AusNet Gas Services Pty Ltd

Gas Access Arrangement Review 2018–2022

Appendix 9A: Historic Reports on Gamma

Submitted: 16 December 2016

Dividend drop-off estimate of theta

Final Report

Re: Application by Energex Limited (No 2) [2010] ACompT 7

21 March 2011

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Overview and executive summary

1. SFG Consulting has been engaged jointly by Energex Limited (ACN 078 849 055), Ergon Energy Corporation Limited (ACN 078 646 062) and ETSA Utilities (ABN 13 332 330 749) to undertake a dividend-drop off study, further to reasons for decision published by the Australian Competition Tribunal on 13 October 2010. The study has been performed in accordance with the Terms of Reference that are attached as Appendix 1 to this report.

2. In accordance with the directions of the Tribunal, a draft version of this report (dated 21 February 2011) was distributed to the AER and the Applicants for comment. The comments from the AER and the Applicants, and our responses to them, are attached to this report as Appendices 2 and 3, respectively. A number of the comments from the parties have led us to perform some additional analyses and to revise the report. This additional work is also noted in our responses to each comment in the appendices.

3. For the reasons set out in detail in this report, we conclude that the appropriate estimate of theta from the dividend drop-off analysis that we have performed is 0.35 and that this estimate is paired with an estimate of the value of cash dividends in the range of 0.85 to 0.90.

Construction of data set

Raw data

4. Raw data was initially compiled by taking every dividend event for every ASX-listed stock in the DatAnalysis database from 1 July 2000 to 30 September 2010. Paragraph 1 of the ToR requires data to be used up to 31 December 2009. It is our view that a larger dataset provides for more robust and statistically reliable results, so we have used the most recent data that was available at the time we commenced the study. DatAnalysis is operated by Aspect Huntley, which is a wholly-owned subsidiary of Morningstar Inc. It is commonly used as the basis for papers published in the academic and practitioner literature relating to empirical finance.[1]

5. We then removed all observations for which:

   a. Any of the required data items is unavailable; or

   b. The company in question conducted a stock split, bonus issue, or other capitalisation change within five trading days of the ex-dividend date; or

   c. The observation involved multiple dividends being paid by the same company and having the same exercise date (e.g., an ordinary and special dividend with the same ex-date). For these observations we removed the multiple observations and replaced them with a single observation that records the total dividend paid; or

   d. The stock did not trade on the cum-dividend day or the ex-dividend day; or

   e. The company in question had a market capitalisation that was less than 0.03% of the market capitalisation of the All Ordinaries index at the time of the ex-dividend date; or

   f. The security in question falls into any one of the following categories: stapled securities; shares whose primary listing is overseas; CHESS depositary interests; CHESS units of foreign securities; or exchange-traded funds.

6. For each observation, the following data items were recorded:

   a. ASX Code;

   b. Ex-dividend date;

   c. Cum dividend (closing) share price;

   d. Ex-dividend (closing) share price;

   e. Dividend amount;

   f. Franking credit amount;

[1] DatAnalysis and FinAnalysis are part of the same database package. FinAnalysis provides a graphical user interface and is useful when manually extracting data for individual companies. DatAnalysis contains all of the dividend events required for this study and is the version of the database that is more amenable to extraction of data for a large number of companies. DatAnalysis will also format the extracted data into a file ready for further processing and analysis. That is, DatAnalysis and FinAnalysis have similar coverage, but DatAnalysis provides the more convenient extraction interface for the exercise at hand.

g. Trading volume on each of the cum-dividend and ex-dividend days;

h. Return on the stock (i.e., the percentage return, measured in the standard way) on each of the cum-dividend and ex-dividend days;

i. Return on the All Ordinaries index on each of the cum-dividend and ex-dividend days;[2] and

j. The mean and standard deviation of the daily excess stock return over the year ending six business days prior to the ex-dividend day.

7. One of the scaling variables that is used in some versions of Generalised Least Squares estimation below is the daily stock return volatility of the company in question. This requires the calculation of the mean and standard deviation of daily excess stock returns over a recent historical period. We use a period of one year, ending six days prior to the ex-dividend date, so that this historical period does not overlap with the ±5 day window around the ex-dividend date. The mean excess stock return was measured over the trading days beginning one year and six days prior to the ex-dividend day and ending six days prior to the ex-dividend day. The excess stock return for each day is defined as the stock return for a particular company *i* less the return on the All Ordinaries index. Formally, the mean excess stock return for company *i* at time *t* is defined as:

$$\overline{er}_{i,t} = \frac{1}{N}\sum_{j=1}^{N} er_{i,t-5-j}$$

where

$$er_{i,t} = r_{i,t} - r_{m,t},$$

and N represents the number of trading days over the relevant year-long period.

8. Similarly, the volatility of excess stock returns was computed as the standard deviation of the excess stock return, measured over the same period. Formally, the volatility of excess stock returns for company *i* at time *t* is defined as:

$$\sigma_{i,t} = \sqrt{\frac{1}{N}\sum_{j=1}^{N}\left(er_{i,t-5-j} - \overline{er}_{i,t}\right)^2}.$$

9. The raw data, compiled as set out in Paragraphs 4 and 5 and consisting of the data items set out in Paragraphs 6-8, is contained in the **DataFinal** worksheet in the attached spreadsheet file.

Cross referencing and manual compilation of data

10. As set out in the paragraphs below, stock prices were cross-referenced between Datastream and FinAnalysis, company announcements were cross referenced between SIRCA, FinAnalysis and the ASX web site, dividend information was cross referenced between DatAnalysis and company

[2] In all cases the All Ordinaries Accumulation Index was used. For a discussion of (a) why the Accumulation Index is conceptually appropriate and the Price Index is inappropriate for the purposes of this study, and (b) why the choice of index is immaterial in practice, see Paragraph 109 below.

announcements from the ASX web site, and capitalisation changes were cross-referenced between Datastream and company announcements on FinAnalysis and the ASX web site. As explained below, in the small number of cases when there was any discrepancy, we adopted the information from the primary source – the detailed company announcement.

11. For every observation that was manually checked, we manually entered data for all relevant variables.[3] In terms of prices, we manually entered information from FinAnalysis for 1,041 observations that were checked and 801 of these observations appear in the final sample of 3,107 observations. Hence, there are manually checked price entries for 26% of the observations which appear in the final sample. Of these, there are 20 observations in which either the cum- or ex-dividend prices differ between the two data bases, with the average difference between the percentage change over the ex-dividend period being 1.2%. In these cases, we have adopted the stock price recorded in FinAnalysis.

12. We manually entered dividend information (from actual company announcements published on the ASX web site) for 866 observations, and 707 observations of these observations appear in the final sample of 3,107 observations. Hence, there are manual dividend entries for 23% of the observations that appear in the final samples. Of these 707 observations there are 40 observations for which the manual dividend entry did not match the dividend compiled from DatAnalysis. However, 38 of these differences are due to dividends denominated originally in a foreign currency. We have observed that the data in DatAnalysis was more likely to contain dividend errors when dividends were denominated in foreign currencies so we manually compiled all dividends which were originally denominated in foreign currencies, and performed manual conversion to Australian dollars using the exchange rate on the relevant date reported by the Reserve Bank of Australia. This leaves just two observations in which there is a discrepancy between the dividends in DatAnalysis and the manually-compiled dividends or 0.3% of the final sample, and we have reviewed the ASX announcements to verify that our manual compilations are correct in those instances.

13. The ex-dividend date is usually (but not always) four trading days prior to the record date for the relevant dividend. (The record date is the day the share registry determines which shareholders are to be paid the dividend.) We manually entered a value for the date four trading days prior to the record date for 849 observations, and 691 of these observations appear in the final sample of 3,107 observations. Hence, there are manual entries for this date for 22% of observations which appear in the final sample. Of these 691 observations there are 13 instances (1.9%) in which the ex-dividend date from DatAnalysis is not precisely four business days prior to the record date. We have checked these observations against the relevant company announcement and have used the ex-dividend date from the announcement.

14. In accordance with Paragraph 3(e) of the ToR, we used the relevant company annual report and/or company description on FinAnalysis to determine whether the security on which the dividend was paid falls into any one of the following categories: stapled securities; shares whose primary listing is overseas; CHESS depositary interests; CHESS units of foreign securities; or exchange-traded funds. If it did, the observation was removed from the sample.

15. In order to determine whether there was a capitalisation change, in accordance with Paragraph 3(b) of the ToR, we performed two steps:

   a. We computed the percentage change in the adjusted closing price and the unadjusted closing price from Datastream over the period beginning five trading days prior to the ex-

[3] If our manual check revealed that the observation was to be excluded from the data set (e.g., due to a capitalisation change, or the security being a stapled security) we did not record data for every field as the observation was clearly not going to be used.

dividend date and ending five trading days after the ex-dividend date. The adjusted closing price is computed after taking account of capitalisation changes. In the absence of any capitalisation changes these two percentage changes would be equal, but for rounding errors due to the fact that prices are only recorded to either two or three decimal places.

b. Where the difference in the two percentage changes in price was greater than or equal to 0.5% (our tolerance for rounding errors) this was an indication of a likely capitalisation change. We then reviewed the company announcements associated with this observation to confirm that there had in fact been a capitalisation change and ascertained the reason for any capitalisation change.[4] In addition, where we observed ASX announcements around the ex-dividend date which were indicative of a capitalisation change, even in the absence of any difference in percentage changes of adjusted and unadjusted prices, we reviewed those announcements to determine whether there has been a capitalisation change which is likely to have affected the pricing of the shares around the ex-dividend date. This would be the case, for example, where the company announces a capital raising, applicable to shareholders at the current or prior date, which the data provider has not incorporated into adjusted share prices during the time period around the ex-dividend date.

If this process confirmed that a capitalisation change had taken place within the ±5 day window, the observation was removed from the dataset.[5]

16. In accordance with Paragraphs 3(a) and (c) of the ToR, we removed all observations for which there was insufficient information. In accordance with Paragraph 3(d) of the ToR, we removed all observations for which the firm did not meet the required size threshold.

Manual checking for data errors

17. A subset of the observations that are contained in the **DataFinal** worksheet were subjected to further manual checking on an ex ante basis. The following observations were further checked:

a. All observations in the top and bottom 2.5 per cent based on dividend drop-off ratio;

b. All observations in the top and bottom 2.5 per cent based on dividend amount; and

c. All observations in the top and bottom 2.5 per cent based on grossed-up dividend yield.[6]

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[4] Capitalisation changes due to the exercise of options occur on a regular basis amongst listed companies. Changes in the number of shares on issue due to option exercise were not considered to be capitalisation changes for two reasons. First, the market will already be aware of the existence of the options and will likely have incorporated the expected capitalisation change associated with option exercise into the share price. Second, capitalisation changes of this nature typically increase the number of shares on issue by less than 1%, and also involve the payment of the exercise price, which mitigates against the dilutive impact of the option exercise.

[5] We provide more details in relation to the approach used to identify capitalisation changes in Paragraph 112 below.

[6] Due to time constraints, we began performing the checks set out in Paragraphs 3 and 4 of the ToR as soon as the preliminary data set had been compiled. That is, rather than perform the checks in Paragraphs 3 and 4 sequentially, we performed them concurrently. We first note that all of the checks set out in Paragraph 3 of the ToR were performed as required. The ToR then requires the checks in Paragraph 4 to be applied to the top and bottom 2.5% of observations by various criteria (e.g., dividend drop-off). Because the Paragraph 4 checks were performed concurrently with the Paragraph 3 checks, we could not be sure what the exact sample size would be after the Paragraph 3 checks had been completed, and consequently we could not be sure about precisely how many observations should be checked under the Paragraph 4 criteria. For this reason we checked a larger number of observations than the 2.5% criteria required. The result is that the Paragraph 3 and Paragraph 4 checks were performed in accordance with the ToR, except for the fact that the Paragraph 4 checks were applied to more than the top and bottom 2.5% of observations that the ToR requires. That is, our process of manually checking observations is more thorough than the ToR requires.

d. Other observations which empirical analysis suggested were most likely to have been affected by errors in raw data. These additional observations were manually checked in the same way that observations identified in (a) to (c) above were checked. These additional checks were performed to ensure that the influential observations were confirmed to be correct in all respects. Also, if any errors did remain in the dataset after the checks in (a) to (c) above had been performed:

  i. If those errors were material and likely to affect the estimate of theta, it is likely that they would be uncovered by the additional checks; and

  ii. If those errors were immaterial and unlikely to affect the estimate of theta, they are of little concern.

The identification of outliers and influential observations was not used as the basis for exclusion of observations, only as the basis for performing a detailed manual check to ensure the correctness of the observation.

18. The additional observations that were checked were identified as follows:

a. Observations that were among the 25 most upwardly or the 25 most downwardly influential observations identified by the stability analysis set out following Paragraph 79 below;

b. Observations that were identified as outliers as a by-product of the robust regression estimation set out following Paragraph 71 below; and

c. Observations for companies that appeared multiple times in the set of observations to be checked. For example, if several observations for a particular company appeared in one of the top and bottom 2.5% samples, or in the set of robust regression outliers, we checked the entire set of observations for that company.

19. For the most extreme observations we generally reviewed observations for the entire company because stocks with certain characteristics, namely high volatility, low-dividend stocks are most-likely to be identified as outliers. For example, Computershare appears 21 times in the dataset, it has a median dividend yield of 0.9% (compared to 2.0% for the full sample), a standard deviation of drop-off ratio of 8.3 (compared to 1.7 for the full sample) and a median standard deviation of daily returns of 2.2% (compared to 1.7% for the full sample). It is also the company associated with the minimum and maximum drop-off ratios of –25.0 and +24.5, respectively.

20. This process resulted in approximately 900 observations being manually compiled from a base of 4,064 observations.[7] In every case, the observation was checked by:

a. Locating the formal ASX announcement of the dividend and reading that announcement to confirm that the raw data contains the correct:

  i. Dividend amount;

[7] In Table 1 we state that 4,076 observations had a market capitalisation which was at least 0.03% of the market capitalisation of the All Ordinaries Index. 11 observations were removed from this set because volume on the ex-dividend day or cum-dividend day was recorded as zero. The remaining set of 4,064 observations was the set used for manual compilation, of which a further 109 observations were excluded because no trades were recorded on either of these dates. The figure of 130 (the sum of 11 and 119) appears in Table 1.

    ii. Franking percentage; and

    iii. Ex-dividend date;[8] and

b. Recording the unadjusted price and trading volume of each security (both obtained from the Datastream database) on the ex-dividend date and the two prior business days (as reported by the FinAnalysis database) and confirming that these details are consistent with the observations in the raw data.

