please answer the following questions in the context of establishing a well defined and transparent methodology. Note that the objective is to set out a methodology which provides a statistically sound and robust basis to test the level of reliability of the data set used by SFG.

- 1 *What types of sampling techniques may be used to investigate the reliability of the data set?*
- 2 *What levels of statistical confidence or reliability can be drawn from the sampling techniques described in 1? Please also describe the sensitivities associated with the methodologies identified.*
- 3 *In your opinion, what is the most appropriate sampling methodology to apply to this data?*
- 4 *Please apply the sampling methodology described in 3 to identify individual observations for further investigation.*
- 5 *Please make any other observations as you consider appropriate.*

Declaration

I have made all the enquiries 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.



John B.F. Field, PhD
5 January 2010

CURRICULUM VITAE

JOHN B.F. FIELD BSc(Hons) PhD AStat

Name: John Benjamin Francis FIELD
Born: Sydney, Australia, 17 May 1946
Nationality: Australian

Education:

1967 B.Sc.(Hons) University of Adelaide
1986 Ph.D. University of Adelaide. (Thesis title: "A statistical study of the distribution of alcohol consumption and consequent inferential problems")

Other qualifications:

1988 Management Certificate (John P Young & Associates)
1995 CSIRO Research Management Program
1999 Accredited Statistician

Scholarships:

Commonwealth University Scholarship

Current position:

Director & Principal, John Field Consulting Pty Ltd

Professional Experience:

CSIRO Mathematical and Information Sciences (formerly Division of Mathematics and Statistics, formerly Division of Mathematical Statistics)

Adelaide: Feb 1968 - Jan. 1970

Townsville: Mar. 1970 - July 1975

Statistical consultant to Davies Laboratory, a multidisciplinary laboratory working in tropical agriculture.

Officer-in-charge, 1972 - 1975

Lecturer in Biometrics, James Cook University, 1972-1973

Editor, DMS Newsletter, 1971-1975

Adelaide: Aug. 1975 – May 2001

Statistical consultant working in fields of human nutrition, environment, industrial statistics, quality improvement and performance measurement.

Officer-in-Charge, 1992 - 2001;

Project Leader – Quality Improvement, Adelaide, 1988 - 1995

Computer system manager, 1981-1989

Lecturer in Statistics 1H, University of Adelaide, 1984

Editor, DMS Newsletter, 1975-1981, 1988

John Field Consulting Pty Ltd

Director & Principal, May 2001 – present

BiometricsSA (University of Adelaide and SARDI)

Senior consultant (part-time) July 2004 – Nov 2006

University of Adelaide and Basil Hetzel Institute

Statistical consultant, Basil Hetzel Institute at The Queen Elizabeth Hospital
(part-time) Nov 2006 – present

Membership of Professional Associations:

Statistical Society of Australia Inc
American Society for Quality
Australian Society of Viticulture and Oenology

Professional Service:

Council member, Statistical Society of Australia (SA Branch)	1979-91
President, Statistical Society of Australia (SA Branch)	1990-91
Secretary, Central Council, Statistical Society of Australia	1984-91
Chairman, Industrial Statistics Section, SSA	1990-92
Presented with SSAI Service Award for "sustained and significant service to the Society over many years"	1999
SA Chapter Committee Member, Quality Society of Australasia	1991-94
CSIRO Representative, <i>Industrial competitiveness through technology and quality management</i> , Nicosia, Cyprus, organised by Commonwealth Consultative Group on Technology Management	1991
Member of Faculty Board, Faculty of Applied Science and Technology, University of S.A.	1994-96

Client list – CSIRO, 1983 –2001

ABM Plastics
AEDC
AMDEL
Australian Wine Research Institute
Australian Institute of Aboriginal Affairs
Australian Quality Council
BHP
Bond University
Coca-Cola Bottlers
Comcare
CSIRO Corporate
CSIRO Division of Human Nutrition
CSIRO Maths & Information Sciences
Domaine Chandon
Donovans Restaurant
Defence Science & Technical Organisation
ElectraNet SA
ETSA
Mouldens Solicitors
Mullins Wheels
Natural Heritage Trust
Noyce and Associates

Optima Energy
Parasport
S Smith and Sons
SA Ambulance Service
SA Independent Industry Regulator
SA Research & Development Institute
SA State Transport Department
Siromath
Sola International Research Centre
Telecom Australia
Thomson Simmons & Co
Tubemakers
University of Adelaide
Vinpac International
WA College of Advanced Education
Wesfarmers

Client list – John Field Consulting, 2001 – 2009

All Saints Wines
Antelco
Arlco Pty Ltd
Australian Domaine Wines
Australian Wine Research Institute
Biometrics SA, University of Adelaide
Bioproperties Pty Ltd
Brown Bros Milawa Vineyard
CitiPower and Powercor Australia
Claim Solutions, NZ
Crawford and Co
CSIRO
HWL Ebsworth Lawyers
Eimeria
ElectraNet SA
ETSA Utilities
Finlaysons Lawyers
Fisher Jeffries
Fosters Group
Freemans Australian
GAB Robins
Johnson, Winter and Slattery
Kellermeister Wines
Lion Nathan Wine Group
Marryatville High School
Montgomery and Co.
Murray Valley Winegrowers
National Electricity Code Administrator
National Measurement Institute
OneSteel Whyalla Steelworks
Pernod Ricard Pacific
Portavin Estate Bottlers
Provisor Pty Ltd
RAAF