21. The input file **review.csv** (provided with this report) contains entries for each item which was manually entered as part of this checking of observations. Where an entry appears in this input file it will either override an entry from the prior data compilation, or insert data which was missing from the prior data compilation. Specifically, the checked observations were either:

a. Confirmed to be correct and retained in the sample; or

b. Corrected and then retained in the sample.

22. Aside from this input file for observations that were checked, we made manual corrections to 18 observations relating to seven companies which had dividends incorrectly recorded in foreign currencies in the raw database. These corrections are made prior to incorporating the **review.csv** inputs and are individually identified by ASX code and ex-dividend date in the SAS program used to conduct the analysis.

Manual review for price-sensitive announcements

23. The observations that remain in the data set after performing the manual checks set out in Paragraphs 17 to 22 were then further checked in relation to price sensitive announcements. For this check we used the SIRCA company announcement file to identify observations where a market announcement is made by the company in question on either the cum-dividend or the ex-dividend day and where that announcement is flagged as a price-sensitive announcement on the ASX company announcements platform. While performing the manual checks set out above, we identified a number of announcements that were flagged as being price sensitive, but which were not included in the SIRCA company announcement file. We added these announcements to the set of announcements to be further examined. Hence, in our final dataset we have a complete set of data that lists whether the company made an announcement which the ASX has flagged as being price sensitive.

24. The full sample of observations that were identified as having ASX-flagged price sensitive announcements were then reviewed to confirm whether the announcement(s) made on the cum-dividend or the ex-dividend days would reasonably be expected to have had a material effect on the price or value of the securities concerned.

25. There are two reasons why an announcement might not have a material effect on the price or value of the securities concerned on the day that announcement was made:

[8] In some instances, the ASX announcement of the dividend does not explicitly disclose the ex-dividend date, but simply reports the record date. ASX rules provide that the ex-dividend date occurs four business days prior to the record date (see www.asx.com.au/research/dividends.htm). In instances where the ex-dividend date is not disclosed, we document the record date and the date four business days prior to the record date and confirm that these dates are consistent with the ex-dividend date in the raw data. Where inconsistencies arise between the ex-dividend date contained in the raw data and the date four days prior to the record date, we relied upon the ex-dividend date contained in the raw data as the best available evidence of the true ex-dividend date.

a. Although being flagged as price sensitive by the ASX analyst, the substance of the announcement is unlikely to have had a material effect on prices. (For example, some announcements that have been labelled as being price sensitive are simple corrections to an aspect of a previous announcement); or

b. The effect of the announcement might have already been incorporated into the stock price prior to the formal announcement being made to the ASX.

26. On the other hand, we readily observe announcements which are not flagged as price-sensitive but which, after having observed the share price change in association with that announcement, would be reasonably considered to have provided relevant information to the market. For example, on the ex-dividend date of 24 September 2010, Cabcharge Ltd announced that it had finalised proceedings in a litigation matter with the ACCC. This announcement was not labelled as price-sensitive by the ASX analyst but on that day the company's share price rose by 10.6%, while the market return was –0.5% and the dividend yield was 3.2%.

27. It should be noted that the labelling of announcements as price-sensitive or not is conducted prior to the release of that information to market participants. Hence, it simply represents the analyst's judgement as to the extent to which the announcement conveys new information to market participants, which does not necessarily coincide with the true information content of the announcement.

28. When investigating the effect that important price-sensitive announcements have on stock prices, researchers typically use a methodology known as an *event study*. When performing an event study, the researcher obtains a sample of a similar type of announcements. For example, in a review of event study research, MacKinlay (1997) provides the example of earnings announcements, where those announcements are separated into three groups:

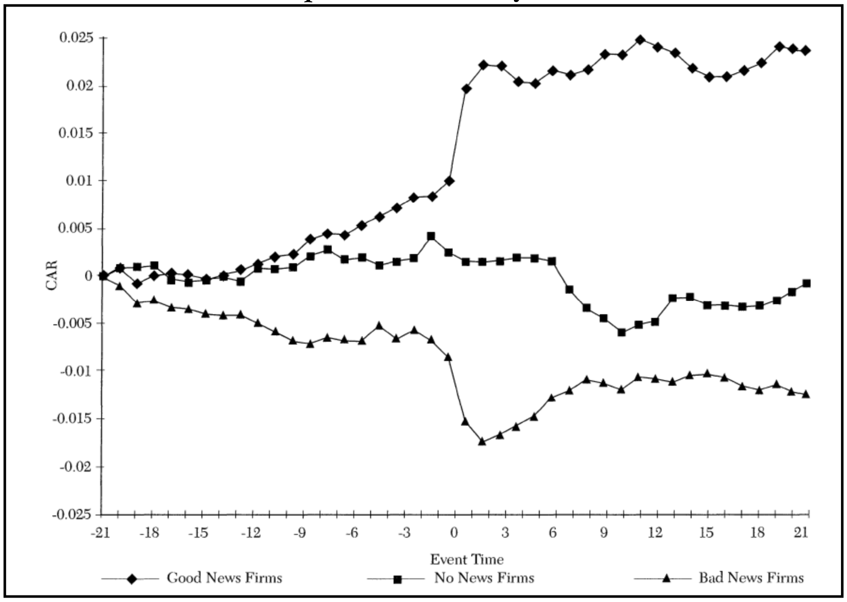
a. Positive announcements (better than forecasts);

b. Neutral announcements (in line with forecasts); and

c. Negative announcements (below forecasts).

29. The event study methodology then compares the average excess returns for each group over the period immediately before and after the announcement. Excess returns are computed as the return on each stock minus an adjustment for broad market movements, such as that set out in Paragraph 7 above. A very common result in event studies is that most of the accumulated excess return occurs *before* the formal announcement is made. This is also the case in the example of MacKinlay (1997), which is reproduced as Figure 1 below. In that figure, Day 0 is defined to be the announcement date. There is clearly a positive reaction (positive cumulative excess returns) to good news announcements and a negative reaction to bad news announcements. Much of the announcement effect occurs prior to the announcement itself and there is relatively little effect after the announcement. This is a common finding in event studies whether the announcement relates to earnings, dividends, takeovers, or other news events. Indeed, for other types of announcements there tends to be an even greater proportion of the reaction prior to the formal announcement and even less "drift" after the announcement.

Figure 1
Example of event study results



Source: MacKinlay (1997) Figure 2a, p. 25.

30. This analysis of event studies is relevant to the present drop-off study insofar as it illustrates that the stock price effect of an important corporate announcement can occur over many days and is certainly not limited to the day on which the announcement is made. Indeed, not only *can* the effect of the announcement occur over many days, on average it *does* occur over many days. Whereas the largest one-day price movement tends to occur on the day of the announcement itself, it is possible that even announcements about matters that are unambiguously price sensitive may not cause a material stock price reaction on the day of the announcement or on the day following the announcement – if the substance of the announcement is anticipated by the market. In summary, it is impossible to read the text of an announcement and to then make a conclusion, on the basis of the subject matter therein, about the extent to which that announcement will have affected the stock price on or about the announcement day.

31. What is required for the present study is the determination of whether a particular announcement would reasonably be expected to have had a material effect on the price or value of the securities concerned over the ex-dividend period. This cannot be determined by simply reading the text of the announcement because it is possible that some or most or all of any price impact may have occurred prior to the formal release of the announcement or because the subject matter was not particularly price sensitive despite the fact that it had been flagged so by the ASX analyst.

32. Rather, to determine whether a particular announcement would reasonably be expected to have had a material effect on the price or value of the securities concerned over the ex-dividend period, we begin by comparing the excess stock return on the cum- and ex-dividend days, with the excess stock return on the same stock over the previous year. The excess stock return is defined as the percentage return on a particular stock minus the percentage return on the All Ordinaries index on the same day, as set out in Paragraph 7 above. If the excess stock return on a particular day is unremarkable, relative to the excess stock return (for the same company) on other days, it is unlikely that an announcement on that particular day has had a material effect on the price of the stock on that day.

33. To formalise this process, we determined the standard deviation of excess stock returns for every observation in the manner set out in Paragraphs 7 and 8. We then identified every observation

for which the company made an announcement that was classified as being price sensitive on either the cum- or ex-dividend days. For all of these observations, we compared the excess stock return on each of the cum- and ex-dividend days with the standard deviation of excess stock returns for that observation. Specifically, for each of the cum- and –ex-dividend days, we divided the excess stock return on the relevant day by the standard deviation of the excess stock return over the previous year, as follows:

$$z_{i,t} = \frac{er_{i,t}}{\sigma_{i,t}}.$$

34. We note that under a normal distribution, approximately 95% of observations occur within two standard deviations of the mean. In this case, the mean excess stock return is set to zero on the basis that firms, on average, are not expected to systematically out- or under-perform the broad market. From this, we conclude that if the $z_{i,t}$ statistic for a particular observation has a magnitude of less than 2.0, the change in the stock price on the particular day is quite unremarkable – it is not significantly different from the amount by which the price of that stock would be expected to change on an average day.

35. Consequently, we conclude that if the $z_{i,t}$ statistic has a magnitude of less than 2.0, any announcement that may have been made on (or near) the particular day is not likely to have had a material effect on the price of the stock on the day in question. Such observations are retained in the sample. This means that observations are only omitted from the sample for reasons of price sensitive announcements if:

    a. The company in question made an announcement to the ASX on the cum- or ex-dividend day (or both) where that announcement was labelled as price sensitive; and

    b. The $z_{i,t}$ statistic on either the cum- or ex-dividend day has a magnitude greater than 2.0, indicating that the stock price on one of those days has moved more than would be expected of that stock on an average day.

36. In summary, we do not omit any observations based on our own subjective judgment. We omit observations only if:

    a. The ASX labels the relative announcement as being price sensitive; and

    b. The market moves the price of the stock significantly more than would have been expected on an average day.

37. As part of our sensitivity and robustness checks, we also perform our analyses after:

    a. having removed all observations for which there was an announcement labelled as price sensitive on either the cum- or ex-dividend day and for which the $z_{i,t}$ statistic on either the cum- or ex-dividend day has a magnitude greater than 1.0;

    b. having removed all observations for which there was an announcement labelled as price sensitive on either the cum- or ex-dividend day, regardless of the market reaction on that day;

c. having removed none of the observations for which there was an announcement labelled as price sensitive on either the cum- or ex-dividend day, regardless of the market reaction on that day; and

d. having removed all observations for which the $z_{i,t}$ statistic on either the cum- or ex-dividend day has a magnitude greater than 2.0, regardless of whether there was an announcement labelled as price-sensitive on the cum- or ex-dividend days.

Final sample

Summary of sample construction

38. In summary, we begin with the data set contained in the worksheet **Data1** and perform a number of steps to incorporate share prices, trades and the data required to exclude observations on the basis of market capitalisation, the release of price-sensitive announcements, historical volatility and particular classes of securities. We then manually compile data for approximately a quarter of the sample, which results in either verification or changes. The resulting sample of observations is the final sample, which is contained in the worksheet **DataFinal**.

39. Table 1 below summarises the compilation of the final dataset, detailing the number of observations available after each step. The final column in Table 1 documents the worksheet in the attached spreadsheet that contains each subset of the data set.

Table 1
Construction of final sample

Criteria	ToR reference	N	Worksheet[9]
Ex-dividend events available on DatAnalysis from 1 July 2000 to 30 September 2010		11,292	Data1
Missing ex-date, currency, exchange rate or where franking >100% or dividend<=0 [Note a]	3a	1,207	
		10,085	Data2
Aggregation of multiple dividends from the same firm on the same ex-date		295	
		9,790	Data3
Share price or market capitalisation data not available	3a	583	
		9,207	Data4
Market capitalisation <0.03% of All Ordinaries Index market capitalisation	3d	5,131	
		4,076	Data5
No trades recorded on either the ex-date or cum-date	3c	130	
		3,946	Data6
Stapled securities, exchange-traded funds or CDIs.	3e	735	
		3,211	Data7
Capitalisation change within 5 days of ex-date	3b	32	
		3,179	Data8
Announcement labelled as "price-sensitive" and excess return on ex- or cum-date greater than 2 standard deviations of historical excess return	5-7	71	
		3,108	Data9
Exclusion of Coal and Allied (28 February 2008) as an extreme observation		1	
		3,107	**DataFinal**

Note a: These observations are omitted because the information in relation to the dividend is incomplete or clearly erroneous.

Removal of outlier

40. The last row of Table 1 notes that we have removed one observation as an extreme outlier. Coal and Allied Limited (CNA) paid a 25 cent fully franked dividend with an ex-dividend date of 28 February 2008. On that day, the stock price increased from \$82 to \$100 per share. This produces a raw drop-off ratio of –72, which is orders of magnitude greater than all other observations. When the stock price movement is adjusted for broad market movements on the ex-dividend day (as described in Paragraph 12 of the attached Terms of Reference), the drop-off ratio becomes –78.5. As a benchmark, the average drop-off ratio in dividend drop-off studies is approximately 1.0. This observation was identified as part of the checking procedure outlined above, however it passes all criteria set out in the Terms of Reference. Nevertheless, it is our view that this observation should be removed for the following reasons:

a. The drop-off ratio is extremely large and unusual relative to other data points. Specifically, the range for all other adjusted drop-off ratios in the sample is –25.0 to +24.5 implying that the magnitude of the drop-off ratio from the next point in the sample is as large as the drop-off ratio from the minimum to the maximum of all other points;

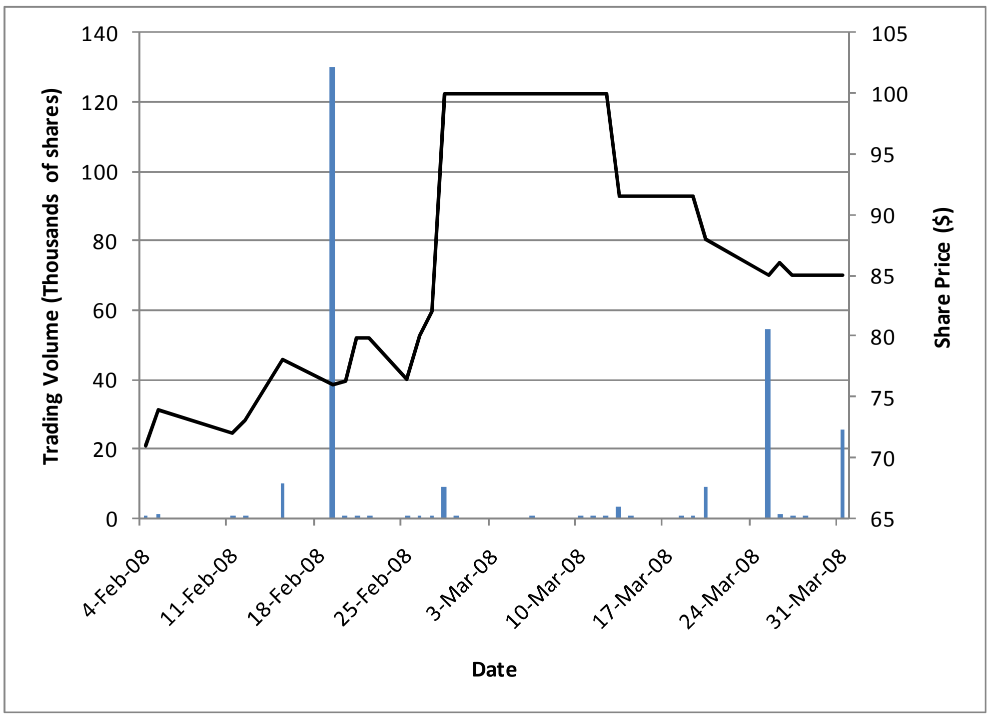
[9] All of the files referred to have been made available to the parties.

b. The trading volume in this stock is generally very small as it is largely held by Rio Tinto Ltd. and volume over the relevant period was particularly small. Just 9,000 shares were traded on the ex-dividend day, 1,000 shares were traded on the cum-dividend day and around 100 shares were traded on the prior day; and

c. The sharp increase in the stock price that occurred on the ex-dividend day (causing the large negative drop-off ratio) was maintained exactly (i.e., the stock price remained at exactly $100) for several days before returning to a lower price. This is set out in Figure 2 below.

41. If this observation is added back into the sample, the result is a lower estimate of theta. This is because there is a large negative drop-off associated with a fully-franked dividend.[10]

Figure 2
Coal and Allied (CNA) stock price and trading volume February-March 2008



Source: Commsec.

Announcements labelled as price sensitive

42. Table 2 contains more detailed information about the treatment of observations for which the company made an announcement that was labelled as being price sensitive. The majority of firms made no price sensitive announcement on either the cum- or ex-dividend days. There were 150 cases in which there was a price sensitive announcement made on the cum-dividend day but not on the ex-dividend day, another 145 cases in which there was a price-sensitive announcement made on the ex-dividend day but not the cum-dividend day and a further 37 cases in which there was an announcement labelled as price sensitive on both the cum- and ex-dividend days.

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[10] A comparison of theta estimates with and without Coal and Allied Ltd in the sample is set out in Table 12 in the Appendix below.

43. In our sample, there are 409 observations where the excess return on the stock was outside the range of ±2 standard deviations of the excess return of that stock measured over the previous year. These are observations where the price movement on the cum- or ex-dividend day is relatively large. Of these, the majority (338) were not associated with a price sensitive announcement. For only 71 observations (29 + 33 + 9) was there an announcement that was labelled as price sensitive *and* a relatively large movement in the stock price on either the cum- or ex-dates.

Table 2
Summary of observations with price sensitive announcements

	None	Cum-dividend day announcement	Ex-dividend day announcement	Both	Total
Full sample	2,846	150	145	37	3,178[11]
Excess return on ex- or cum-date greater than 2 standard deviations of historical excess return	338	29	33	9	409

Summary statistics

44. A number of summary statistics for the final sample are set out in Table 3 below. The median drop-off ratio is 1.02 for fully-franked dividends, 0.98 for partially-franked dividends and 0.87 for unfranked dividends. The median dividend yield (per dividend event, not per year) is approximately 2.0%, which matches the median stock price decline on the ex-dividend date. That is, consistent with prior studies, the stock price falls by the amount of the cash dividend on the ex-date in the typical case. The majority of observations are fully-franked dividends. The median-sized firm has a market capitalisation of $1.3 billion. For all of these summary statistics, there are a range of values across the sample. Even after the application of the various filters and manual checks, the drop-off ratio ranges from –25 to +24 and the percentage change in stock price ranges from –13% to +16%. Because of this variation, it is important that the regression diagnostics examine the extent to which a small number of the more extreme observations might influence the estimates.

[11] The figure of 3,178 corresponds to the figure of 3,179 in Table 1, minus the exclusion of the Coal and Allied outlier.

Table 3
Summary statistics for final sample

	Drop-off ratio (adjusted)	Ex-day stock return (decline, adjusted)	Dividend yield	Grossed-up dividend yield	Franking percentage	Market cap ($millions)	Volatility of excess returns (daily)	*N*
All								
Mean	0.8515	0.0198	0.0217	0.0289	77	4,764	0.0193	3107
Median	0.9848	0.0198	0.0201	0.0270	100	1,308	0.0177	
Standard deviation	1.6693	0.0233	0.0119	0.0159	39	11,629	0.0079	
Minimum	-25.0277	-0.1339	0.0006	0.0009	0	184	0.0057	
Maximum	24.4784	0.1643	0.1667	0.2074	100	137,868	0.0735	
Fully franked								
Mean	0.8594	0.0200	0.0214	0.0307	100	5,201	0.0193	2240
Median	1.0197	0.0200	0.0200	0.0287	100	1,202	0.0177	
Standard deviation	1.6561	0.0236	0.0113	0.0162	0	13,118	0.0073	
Minimum	-25.0277	-0.1125	0.0006	0.0009	100	188	0.0057	
Maximum	24.4784	0.1643	0.1369	0.2074	100	137,868	0.0725	
Partially franked								
Mean	0.9273	0.0193	0.0211	0.0255	48	5,946	0.0197	322
Median	0.9775	0.0192	0.0200	0.0241	50	3,383	0.0181	
Standard deviation	1.0542	0.0202	0.0090	0.0112	21	8,664	0.0078	
Minimum	-3.2609	-0.0527	0.0026	0.0031	3	219	0.0067	
Maximum	5.1228	0.1052	0.0551	0.0720	92	68,523	0.0533	
Unfranked								
Mean	0.7740	0.0189	0.0235	0.0235	0	2,270	0.0189	545
Median	0.8749	0.0188	0.0203	0.0203	0	1,098	0.0159	
Standard deviation	1.9889	0.0239	0.0154	0.0154	0	3,415	0.0099	
Minimum	-19.3595	-0.1339	0.0015	0.0015	0	184	0.0071	
Maximum	13.6553	0.1308	0.1667	0.1667	0	33,395	0.0735	

The drop-off ratio (adjusted) is defined as the change in stock price from the close of the cum-dividend day to the close of the ex-dividend day (divided by 1 + the market return) divided by the amount of the dividend. The percentage change in stock price (adjusted) is defined as the change in stock price from the close of the cum-dividend day to the close of the ex-dividend day (divided by 1 + the market return) divided by the stock price at the close of trading on the cum-dividend day. The dividend yield is defined as the amount of the dividend divided by the stock price at the close of trading on the cum-dividend day. The grossed-up dividend yield is defined as the dividend plus the associated franking credit dividend by the stock price at the close of trading on the cum-dividend day. The franking percentage is the proportion of the dividend that is franked. Market cap is the market capitalisation of the firm paying the dividend on the ex-dividend day. Volatility of excess returns is computed as set out in Paragraph 5. *N* represents the number of observations in each sample.

Potential data errors

45. It is important to note that even the thorough checking of data points set out above cannot guarantee that every data point in the sample is completely error-free. Every financial database contains some erroneous data points and where there is a discrepancy between two databases it is often difficult to determine which is the correct entry. In addition, in a dataset of over 3,000 observations compiled from a number of sources, plus thousands of manual entries, there will be residual errors in the data, which is a challenge confronted by every empirical study in finance. Furthermore, even if every data point was a valid observation under the criteria we have applied, that criteria provides no guarantee that the resulting data will generate a precise analysis of the issue at hand. For example, our criteria would not have excluded the observation for Coal and Allied. But the alternative to applying a set of objective criteria is to have the analysis clouded by imposing the researcher's subjective assessment of what is "correct" which impedes comparison of studies amongst researchers. For these reasons it is standard empirical procedure to:

a. Use a data set that is as large as possible so that the influence of each single data point is reduced; and

b. Identify observations most likely to generate a spurious result and analyse the impact of including or excluding these observations.

46. We follow this practice by beginning with all ex-dividend observations in the period from July 1 2000 onwards to maximise the size of the data set, by estimating different variations of the econometric model (defining the independent variable in terms of dividend drop-off and stock return, using OLS and GLS estimation), and by performing a range of sensitivity analyses and robustness checks (including robust regression estimation and stability analysis).

Econometric analysis

Econometric models to be estimated

47. In accordance with Paragraph 12 of the Terms of Reference (attached as an appendix to this report) we estimated the parameters of the following model:

$$\frac{P_{i,t-1} - P_{i,t}^{*}}{D_i} = \delta + \theta \frac{FC_i}{D_i} + \varepsilon_i \tag{1}$$

where $P_{i,t-1}$ is the cum-dividend stock price for observation i; $P_{i,t}^{*} = \frac{P_{i,t}}{1 + r_{m,t}}$ is the market-adjusted ex-dividend stock price (where $r_{m,t}$ is the return on the All Ordinaries index on day *t*); D_i is the amount of the dividend for observation i; and FC_i is the amount of franking credits associated with observation *i*.

48. The two parameters to be estimated are δ and θ where:

a. δ represents the estimated market value of cash dividends as a proportion of their face value; and

b. θ represents the estimated market value of distributed franking credits as a proportion of their face value.

49. The econometric model in Equation (1) was estimated using regression analysis applied to the final sample. It was estimated using ordinary least squares, generalised least squares and robust regression methods.

50. Generalised least squares estimation involves multiplying all terms in the original econometric model by the same variable.[12] This would be done if the researcher was concerned about a potential relationship between the variance of the residuals (ε_i) and a particular variable. Suppose, for example, that there is a potential relationship between the variance of the residuals in Equation (1) and dividend yield, $\frac{D_i}{P_{i,t-1}}$, such that the variance of residuals is inversely related to dividend yield. This would be the case if the model in Equation (1) provided a closer fit to the data and generally smaller residuals for observations with a higher dividend yield. If this were actually the case, the coefficient estimates in Equation (1) would be consistent and unbiased, but the usual procedures for conducting statistical inference (e.g., *t*-statistics) may be inaccurate.

51. Generalised least squares estimation is designed to eliminate any relationship between the variance of residuals and the variable in question. This is done by scaling every term in the original model by the variable in question. If, for example, all terms in Equation (1) are multiplied by dividend yield, $\frac{D_i}{P_{i,t-1}}$, then Equation (1) becomes:

[12] A detailed discussion of the statistical motivation for GLS estimation is set out in Paragraph 143 below.

$$\frac{P_{i,t-1}-P_{i,t}^{*}}{D_i}\times\frac{D_i}{P_{i,t-1}}=\delta\times\frac{D_i}{P_{i,t-1}}+\theta\frac{FC_i}{D_i}\times\frac{D_i}{P_{i,t-1}}+\varepsilon_i\times\frac{D_i}{P_{i,t-1}}$$

which is equivalent to:

$$\frac{P_{i,t-1}-P_{i,t}^{*}}{P_{i,t-1}}=\delta'\frac{D_i}{P_{i,t-1}}+\theta'\frac{FC_i}{P_{i,t-1}}+\varepsilon_i'. \tag{2}$$

52. The idea behind generalised least squares estimation in this example is that if the variance of the original residuals (ε_i) is inversely related to dividend yield, the scaled residuals (ε_i') are not related to the dividend yield, and standard statistical inference can be performed (i.e., the *t*-statistics will be correct).

53. Consequently, Equation (2) can be thought of as GLS estimation of Equation (1), where the scaling variable is dividend yield, or as OLS estimation of a model in which the percentage stock return is regressed on dividend yield and franking credit yield.

54. The prior literature (e.g., Michaely, 1991; Bellamy and Gray, 2004) identifies dividend yield and stock return volatility as variables that might be related to the variance of the residuals in Equation (1) and we are not aware of any dividend drop-off analysis that uses GLS scaling variables other than dividend yield and stock return volatility. It is possible that Equation (1) provides a better fit to the data for observations from low-volatility stocks. Other things equal, the magnitude of the residuals may be greater for high-volatility stocks because stock price changes tend to be greater for these stocks. In this case, the relevant GLS adjustment would be to scale by the inverse of the volatility of stock returns for the company in question. This adjustment would produce the following econometric specification:

$$\frac{P_{i,t-1}-P_{i,t}^{*}}{D_i\sigma_i}=\delta''\frac{1}{\sigma_i}+\theta''\frac{FC_i}{D_i\sigma_i}+\varepsilon_i''. \tag{3}$$

55. If both GLS adjustments are applied, the econometric specification is:

$$\frac{P_{i,t-1}-P_{i,t}^{*}}{P_{i,t-1}\sigma_i}=\delta'''\frac{D_i}{P_{i,t-1}\sigma_i}+\theta'''\frac{FC_i}{P_{i,t-1}\sigma_i}+\varepsilon_i'''. \tag{4}$$

56. In accordance with the Terms of Reference (Paragraphs 12 and 14), we estimate the four model specifications set out in Equations (1) to (4) above using OLS regression analysis, noting that the models in Equations (2) to (4) can be thought of as GLS estimates (with different scaling adjustments) of the basic model in Equation (1). In summary, we estimate each of the four models that are set out in Table 4 below. Even though we refer to the four specifications as "Models" 1 to 4 for convenience, we note that they are actually just different econometric specifications of the one model in which cash dividends and franking credits are posited as the only systematic factors in driving the ex-dividend day change in stock prices.

Table 4
Econometric models to be estimated

Model	Specification	Interpretation
Model 1	$\frac{P_{i,t-1} - P_{i,t}^*}{D_i} = \delta + \theta \frac{FC_i}{D_i} + \varepsilon_i$	Basic model.
Model 2	$\frac{P_{i,t-1} - P_{i,t}^*}{P_{i,t-1}} = \delta' \frac{D_i}{P_{i,t-1}} + \theta' \frac{FC_i}{P_{i,t-1}} + \varepsilon_i'$	GLS estimation of (1) with weighting variable dividend yield, $\frac{D_i}{P_{i,t-1}}$.
Model 3	$\frac{P_{i,t-1} - P_{i,t}^*}{D_i \sigma_i} = \delta'' \frac{1}{\sigma_i} + \theta'' \frac{FC_i}{D_i \sigma_i} + \varepsilon_i''$	GLS estimation of (1) with weighting variable inverse stock return volatility, $\frac{1}{\sigma_i}$.
Model 4	$\frac{P_{i,t-1} - P_{i,t}^*}{P_{i,t-1} \sigma_i} = \delta''' \frac{D_i}{P_{i,t-1} \sigma_i} + \theta''' \frac{FC_i}{P_{i,t-1} \sigma_i} + \varepsilon_i'''$	GLS estimation of (1) with weighting variables dividend yield, and inverse stock return volatility.