G. Rudkin
Royal Australasian College of Surgeons
Rural Ambulance Victoria
SA Dept of Water, Land & Biodiversity Conservation
SA Research & Development Institute
Scorpex Wine Services
S. Smith and Sons (Yalumba Wines)
Scholefield Robinson Horticultural Services
Scholle Industries
Sinclair Knight Merz
Southcorp Wines
Tahbilk Winery
Taltarni Vineyards
Technical Assessing (SA)
Thebarton Senior College
Thomson Playford
Timbercorp Ltd
TRC Mathematical Modelling, University of Adelaide
United Energy
University of Adelaide Health Sciences
Villa Maria Winery
Vinpac International

Publications and conference papers:

- Field, J.B.F. (1968). Trend Surface Analysis. *Amdel Bulletin*
- Field, J.B.F. (1969). Certification of Algorithm 322 - F-distribution. *Comm. A.C.M.* 12, 39.
- Davis A.W. and Field J.B.F. (1971). Tables of some multivariate test criteria. DMS Technical Paper 32.
- Siebert B.D. and Field J.B.F. (1975). Reproductive activity in beef heifers following post-weaning feeding on spear grass hay alone or with supplements. *Aust. J. Exp. Agric. Anim. Husb.* 15, 12-16.
- Edye L.A., Field J.B.F. and Cameron D.F. (1975). Comparison of some *Stylosanthes* species in the dry tropics of Queensland. *Aust. J. Exp. Agric. Anim. Husb.* 15, 655-662.
- Jones R.K. and Field J.B.F. (1976). A comparison of biosuper and superphosphate on a sandy soil in the monsoonal tropics of north Queensland. *Aust. J. Exp. Agric. Anim. Husb.* 16, 99-102.
- Edye L.A., Field J.B.F., Bishop H.G., Hall R.L., Prinsen J.H. and Walker B. (1976). Comparison of some *Stylosanthes* species at three sites in central Queensland. *Aust. J. Exp. Agric. Anim. Husb.* 16, 715-722.
- Isbell R.F. and Field J.B.F. (1977). A comparison of some red and yellow earths in tropical Queensland and northeast Brazil. *Geoderma* 18, 155-175.
- McCown R.L., Murtha G.G. and Field J.B.F. (1977). Pattern of distribution of Townsville stylo, annual grasses and perennial grasses in relation to soil variation. *J. Appl. Ecol.* 14, 621-630.
- Sweetapple G.F. and Field J.B.F. (1978). Some factors causing variability in high volume sampling of air. *Proc. Int. Clean Air Confce, Brisbane*, 357-364.
- Stafford R.G., Stubbs T.J. and Field J.B.F. (1979). Prediction of noise levels from road traffic. S.A. Dept for the Environment Report 18, 1-22.
- Siebert D.J., Bochner F., Imhoff D.M., Watts S., Lloyd J.V., Field J.B.F. and Gabb B.W. (1983). Aspirin kinetics and platelet aggregation in man. *Clinical Pharmacology and Therapeutics* 33(3), 367-374.

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- Cheek, D.B., Wishart, J., Phillipou, G., Field, J. and Spargo, R. (1985). Zinc status, body composition, and maturation in aboriginal boys. pp 209-227 in: *Trace Elements in Nutrition of Children*, (ed. R.K. Chandra). New York: Raven Press.
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Sequence	Observation
1	29
2	44
3	49
4	68
5	127
6	150
7	195
8	237
9	245
10	252
11	256
12	287
13	291
14	301
15	328
16	336
17	341
18	349
19	363
20	391
21	392
22	407
23	439
24	497
25	524
26	548
27	564
28	581
29	588
30	594
31	613
32	625
33	641
34	664
35	669
36	671
37	747
38	748
39	754
40	757
41	780
42	804
43	814
44	829
45	846
46	883
47	889
48	959
49	960
50	979

51	988
52	1001
53	1005
54	1018
55	1080
56	1134
57	1185
58	1200
59	1211
60	1259
61	1296
62	1314
63	1363
64	1371
65	1406
66	1424
67	1449
68	1496
69	1506
70	1531
71	1550
72	1567
73	1583
74	1630
75	1642
76	1668
77	1671
78	1706
79	1710
80	1789
81	1809
82	1839
83	1882
84	1887
85	1889
86	1910
87	1933
88	1946
89	1950
90	1974
91	1990
92	2002
93	2043
94	2046
95	2049
96	2067
97	2081
98	2082
99	2090
100	2121
101	2130

102	2153
103	2176
104	2188
105	2234
106	2243
107	2281
108	2346
109	2366
110	2385
111	2455
112	2462
113	2471
114	2514
115	2520
116	2534
117	2575
118	2613
119	2620
120	2623
121	2629
122	2633
123	2645
124	2657
125	2661
126	2676
127	2706
128	2707
129	2711
130	2715
131	2727
132	2748
133	2811
134	2846
135	2874
136	2880
137	2885
138	2919
139	2921
140	2922
141	2927
142	2963
143	2991
144	3007
145	3017
146	3074
147	3107
148	3137
149	3181
150	3200