57. Another reason for using the dividend yield scaling variable is that it converts the basic Model 1 (which is in the form of dividend drop-off ratios) into Model 2 (which is in the form of ex-day stock price returns). During the process of finalising the ToR, the AER submitted that its preferred specification was in the form of ex-day stock returns, such as in Model 2. That is, the AER's preferred specification involves scaling by dividend yield. The inverse stock return volatility was also discussed as a potential GLS scaling variable at the meeting with the AER to discuss the ToR that was held in Melbourne on 18 November 2011.

58. Finally, there is also statistical support for the choice of dividend yield and stock return volatility as GLS scaling variables in the estimation results below. We show below that the potential relationship between the variance of residuals and each of the two proposed scaling variables (i.e., the relationships that have been documented in papers in the prior literature and have drawn other authors to adopt the same two GLS scaling variables) is also present in our sample.

Estimation results

59. The results of our estimations are set out in Table 5 below. The key results are:[13]

a. The point estimate of the value of a dollar of cash dividends ranges from 80 cents to 91 cents;

b. The point estimate of the value of a dollar of imputation credits ranges from 16 cents to 41 cents; and

c. The point estimate of the value of the package of a one dollar cash dividend and the associated 43 cent franking credit ranges from 87 cents to 105 cents.

60. We use two methods to estimate standard errors:

[13] Paragraph 127 below demonstrates that the results are immaterially different if the data period is restricted to 31 December 2009.

a. The White method for computing heteroscedasticity-consistent standard errors (which allows for unspecified heteroscedasticity in the residuals); and

b. A method that allows for clustering at the firm level (i.e., allows for the variance of residuals to differ by firms).[14]

61. The two methods produce standard error estimates that are similar in magnitude and generally indicate that the estimates of the value of cash dividends are significantly less than one and franking credits are significantly greater than zero. The standard errors for the estimated value of a fully-franked dividend (i.e., the package of cash dividend and the associated franking credit) are considerably lower than the standard errors for the estimated values of cash or franking credits separately, meaning there is reliable evidence that the value of one dollar of a fully-franked dividend is approximately one dollar. These three results from the regression analysis are consistent with the descriptive statistics, which showed a median drop-off ratio of 1.02 for fully-franked dividends, 0.98 for partially-franked dividends and 0.87 for unfranked dividends.

62. The R^2 statistics measure how much of the variation in the dependent variable is explained by variation in the independent variables. For Models (2) and (4), the R^2 statistics are substantial – 58% and 70% (respectively) of the variation in the ex-day percentage price change can be explained by variation in the cash dividend and franking credit.[15]

63. For Models (1) and (3), however, the explanatory power of the cash dividend is moved from the right-hand side of the regression to the left-hand side – the cash dividend appears only on the left-hand side as part of the dependent variable. For these models, the R^2 statistic must be interpreted as a measure of the extent to which the franking percentage is able to explain the ex-day price change – beyond that which can be explained by the cash dividend.

64. That is, for Models (2) and (4) the R^2 statistic measures the combined explanatory power of the cash dividend and the franking credit. For Models (1) and (3) it measures only the incremental explanatory power of the franking credits – the cash dividend is effectively given full opportunity to explain whatever it can of the ex-day price change and the R^2 statistic measures only what the franking credit can explain beyond this. Consequently, it would be wrong to compare R^2 statistics across models or to use them as a basis for selecting a preferred model.

65. To illustrate this point we ran regression Models (2) and (4) after excluding the franking credit variable (i.e., we regressed percentage change in price against dividend yield). For the OLS regression the coefficient on dividend yield was 0.9376 (clustered standard error = 0.0210) and the R^2 statistic was 57.70%. Hence, incorporating franking credits into the regression increased the R^2 statistic by 0.38%. For the GLS regression the coefficient on dividend yield was 1.0062 (clustered standard error = 0.0159) and the R^2 statistic was 70.23%. In this instance, incorporating franking credits into the regression increased the R^2 statistic by 0.26%.

[14] As mentioned previously we have reason to believe that standard errors vary systematically with firm characteristics, namely higher standard errors for volatile stocks with low dividend yields. We observe a number of firms appearing multiple times in examination of outliers. Hence, this is our preferred technique for estimating standard errors but we present White's (1984) adjusted standard errors for completeness. For a review of estimation techniques for standard errors refer to Petersen (2009).

[15] We refer to the *R*-squared statistic throughout, rather than the adjusted *R*-squared statistic, because the robust regression analysis considered later only generates an *R*-squared statistic and we want to present explanatory power on a consistent basis throughout.

Table 5
Estimation results: OLS/GLS estimation

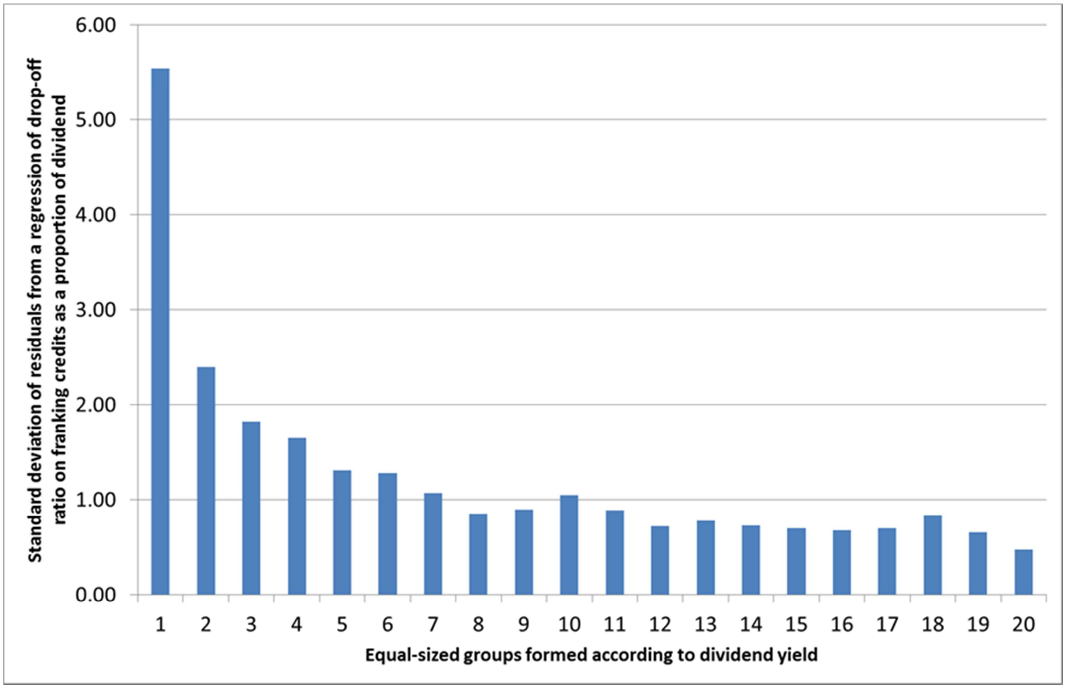
Model 1			
	Estimate	**Std Err (White)**	**Std Err (Firm clustering)**
Cash	0.7964	0.0738	0.0673
Franking credits	0.1640	0.1946	0.1808
Package	0.8667	0.0339	0.0322
R-squared	0.0003		
Adjusted R-Squared	0.0000		
N	3107		
Model 2			
	Estimate	**Std Err (White)**	**Std Err (Firm clustering)**
Cash	0.8070	0.0370	0.0333
Franking credits	0.4096	0.0970	0.0945
Package	0.9826	0.0182	0.0223
R-squared	0.5808		
Adjusted R-Squared	0.5806		
N	3107		
Model 3			
	Estimate	**Std Err (White)**	**Std Err (Firm clustering)**
Cash	0.8861	0.0373	0.0352
Franking credits	0.1936	0.1040	0.1018
Package	0.9690	0.0228	0.0232
R-squared	0.0009		
Adjusted R-Squared	0.0006		
N	3107		
Model 4			
	Estimate	**Std Err (White)**	**Std Err (Firm clustering)**
Cash	0.9129	0.0222	0.0232
Franking credits	0.3113	0.0653	0.0696
Package	1.0463	0.0161	0.0183
R-squared	0.7049		
Adjusted R-Squared	0.7047		
N	3107		

Cash represents the estimated value of a one dollar cash dividend; *Franking credits* represents the estimated value of a one dollar franking credit; *Package* represents the estimated combined value of a one dollar cash dividend plus the associated 43 cent franking credit. The *package* value is estimated as the sum of the *cash* coefficient and 0.43 times the *franking credits* coefficient. The standard error for the *package* estimate is computed as a function of the standard errors of the *cash* and *franking credits* coefficients, and the correlation between them.

GLS scaling variables

66. To assess the appropriateness of the variables that have been proposed for GLS scaling, we examine whether the residuals from Model (1) are related to dividend yield and stock return volatility. To do this, we first rank all observations in our sample by dividend yield and form 20 equal-sized groups ranging from low to high dividend yield. For each group, we compute the standard deviation of the residuals from Model (1). We then plot the relationship between the standard deviation of residuals and dividend yield in Figure 3.

Figure 3
Standard deviation of residuals and dividend yield

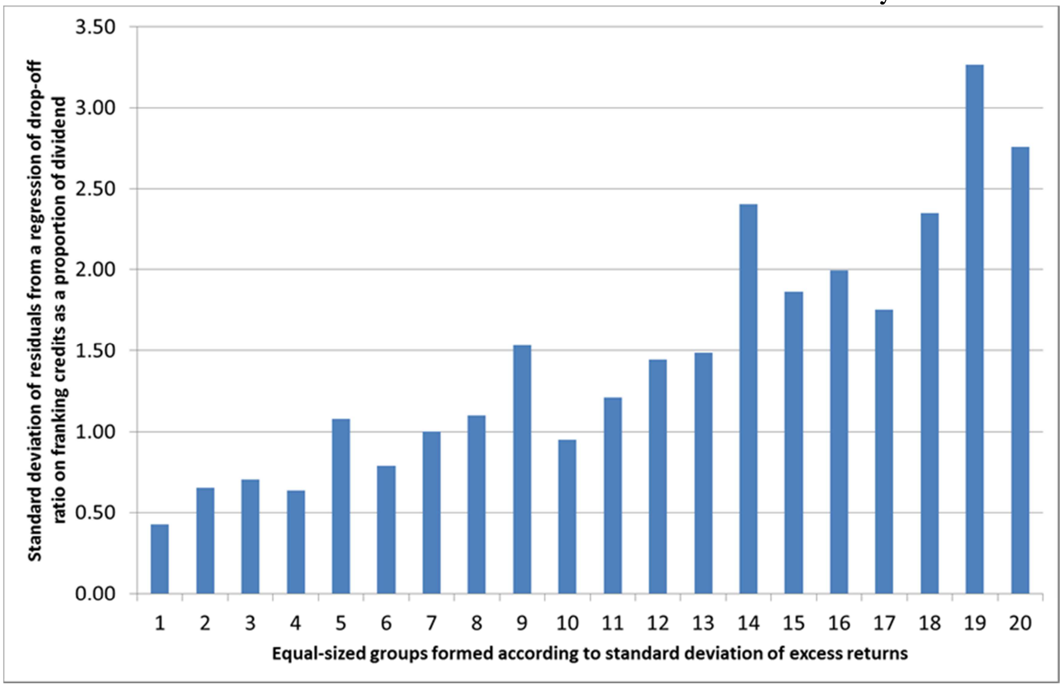


The horizontal axis sets out 20 portfolios ranked from low dividend yield to high dividend yield. The vertical axis shows the standard deviation of residuals from Model (1) for each of the 20 groups.

67. Figure 3 shows that there is a clear negative relationship between dividend yield and the standard deviation of the residuals. Observations with high dividend yields are more likely to have residuals that are relatively smaller in magnitude. This provides some justification for scaling by dividend yield as one of the GLS adjustments in Table 4.

68. We then perform a similar exercise whereby we rank all observations by the standard deviation of excess stock returns over the year prior to the ex-dividend date. Again, we form 20 equal-sized groups ranging from low to high volatility. For each group, we compute the standard deviation of the residuals from Model (1). We then plot the relationship between the standard deviation of residuals and stock return volatility in Figure 4.

Figure 4
Standard deviation of residuals and stock return volatility



The horizontal axis sets out 20 portfolios ranked from low stock return volatility to high stock return volatility. The vertical axis shows the standard deviation of residuals from Model (1) for each of the 20 groups.

69. Figure 4 shows that there is a clear positive relationship between stock return volatility and the standard deviation of the residuals. Observations from high-volatility stocks are more likely to have residuals that are relatively larger in magnitude. This provides some justification for scaling by stock return volatility as one of the GLS adjustments in Table 4.

Sensitivity analysis and robustness checks

70. In this section, we report the results of a number of sensitivity analyses and robustness checks.

Robust regression estimation

71. In accordance with the Terms of Reference (Paragraphs 12 and 14), we estimate the four models set out in Equations (1) to (4) above using robust regression analysis. Robust regression analysis uses automated statistical adjustments to down-weight the influence of extreme data points or outliers. We use the SAS procedure ROBUSTREG to implement the MM robust regression method. The MM method was developed by Yohai (1987) and accounts for imprecision in the dependent and independent variables. Of the four alternative techniques available in the ROBUSTREG procedure it provides the most comprehensive analysis of outliers.[16] The application of these methods in the SAS package is explained in detail in Chen (2002).

72. When implementing the MM robust regression method in SAS, the user is able to over-ride default values and impose values for certain parameters. For example, the INEST option allows the user to impose a prior expectation for the values of the regression coefficients, rather than using values from a first stage estimation procedure. In our implementation, we use the default (neutral) values for all options.

[16] Additional detail on the selection of the MM robust regression procedure is set out in Paragraph 121 below.

73. The results of our estimation using the ROBUSTREG-MM procedure are summarised in Table 6 below. The estimates of theta are generally very similar to those reported in Table 5 above. The only material difference between the point estimates of theta arises for Model 1. In the OLS specification, there is no down-weighting of "noisy" observations (i.e., those observations for which the "signal" from the dividend yield is low and the extraneous "noise" from volatility in the returns of the particular stock, unrelated to the dividend, is high). The robust regression procedure does down-weight those noisy observations, and that is what drives the difference between the estimates for Specification 1. For the other specifications, the GLS weighting procedure and the robust regression procedure tend to have much the same effect – both procedures tend to down-weight the noisy observations, and this leads to similar estimates across the two approaches.

74. The ROBUSTREG procedure available in SAS does not permit the calculation of White heteroscedastic-consistent standard errors or standard errors based on firm clustering. The procedure only allows for estimates of the standard covariance matrix of parameters, albeit that four different techniques are available to perform this estimation. The result is that the "regular" standard errors in Table 6 are lower than the heteroscedastic-consistent and firm clustering standard errors reported in Table 5. This should not be seen as an improvement in the precision of estimates, but rather that a different definition of standard error is being reported.

Table 6
Estimation results: Robust regression

Model 1		
	Estimate	**Std Err**
Cash	0.8593	0.0341
Franking credits	0.3392	0.0903
Package	1.0047	0.0176
R-squared	0.0028	
N	3107	
Model 2		
	Estimate	**Std Err**
Cash	0.8897	0.0255
Franking credits	0.3839	0.0688
Package	1.0542	0.0145
R-squared	0.5104	
N	3107	
Model 3		
	Estimate	**Std Err**
Cash	0.9080	0.0220
Franking credits	0.2653	0.0611
Package	1.0217	0.0137
R-squared	0.0028	
N	3107	
Model 4		
	Estimate	**Std Err**
Cash	0.9323	0.0152
Franking credits	0.3713	0.0444
Package	1.0914	0.0112
R-squared	0.6480	
N	3107	

Cash represents the estimated value of a one dollar cash dividend; *Franking credits* represents the estimated value of a one dollar franking credit; *Package* represents the estimated value of a one dollar cash dividend plus the associated 43 cent franking credit.

Screening of market sensitive announcements

75. Our approach to market sensitive announcements, set out above, is to eliminate an observation only if:

a. On either the cum- or ex-dividend day the company made an announcement that was labelled as being price sensitive; and

b. The price on either the cum- or ex-dividend day moved significantly relative to the variation in stock prices observed on average over the year prior to five days before the ex-dividend day.

76. In the analysis above, a significant stock price movement is defined in terms of the $z_{i,t}$ statistic (as defined in Paragraph 33) having a magnitude greater than 2.0. We re-estimate the results set out in Table 5 using a data set that:

a. Eliminates observations where the $z_{i,t}$ statistic has a magnitude greater than 1.0;

b. Eliminates all observations for which the firm made an announcement that was labelled as being price sensitive, regardless of the observed stock market reaction on the cum- or ex-dividend days; and

c. Eliminates none of the observations for which the firm made an announcement that was labelled as being price sensitive.

77. We report the relevant estimates of theta in Table 7 below.[17] It is clear that the estimates of theta are not sensitive to choices about whether price sensitive announcements are included or excluded from the sample.

Table 7
Sensitivity to treatment of market-sensitive announcements

	None removed	***z*>2 removed**	***z*>1 removed**	**All removed**
Number removed	0	71	177	332
OLS/GLS Theta estimates				
Model 1	0.21	0.16	0.13	0.14
Model 2	0.48	0.41	0.42	0.43
Model 3	0.24	0.19	0.17	0.16
Model 4	0.33	0.31	0.32	0.32
Robust Regression Theta estimates				
Model 1	0.36	0.34	0.34	0.32
Model 2	0.40	0.38	0.39	0.39
Model 3	0.28	0.27	0.25	0.23
Model 4	0.38	0.37	0.38	0.38

78. We also perform the regression analyses on a sample that excludes all observations for which the cum- or ex-day excess return was more than two standard deviations of historical excess returns, regardless of whether the firm made any announcement or not. This excludes those observations for which there was a significant movement in the stock price, beyond what would be expected

[17] Full information about standard errors and confidence intervals is available in the attached pdf files and the computer code can be used to reproduce these standard errors and confidence intervals.

given the dividend and movements in the broad market – even if the firm did not make an announcement that was labelled as price sensitive. We summarise the point estimates of theta from those regressions in Table 8. The OLS point estimate of theta from Model (1) is somewhat lower than the corresponding estimates in Table 7, but all other estimates are very similar and further corroborate the results presented above.

Table 8
Sensitivity to treatment of market-sensitive announcements

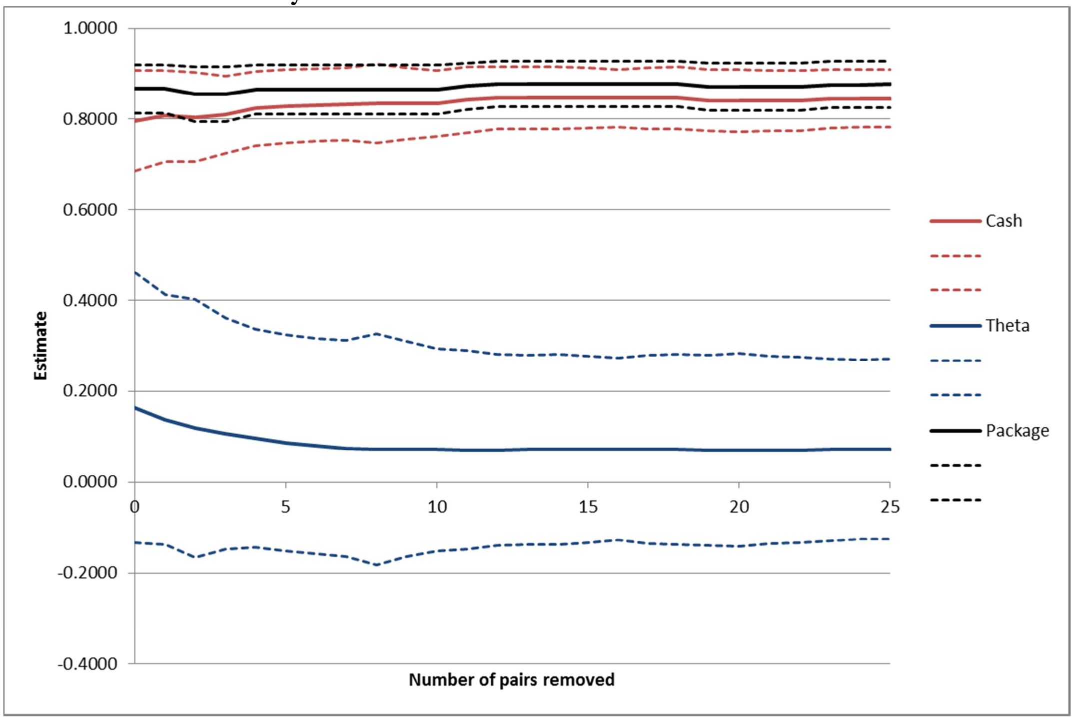
	OLS		Robust regression	
Number removed	409		409	
	Cash dividends	**Theta**	**Cash dividends**	**Theta**
Model 1	0.88	0.08	0.89	0.29
Model 2	0.85	0.38	0.91	0.35
Model 3	0.93	0.20	0.93	0.27
Model 4	0.92	0.34	0.94	0.36

Stability analysis: Robustness to influential observations

79. The ex-ante screening and checking of data required by the Terms of Reference is designed to eliminate outlier data points that are erroneous in some respect and which are likely to have had a disproportionate influence on the estimate of theta. Even after having performed this screening and checking process, it is inevitable that some of the remaining data points will be more influential than others. Consequently, we have quantified the sensitivity of our estimates of theta to influential observations by conducting a stability analysis. We do this by first determining which single observation, if removed, would result in the greatest increase in our estimate of theta. We then determine which single observation, if removed, would result in the greatest decrease in our estimate of theta. We then remove both observations and re-estimate theta. We then repeat this process by removing another pair of observations. We continue in this manner, removing pairs of observations, until 25 pairs have been removed.

80. The results of applying this process to Model 1 are summarised in Figure 5. The solid lines represent the estimates of the value of cash dividends, the value of theta, and the value of the combined package, as indicated. In each case, the corresponding dashed lines represent the 95% confidence interval around the point estimate.

Figure 5
Sensitivity to removal of influential observations: Model 1



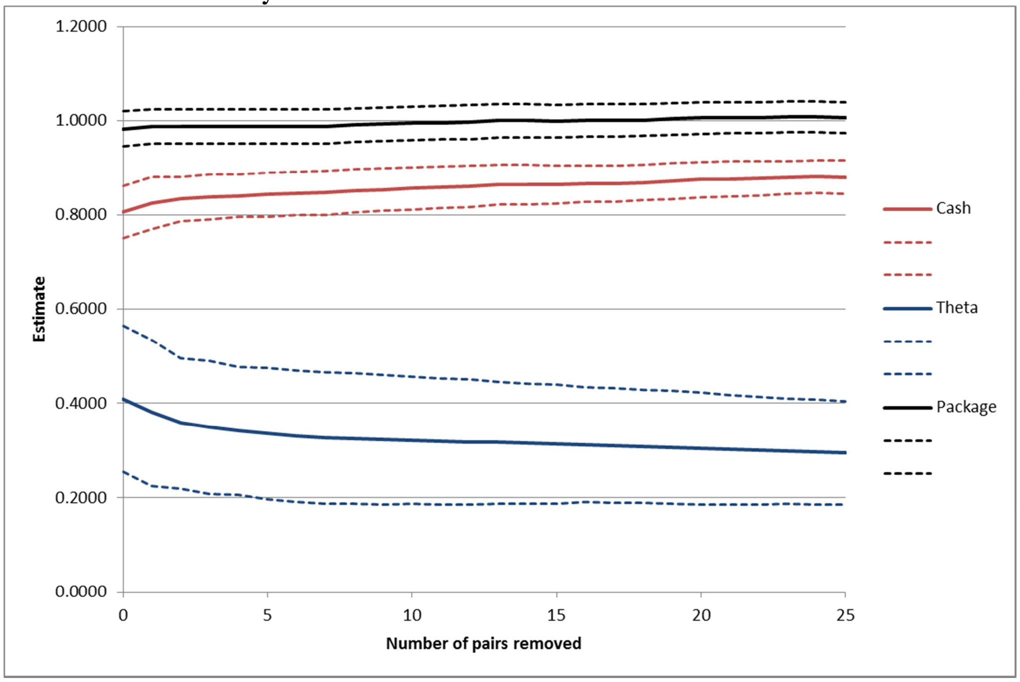
81. Figure 5 shows that the original point estimate of theta from Model 1 was 0.16. When the first pair of observations (i.e., one observation that would maximally increase the estimate of theta and one that would maximally decrease the estimate of theta) is removed, the point estimate of theta falls to 0.14. As further pairs of observations are removed, the point estimate of theta falls more marginally before levelling off at approximately 0.07.

82. The point estimates of the value of cash dividends move in the opposite direction. As pairs of influential observations are removed, the estimate increases slightly before settling at approximately 0.85.

83. The combined value of dividend plus franking credit is stable throughout, taking a constant value whether the influential observations are included or excluded.

84. The result of applying the same process of removing pairs of influential observations to Model 2 is summarised in Figure 6 below. These results are similar to those for Model 1 above. The point estimate of theta falls slightly as the first pairs of influential observations are removed before stabilising at a constant level – approximately 0.3 in this case.

Figure 6
Sensitivity to removal of influential observations: Model 2



85. The stability analysis for Models 3 and 4 are set out in Figure 7 and Figure 8 respectively.

Figure 7
Sensitivity to removal of influential observations: Model 3

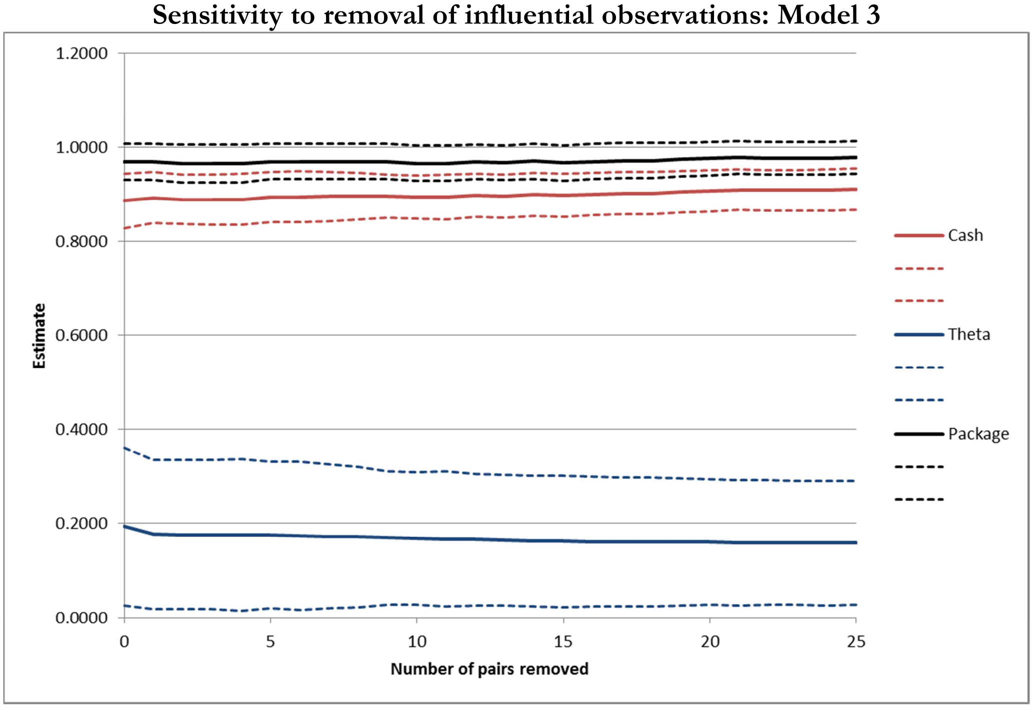
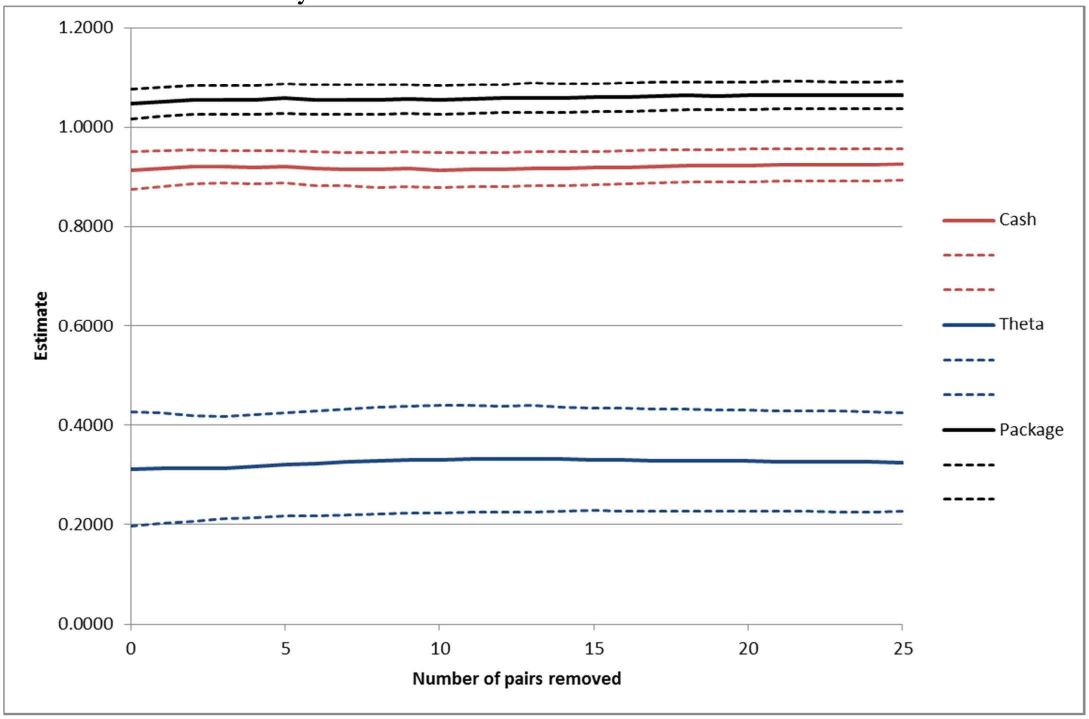


Figure 8
Sensitivity to removal of influential observations: Model 4



86. The stability analysis for Model 4, in Figure 8 above, shows that the estimates of the value of cash dividends, the value of theta, and the value of the combined package are very stable and robust to the removal of pairs of influential data points. That is, the estimates from Model Specification 4 are less sensitive to the effects of influential observations.

87. In summary, the stability analyses demonstrate that the estimates of theta are either maintained or lowered when pairs of influential observations are removed from the data set.

Additional sensitivity analyses and robustness checks suggested by the parties

88. In their comments on the draft version of this report, the parties suggested a number of additional robustness checks. We have performed all of these checks, and set out the results in the item-by-item responses to the parties' comments in the appendices below. The main additional checks that we perform are:

a. We re-estimate the models with and without five observations that involve cash distributions that are deemed to be "return of capital" (see Table 9 below);

b. We re-estimate the models using different robust regression techniques (see Table 10 below);

c. We re-estimate the models using a sample period that ends on 31 December 2009 (see Table 11 below); and

d. We re-estimate the models with and without the CNA outlier observation (see Table 12 below).

89. None of these additional tests produces a set of estimates that is materially different from those reported above.

Conclusions and recommendations

90. Our conclusion is that the appropriate estimate of theta from the dividend drop-off analysis that we have performed is 0.35 and that this estimate is paired with an estimate of the value of cash dividends in the range of 0.85 to 0.90. The reasons for this conclusion are set out in the remainder of this section of the report.

Elimination of factors that have an immaterial effect on estimates

91. The first step in forming a conclusion is to eliminate factors that have an immaterial effect on the final estimates. In this report we prepare a range of estimates that vary across a number of dimensions. The sensitivity and robustness analyses that we have conducted lead us to conclude that the results are insensitive to a number of factors:

a. The results are insensitive to whether the sample period ends on 31 December 2009 or 30 September 2010. Restricting the sample period to 31 December 2009 generally results in slightly lower estimates of theta, but none of the differences are statistically significant;

b. The results are insensitive to the treatment of price sensitive announcements. Whether these observations are included, excluded, mostly included or mostly excluded, the estimates of theta are immaterially different;

c. The results are insensitive to which of the four robust regression techniques are used;

d. The results are insensitive to whether the CNA outlier is included or excluded. To the extent that adding back the CNA outlier does result in different estimates, it generally results in a decrease in the estimate of theta; and

e. The results are insensitive to whether the five observations that involve cash distributions that are deemed to be "return of capital" are included or excluded.

Greater weight assigned to more precise and more stable estimates

92. The estimates from some model specifications and some estimation techniques are more stable than for others. For example, the estimates of theta for Model Specification 1 vary more across estimation techniques and have larger standard errors than is the case for Model Specification 4. The robust regression estimates of theta vary less across model specifications than do the OLS estimates. In this regard, we note that the GLS weighting procedure in Model 4 and the robust regression procedure both tend to down-weight the observations that are most affected by noise – observations for which the dividend yield is low and stock return volatility is high. It is precisely these observations for which the effect of the dividend is most likely to be "lost" among large changes in the stock price caused by exogenous factors. Applying a lower weighting to these observations results in more stable and reliable results in our data set.

93. In determining a final recommended point estimate, we assign more weight to the results of estimates of Model Specification 4 and to the results of robust regression estimation. This is because those results are the most stable and consistent across the range of sensitivity analysis and robustness checks that we have performed. In this regard, we note that:

a. The average of the robust regression estimates of theta in Table 6 is 0.34; and

b. The average of the estimates of theta from Model Specification 4 across Tables 5 to 8 is 0.35.

Results to be considered in total

94. In our view, the most appropriate estimate must be consistent with (or corroborated by) the different versions of the estimation that have been performed. Even though it is appropriate to afford some model specifications and some estimation techniques greater weight than others, an estimate that is consistent with a whole range of different specifications and different estimation techniques is more robust and reliable.

95. That is, we do not recommend the adoption of a single estimate that is based on a single specific choice of:

a. Model specification;

b. Estimation technique;

c. Sample period;

d. Treatment of corporate announcements; and

e. Treatment of outliers,

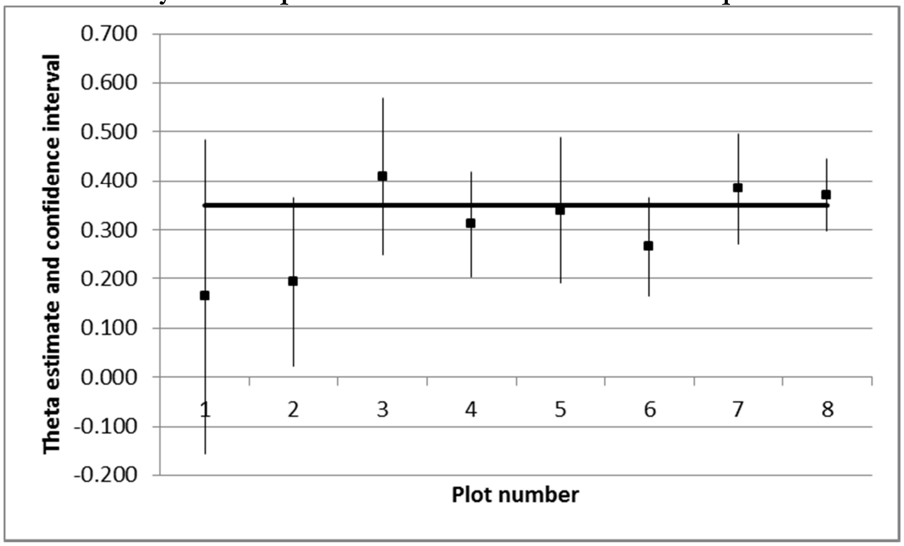
but rather examine whether the proposed estimate is consistent with a whole range of different estimations.

0.35 is consistent with results from different model specifications and estimation techniques

96. We note that 0.35 lies within the standard statistical 95% confidence interval for all the estimations we have performed. We illustrate this in Figure 9 to Figure 12 below. Each of those figures plots the point estimates and 95% confidence intervals for a range of estimations, and demonstrates that the proposed estimate of 0.35 is within the confidence interval for every estimation.

97. Figure 9 plots estimates for Model Specifications 1-4 estimated by OLS/GLS (Plots 1-4 in the figure) and then the corresponding robust regression estimates (Plots 5-8 in the figure). For none of these estimations can the proposed estimate of 0.35 be statistically rejected.

Figure 9
Summary of point estimates and confidence intervals for theta by model specification and estimation technique



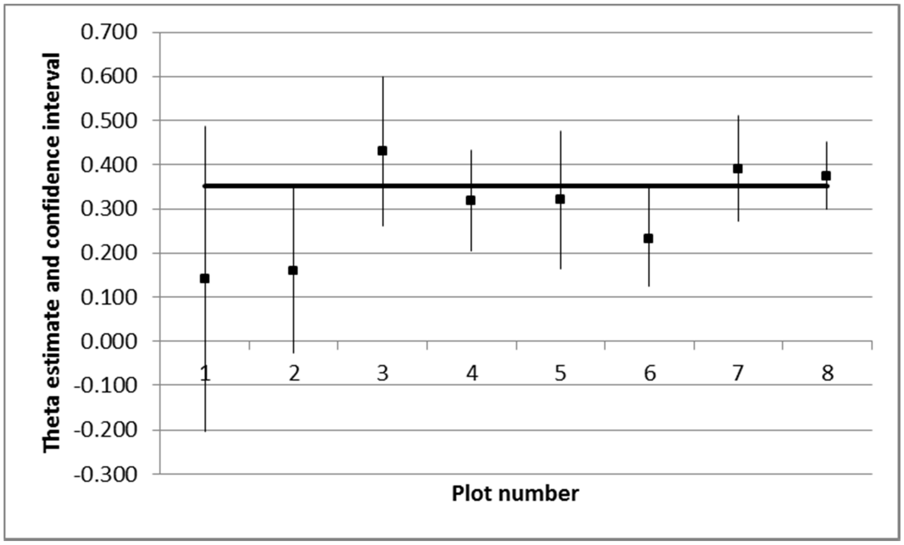
For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35. For all models, the announcement threshold is set to two standard deviations.

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

0.35 is consistent with results from different treatment of market sensitive announcements

98. Figure 10 is structured in the same way as Figure 9, but displays estimates for the case where *all* observations involving a market sensitive announcement are removed. Again, for none of these estimations can the proposed estimate of 0.35 be statistically rejected.

Figure 10
Summary of point estimates and confidence intervals for theta with removal of market sensitive announcements

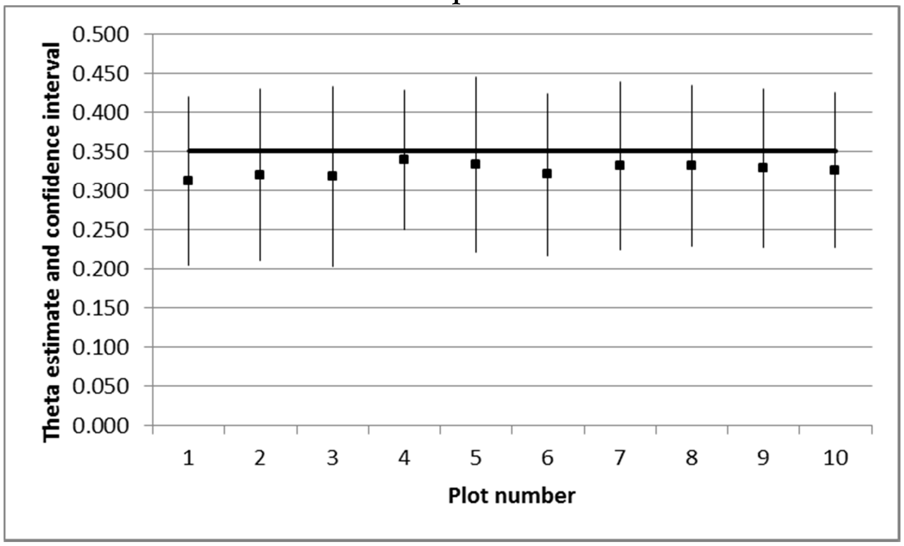


For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35. For all models, all observations for which the firm made a "market sensitive" announcement are removed.
Plot 1: Model specification 1, OLS estimation; Plot 2: Model specification 2, OLS estimation;
Plot 3: Model specification 3, OLS estimation; Plot 4: Model specification 4, OLS estimation;
Plot 5: Model specification 1, RR estimation; Plot 6: Model specification 2, RR estimation;
Plot 7: Model specification 3, RR estimation; Plot 8: Model specification 4, RR estimation.

0.35 is consistent with all of the results from Model Specification 4, which is given relatively higher weight

99. Figure 11 plots a range of estimates for Model Specification 4. Plots 1-5 in the figure vary the treatment of market sensitive announcements, and Plots 6-10 vary the treatment of influential observations. This figure shows that the estimates from Model Specification 4 are highly consistent and have relatively narrow confidence intervals. That is, these estimates are stable and precise. The figure also shows that the estimate of 0.35 is close to (within 0.05) of the point estimates from all of these estimations.

Figure 11
Summary of point estimates and confidence intervals for theta from Model Specification 4



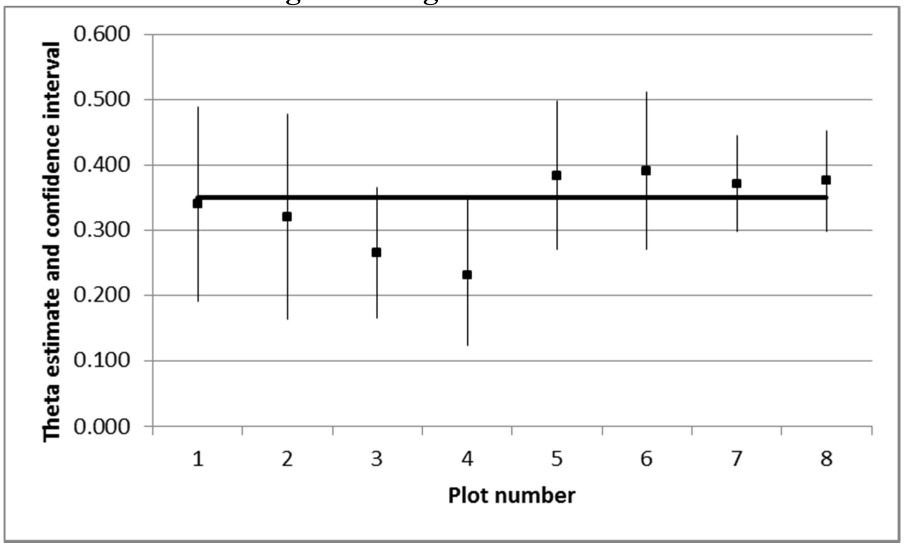
For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35. All estimates relate to Model Specification 4.

Plot 1: OLS estimation, announcement threshold=2; Plot 2: OLS estimation, announcement threshold=1; Plot 3: OLS estimation, all announcements removed; Plot 4: OLS estimation all returns>2 std dev removed; Plot 5: OLS estimation, no announcements removed; Plot 6: Same as Plot 1, with 5 influential pairs removed; Plot 7: Same as Plot 1, with 10 influential pairs removed; Plot 8: Same as Plot 1, with 15 influential pairs removed; Plot 9: Same as Plot 1, with 20 influential pairs removed; Plot 10: Same as Plot 1, with 25 influential pairs removed.

0.35 is consistent with all of the robust regression results, which are given relatively higher weight

100. Figure 12 plots a range of robust regression estimates. These are all estimates using the MM robust regression technique, but applied to the four model specifications and across different treatments of market sensitive announcements. The odd numbered plots are for Model Specifications 1-4 where market sensitive announcement observations are only removed if the cum- or ex-dividend day excess return was greater than two standard deviations of historical excess returns, and the even numbered plots show the corresponding results when all market sensitive observations are removed. This figure shows that the robust regression estimates are relatively consistent and have relatively narrow confidence intervals. The figure also shows that the estimate of 0.35 is slightly above four of the point estimates and very slightly below the other four point estimates.

Figure 12
Summary of point estimates and confidence intervals for theta using robust regression estimation



For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35. All estimates are computed using robust regression.

Plot 1: Model 1, announcement threshold=2; Plot 2: Model 1, all announcements removed;
Plot 3: Model 2, announcement threshold=2; Plot 4: Model 2, all announcements removed;
Plot 5: Model 3, announcement threshold=2; Plot 6: Model 3, all announcements removed;
Plot 7: Model 4, announcement threshold=2; Plot 8: Model 4, all announcements removed.

Final conclusion

101. In our view, considering all of the evidence set out above, an appropriate point estimate for theta based on dividend drop-off analysis is 0.35.

102. Finally, it is important to note that dividend drop-off analysis produces estimates of two parameters: theta and the value of cash dividends. That is, the estimates from drop-off analysis come in pairs. The point estimate of 0.35 for theta is not independent of the estimated value of cash dividends. Rather the estimate of 0.35 for theta corresponds with an estimate in the range of 0.85 to 0.90 for the value of cash dividends.

Response to AER comments on Draft Report

103. *AER Issue 1: The correct references should be paragraphs 5 and 6 respectively.*

Corrected in Final Report.

104. *AER Issue 2a: Data should be sourced from the databases specified in the ToR and cross-referenced and reconciled as required by the ToR.*

Paragraph 3 of the Draft Report notes that:

> DatAnalysis is operated by Aspect Huntley, which is a wholly-owned subsidiary of Morningstar Inc. It is commonly used as the basis for papers published in the academic and practitioner literature relating to empirical finance.

DatAnalysis and FinAnalysis are part of the same database package. FinAnalysis provides a graphical user interface and is useful when manually extracting data for individual companies. DatAnalysis contains all of the dividend events required for this study and is the version of the database that is more amenable to extraction of data for a large number of companies. DatAnalysis will also format the extracted data into a file ready for further processing and analysis. That is, DatAnalysis and FinAnalysis have similar coverage, but DatAnalysis provides the more convenient extraction interface for the exercise at hand.

Data was sourced from the Datastream, SIRCA, and DatAnalysis databases, in accordance with Paragraph 1 of the ToR (noting that the ToR refers to *Fin*Analysis whereas we have used the *Dat*Analysis data extraction tool). Datastream was used as our primary source of stock prices and stock and market return data, SIRCA was used as our primary source of company announcement data, and DatAnalysis was used as our primary source of dividend information.

105. As set out in the paragraphs below, stock prices were cross-referenced between Datastream and FinAnalysis, company announcements were cross referenced between SIRCA, FinAnalysis and the ASX web site, dividend information was cross referenced between DatAnalysis and company announcements from the ASX web site, and capitalisation changes were cross-referenced between Datastream and company announcements on FinAnalysis and the ASX web site. As explained below, in the small number of cases when there was any discrepancy, we adopted the information from the primary source – the detailed company announcement.

106. For every observation that was manually checked, we manually entered data for all relevant variables.[18] In terms of prices, we manually entered information from FinAnalysis for 1,041 observations that were checked and 801 of these observations appear in the final sample of 3,107 observations. Hence, there are manually checked price entries for 26% of the observations which appear in the final sample. Of these, there are 20 observations in which either the cum- or ex-dividend prices differ between the two data bases, with the average difference between the percentage change over the ex-dividend period being 1.2%. In these cases, we have adopted the stock price recorded in FinAnalysis.

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[18] If our manual check revealed that the observation was to be excluded from the data set (e.g., due to a capitalisation change, or the security being a stapled security) we did not record data for every field as the observation was clearly not going to be used.

107. We manually entered dividend information (from actual company announcements published on the ASX web site) for 866 observations, and 707 observations of these observations appear in the final sample of 3,107 observations. Hence, there are manual dividend entries for 23% of the observations that appear in the final samples. Of these 707 observations there are 40 observations for which the manual dividend entry did not match the dividend compiled from DatAnalysis. However, 38 of these differences are due to dividends denominated originally in a foreign currency. We have observed that the data in DatAnalysis was more likely to contain dividend errors when dividends were denominated in foreign currencies so we manually compiled all dividends which were originally denominated in foreign currencies, and performed manual conversion to Australian dollars using the exchange rate on the relevant date reported by the Reserve Bank of Australia. This leaves just two observations in which there is a discrepancy between the dividends in DatAnalysis and the manually-compiled dividends or 0.3% of the final sample, and we have reviewed the ASX announcements to verify that our manual compilations are correct in those instances.

108. The ex-dividend date is usually (but not always) four trading days prior to the record date for the relevant dividend. (The record date is the day the share registry determines which shareholders are to be paid the dividend.) We manually entered a value for the date four trading days prior to the record date for 849 observations, and 691 of these observations appear in the final sample of 3,107 observations. Hence, there are manual entries for this date for 22% of observations which appear in the final sample. Of these 691 observations there are 13 instances (1.9%) in which the ex-dividend date from DatAnalysis is not precisely four business days prior to the record date. We have checked these observations against the relevant company announcement and have used the ex-dividend date from the announcement.

This information appears in the Final Report at Paragraphs 10 to 14.

The parties have been provided with all manually compiled information in the file **review.csv** which has been updated for the final report. We re-iterate that no researcher in empirical finance can attest that every data item from tens of thousands is free from error. What researchers can do is implement procedures designed to minimise the chance that data errors generate a spurious result, namely the review of extreme data points for compilation errors, and presentation of the relative impact of including or excluding potentially contaminating observations. We have not been provided with information from the parties to suggest that any particular data point is in error, or that our review procedures are likely to have resulted in a dataset which over- or under-states the value of imputation credits.

109. *AER Issue 2b: The All Ordinaries Index price index should be used, in accordance with the ToR.*

The difference between the All Ordinaries Price Index and the All Ordinaries Accumulation Index is that the Accumulation Index includes the returns that come from dividends whereas the Price Index does not.

The index is primarily used in the study to adjust the ex-day price for the effects of market movements. For example, if the market return over the ex-dividend day (as measured by the percentage change in the market index) is +1%, the study effectively assumes that the price of the stock whose dividend is being examined would have risen by 1% in the absence of the dividend. If the price of that stock then falls by 1.5% on the ex-dividend day, the study would conclude that a fall of 2.5% can be attributed to the dividend (there would have a been a 1% rise without the dividend, but there turned out to be a 1.5% fall with the dividend).

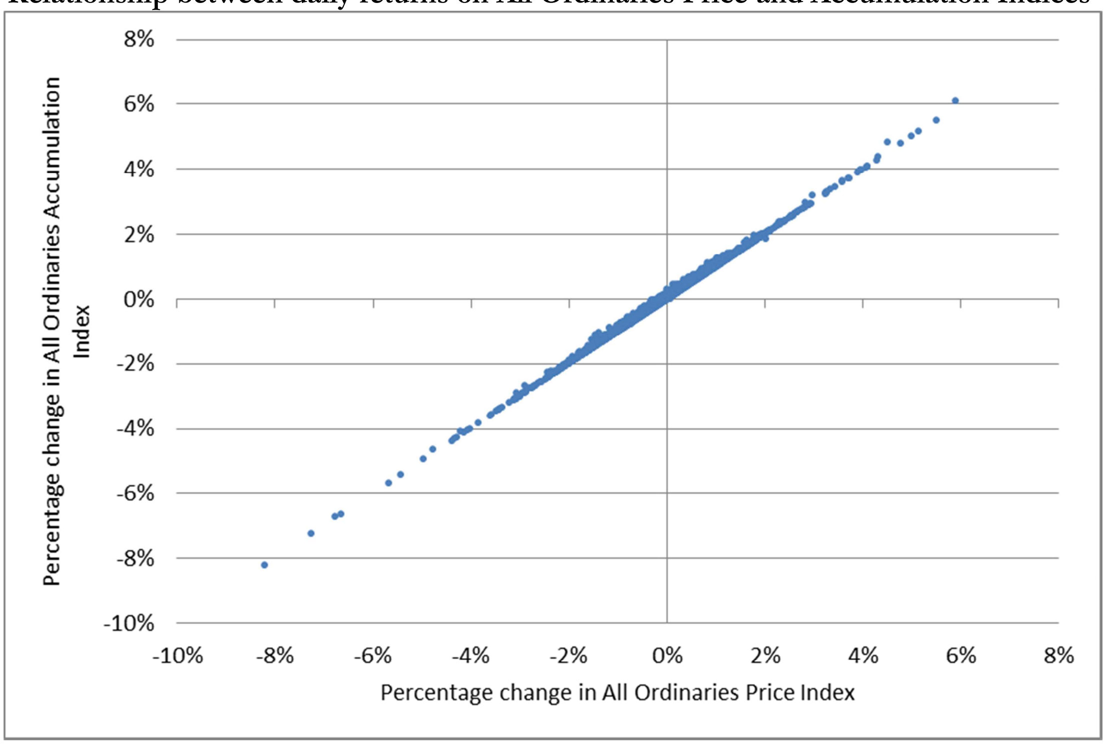
Conceptually, it is the Accumulation Index, as used in the study, that should be used to adjust ex-day stock returns. To see this, consider a conceptual example in which every company in the market pays a 2% dividend on a particular day that is completely neutral from a news perspective (i.e., there is no news either good or bad so the market is perfectly flat that day). Also suppose that the payment of the 2% dividend on a flat day results in the stock prices of every company falling by 2%. That is, but for the dividend there is no change to stock prices as there is no news to move them, so the prices simply fall to reflect the separation of the dividend from the shares. In this case the return on the Price Index would be -2% and the return on the Accumulation Index would be 0% (as the dividends are added back when calculating the Accumulation Index).

Now consider a particular observation in the study. This company, like all of the others in the market in this example, pays a dividend of 2% and the stock price falls by 2%. If the Accumulation Index is used in the market adjustment step, we would say that but for the dividend a return of 0% would have been expected – so when we see a 2% decline in the share price we attribute all of that to the dividend, which is clearly correct.

By contrast, if the Price Index is used in the market adjustment step, we would say that but for the dividend a return of -2% would have been expected – so when we see a 2% decline in the share price we would conclude that the dividend had no effect on this stock, which is clearly incorrect.

Conceptually, the Accumulation Index should be used for the purposes of the study and that is what has been used. In practice, however, it makes no material difference. This is because ex-dividend dates are spread throughout the year so that on any given day a relatively small number of companies have an ex-dividend event. Consequently, the daily returns on the Price Index and the Accumulation Index are virtually identical, as illustrated in Figure 13 below.

Figure 13
Relationship between daily returns on All Ordinaries Price and Accumulation Indices



Source: Datastream, using data from June 1992, the period for which both indices are available.

We have added Footnote 2 to the Final Report in relation to the choice of which All Ordinaries Index should be used.

110. *AER Issue 3a: SFG should confirm that the sample includes all companies and trusts listed on the ASX that have distributed cash dividends over the specified time period.*

From DatAnalysis we extracted dividend information for all companies and trusts that have distributed cash dividends over the specified time period.

111. *AER Issue 3b: Capital distribution events should be removed from the sample. Furthermore, SFG should remove any cash dividend event if the security in question has a capital distribution within five trading days of the ex-dividend day, as per paragraph 3(b) of the ToR.*

This comment appears to confuse the concepts of a capital distribution and a capitalisation change. Paragraph 3(b) of the ToR refers to capitalisation changes. For example, if a firm conducts a 2:1 stock split, its equity capital base may change from having 1 billion shares at a price of $20 each to 2 billion shares at a price of $10 each. If such a capitalisation change occurred on the ex-dividend day, it could clearly distort the drop-off analysis as the effect of the potentially very large stock price change would be attributed to the dividend. Consequently, our data set has removed all observations for which there was a capitalisation change on the ex-date or within five days of the ex-date (to guard against any possibility that the effects of the capitalisation change on the stock price could spill over to nearby days).

By contrast, a capital distribution is not a capitalisation change, but is rather the payment of a cash distribution that is defined to be a "return of capital" rather than a "dividend." In both cases, the company makes a payment of cash to the equity holder. The reason that some dividends, and some parts of some dividends, are defined to be a return of capital rather than an ordinary dividend can generally be tied to the legal structure of the particular entity making the distribution. For example, corporate dividends can be paid to shareholders out of profits generated in the current financial year and out of retained profits generated in earlier years. For a trust structure, however, a "dividend" can only be paid out of current year trust income. Any distribution of non-assessable income, such as a distribution of free cash flow in excess of accounting profit in the particular year (e.g., out of retained profits) is treated as a return of capital under CGT event E4.[19]

The key point here is that whether part of the cash distribution is formally defined to be a "dividend" paid out of retained profits or a "return of capital" paid out of retained profits, if it is a cash distribution in either case it should be retained in the sample. This is for the same reason that dividends should be retained in our sample whether they are defined to be "interim," or "final," or "special." In all cases, a cash payment is made from the company to the equity holder.

Our initial data set contained 115 observations that were classified as a "Capital Return" in DatAnalysis. All but five of these observations were filtered out of the data set in accordance with the checks performed under the ToR (many of these observations were for stapled securities). We have re-estimated coefficients where the remaining capital returns are excluded from the data set and we report the results in Table 9 below. We conclude that there is no valid reason to exclude the five capital return observations from the analysis, and that even if those observations were excluded our conclusions would not change.

[19] Income Tax Assessment Act 1997 (Cth), s 104-70(1).

Table 9
Estimates including and excluding five "return of capital" observations

Estimation method	**OLS/GLS**		**Robust regression**	
Return of capital	**Included**	**Excluded**	**Included**	**Excluded**
Model 1				
Cash dividend	0.80	0.80	0.86	0.86
Franking credit	0.16	0.17	0.34	0.34
Model 2				
Cash dividend	0.81	0.81	0.89	0.89
Franking credit	0.41	0.41	0.38	0.39
Model 3				
Cash dividend	0.89	0.89	0.91	0.91
Franking credit	0.19	0.19	0.27	0.27
Model 4				
Cash dividend	0.91	0.91	0.93	0.93
Franking credit	0.31	0.31	0.37	0.37

112. *AER Issue 4a: Secondary data filters should be applied in accordance with the ToR.*

Paragraph 3b of the ToR requires that an observation must be eliminated from the sample if:

> The company in question conducted a stock split, bonus issue, or other capitalisation change within five trading days of the ex-dividend date.

Our method for determining whether the company in question conducted a stock split, bonus issue, or other capitalisation change is set out in Paragraph 11 of the Draft Report. This approach is to first identify any observation for which there *may* have been a capitalisation change by comparing the "adjusted" and "unadjusted" prices in the Datastream database, where the adjusted prices take account of any changes in the number of outstanding shares and the unadjusted prices do not. A difference between these two figures does not necessarily indicate that a capitalisation change has occurred. For example, the number of outstanding shares may have increased slightly due to the exercise of a small number of executive stock options. That is, a difference between the two price series only indicates that a capitalisation change *may* have occurred.

If this check revealed that there may have been a capitalisation change, we manually checked the relevant company announcements to determine definitively whether a capitalisation change had been made, and if so, what the terms of that change were.

In our view, this is the most thorough and accurate method of implementing the requirement of Paragraph 3b in the ToR.

We have included Footnote 5 in the Final Report in relation to this issue.

113. *AER Issue 4b: The code should be corrected to account for public holidays.*

The computer code for our Draft Report removed all observations for which there was a capitalisation change within five week days (Monday to Friday) of the ex-dividend date. We have revised to code to account for public holidays so that the window becomes five trading days rather than five week days. This resulted in no change to the sample as there were no observations for which there was a capitalisation change in the marginal day or two that was added due to the consideration of public holidays in the ±5 day window.

In our computation of the standard deviation of historical excess returns we also adjusted our computations to exclude public holidays. This made no material difference to these standard deviation estimates, as it simply removes a small number of zero return observations from approximately 240 – 250 trading days in the year

114. *AER Issue 4c: Query whether SFG intended to refer to the (trading) day prior to the cum-dividend day. The exclusion of dividend events without a trade on the day prior to the cum-dividend day is not consistent with the ToR. As SFG's method for reviewing ASX-flagged price sensitive observations is also inconsistent with the ToR, the AER does not accept that stocks that do not trade on the day prior to the cum-date should be excluded.*

The reference to "the day before the ex-dividend day" should have been a reference to "the day before the cum-dividend day." This reference has now been removed as we no longer exclude any observations on the basis of non-trading prior to the cum-dividend day.

A total of 20 observations were eliminated from the sample on the basis that they had no trade on the day before the cum-dividend day and eleven of those observations were eliminated due to the stapled security filter or the capitalisation change filter. We have added the remaining observations back into the sample for all estimates that appear in the Final Report. The inclusion of these additional observations has no material effect on the estimates of theta.

For the purposes of Table 7 in the Final Report, the observations for which there is no trade on the day prior to the cum-dividend day are treated as not having a return on the cum-dividend day that is materially different from the average daily return on the particular stock over the previous year.

115. *AER Issue 5a: The selection of observations for further manual checking should occur after the application of secondary filters, in accordance with the ToR.*

The manual checking of an observation in the data set is a labour-intensive task that takes a significant amount of time. Because we had a limited amount of time available, we began performing the checks set out in Paragraphs 3 and 4 of the ToR as soon as the preliminary data set had been compiled. That is, rather than perform the checks in Paragraphs 3 and 4 sequentially, we performed them concurrently.

We first note that all of the checks set out in Paragraph 3 of the ToR were performed as required. The ToR then requires the checks in Paragraph 4 to be applied to the top and bottom 2.5% of observations by various criteria (e.g., dividend drop-off). Because the Paragraph 4 checks were performed concurrently with the Paragraph 3 checks, we could not be sure what the exact sample size would be after the Paragraph 3 checks had been completed, and consequently we could not be sure about precisely how many observations should be checked under the Paragraph 4 criteria. For this reason we checked a larger number of observations than the 2.5% criteria required.

The result is that the Paragraph 3 and Paragraph 4 checks were performed in accordance with the ToR, except for the fact that the Paragraph 4 checks were applied to more than the top and bottom 2.5% of observations that the ToR requires. That is, our process of manually checking observations is more thorough than the ToR requires.

We have included Footnote 6 in the Final Report in relation to this issue.

116. *AER Issue 5b: This step does not accord with the ToR. The AER also notes that the criteria applied by SFG are unspecified or unclear. Furthermore, it is not clear from the SFG data files which observations have been identified on this basis.*

In addition to the manual checking required by Paragraphs 3 and 4 of the ToR, we also performed the same manual checks on observations that were identified as being influential or outliers. These additional observations were manually checked in the same way that observations identified in accordance with Paragraphs 3 and 4 of the ToR were checked. These additional checks were performed to ensure that the influential observations were confirmed to be correct in all respects. Also, if any errors did remain in the dataset after the Paragraph 3 and 4 checks had been performed:

a. If those errors were material and likely to affect the estimate of theta, it is likely that they would be uncovered by the additional checks; and

b. If those errors were immaterial and unlikely to affect the estimate of theta, they are of little concern.

The identification of outliers and influential observations was not used as the basis for exclusion of observations, only as the basis for performing a detailed manual check to ensure the correctness of the observation.

The additional observations that were checked were identified as follows:

a. Observations that were among the 25 most upwardly or the 25 most downwardly influential observations identified by the stability analysis;

b. Observations that were identified as outliers as a by-product of the robust regression estimation; and

c. Observations for companies that appeared multiple times in the set of observations to be checked. For example, if several observations for a particular company appeared in one of the top and bottom 2.5% samples, or in the set of robust regression outliers, we checked the entire set of observations for that company.

The file **review.csv** provides all information resulting from our manual review of individual data points. The information set out in this response appears in Paragraphs 17 and 18 of the Final Report.

117. *AER Issue 5c: FinAnalysis was used for further manual checking of unadjusted price and trading volumes data. However, SFG does not appear to take any procedures for resolving any discrepancies between Datastream and FinAnalysis price and volume data that were identified through manual checking. SFG should verify and correct the error where there is a discrepancy between the data sources.*

This point is dealt with in our response in Paragraph 104 above. With respect to trading volume, the volume recorded in Datastream has been adjusted to account for capitalisation changes but the volume entered from FinAnalysis was the unadjusted volume which appears on the same screen as unadjusted prices. There is no reconciliation of volume differences because we only wanted to observe volume to ensure that a trade had in fact occurred on that day. The volume number itself is not used in the study.

118. *AER Issue 6: The manual review of ASX-flagged announcements is to be done by having regard to the terms of the announcement, with the dividend observation to be excluded from the dataset only where the reviewer concludes (contrary to the ASX's assessment) that the announcement in question would not reasonably be expected to be materially price sensitive.*

Paragraph 6 of the ToR requires a consideration of:

> whether the announcement(s) made on the cum-dividend or the ex-dividend days would reasonably be expected to have had a material effect on the price or value of the securities concerned.

Paragraph 7 of the ToR requires:

> an explanation of the criteria and the methodology that have been applied

and a listing of:

> a. all observations which have been identified by the automatic screening process; and
>
> b. all of those observations which it is determined would not be expected to have been materially price-sensitive and the basis for each such determination.

The Draft Report notes that there are 330 observations (332 in the Final Report) for which the company made an announcement that was labelled as price sensitive on the cum- or ex-dividend day.

The Draft Report also explains the procedure for determining whether the announcement "had a material effect on the price." This was done by comparing the magnitude of the price change on the cum- and ex-dividend days with the magnitude of price changes over the previous year. An announcement is "likely to have had a material effect on the price" if the magnitude of the cum-day or ex-day price changes is large relative to the usual magnitude of price changes over the previous year. By contrast, if there was a particular announcement and the price did not move on either the cum- or ex-day, it is unlikely that the particular announcement had a material effect on the price.

For the reasons set out in the Draft Report, it is generally not possible to determine from simply reading the text of the announcement whether that announcement is likely to have had a material effect on the price.

The Draft Report examines four different tolerance levels for the exclusion of announcements that have been labelled as market sensitive:

a. removing only those for which the magnitude of the cum- or ex-day price change is more than two times the standard deviation of daily price changes in that stock over the previous year;

b. removing only those for which the magnitude of the cum- or ex-day price change is more than one times the standard deviation of daily price changes in that stock over the previous year; and

c. removing all observations for which a market sensitive announcement was made.

The results show that the estimate of theta is almost identical for all three cases. This applies whether OLS/GLS or robust regression methods are used. That is, the estimate of theta is not sensitive to the way in which the "market sensitive" announcements are handled.

To further explore the sensitivity of the results to different treatments of the "market sensitive" announcements, the Final Report includes an additional column in Table 7 that reports estimates for the case where *no* observations are removed on this basis. Again, the estimates of theta are generally almost indistinguishable from those in the three previous columns.

From the results on this issue in the Final Report, it seems clear that the estimates of theta are not sensitive to whether all market sensitive announcements are included, all are excluded, most are included, or most are excluded. The announcements that are labelled as being market sensitive have an immaterial impact on the estimate of theta.

119. *AER Issue 7: Errors in the table should be rectified.*

All tables have been updated for the Final Report.

120. *AER Issue 8a: The AER does not accept that there is broad support in the prior literature for weighting by dividend yield and/or by inverse stock return variance. SFG should review the literature to identify potential weighting variables.*

A number of papers in the relevant literature use the same two GLS scaling variables that are examined in the Draft Report. For example:

- Michaely, R., 1991, "Ex-Dividend Day Stock Price Behavior: The Case of the 1986 Tax Reform Act", *Journal of Finance*, 46, 3, 845-859.

- Bellamy, D., and S. Gray, (2004), "Using Stock Price Changes to Estimate the Value of Dividend Franking Credits," Working Paper, University of Queensland, Business School.

We are not aware of any dividend drop-off analysis that uses GLS scaling variables other than dividend yield and stock return volatility.

Another reason for using the dividend yield scaling variable is that it converts the basic Model 1 (which is in the form of dividend drop-off ratios) into Model 2 (which is in the form of ex-day stock price returns). During the process of finalising the ToR, the AER submitted that its preferred specification was in the form of ex-day stock returns, such as in Model 2. That is, the AER's preferred specification involves scaling by dividend yield. The inverse stock return volatility was also discussed as a potential GLS scaling variable at the meeting with the AER to discuss the ToR that was held in Melbourne on 18 November 2011.

In addition, the Draft Report examines the relationship between the variance of residuals and each of the scaling variables. That is, there is also a statistical motivation for examining models with these two scaling variables. See Paragraph 143 below for further details about the selection and use of GLS scaling variables. We have expanded the discussion of GLS estimation and the selection of GLS scaling variables in Paragraphs 54 to 58 in the Final Report.

121. *AER Issue 8b: SFG should provide detailed description and further justification for using MM robust regression method in SAS and consider other suitable robust regression methods.*

Detailed documentation on the MM robust regression method in SAS is attached as an appendix to the Final Report.

Paragraph 71 of the Draft Report notes that:

> Of the four alternative techniques available in the ROBUSTREG procedure it provides the most comprehensive analysis of outliers.

Chen (2010, p.1) summarises the qualities of the four robust regression methods as follows:

> 1. M estimation was introduced by Huber (1973), and it is the simplest approach both computationally and theoretically. Although it is not robust with respect to leverage points, it is still used extensively in analyzing data for which it can be assumed that the contamination is mainly in the response direction.
>
> 2. Least Trimmed Squares (LTS) estimation is a high breakdown value method introduced by Rousseeuw (1984). The breakdown value is a measure of the proportion of contamination that a procedure can withstand and still maintain its robustness.
>
> 3. S estimation is a high breakdown value method introduced by Rousseeuw and Yohai (1984). With the same breakdown value, it has a higher statistical efficiency than LTS estimation.
>
> 4. MM estimation, introduced by Yohai (1987), combines high breakdown value estimation and M estimation. It has both the high breakdown property and a higher statistical efficiency than S estimation.

We have adopted MM estimation on the basis that it is effectively a combination of the earlier and more basic methods and has a higher statistical efficiency than the other methods. We retain the MM robust regression estimates in the Final Report. In Table 10 below, we compare and contrast estimates from the four methods applied to the base case sample in the Final Report. We conclude from this that our choice of robust regression method has no material impact on the results. We have included Footnote 16 in the Final Report in relation to this issue.

Table 10
Estimates using different robust regression techniques

Estimation method	MM	M	LTS	S
Model 1				
Cash dividend	0.86	0.85	0.88	0.87
Franking credit	0.34	0.33	0.42	0.35
Model 2				
Cash dividend	0.89	0.87	0.95	0.90
Franking credit	0.38	0.39	0.36	0.38
Model 3				
Cash dividend	0.91	0.91	0.88	0.92
Franking credit	0.27	0.30	0.42	0.31
Model 4				
Cash dividend	0.93	0.93	0.94	0.94
Franking credit	0.37	0.36	0.37	0.38

122. *AER Issue 8c: Notwithstanding SFG's footnote 7, adjusted R^2 statistics should also be reported wherever they are generated.*

We have included adjusted R^2 statistics in Table 5. Because the analysis uses a large sample size and has a small number of coefficients to estimate, the R^2 and adjusted R^2 statistics are almost indistinguishable (in all cases, the fourth decimal point changes by either 2 or 3). For this reason, we continue to report R^2 statistics in the other tables to allow for comparability across tables.

123. *AER Issue 8d: The 'package' is not a variable modelled on the right hand side of any of the regression equations. SFG should make it clear in reporting this computed variable.*

The precise definition of every regression equation was specified in the Draft Report. We have also now added a specific note to Table 5 in the Final Report in line with the AER's comment above.

124. *AER Issue 9: The AER notes that the sensitivity analysis performed is not specified in the ToR.*

We performed this sensitivity analysis as part of the regression output and diagnostics that are referred to in Paragraph 14 of the ToR. We consider the sensitivity analysis to be a useful and informative diagnostic, so have retained it in the Final Report.

125. *AER Issue 10: All raw data files, computer codes and output files should be made available in text or Excel format (as appropriate). SFG has not made the SAS program output files (e.g., SAS log file in text format) available as part of the study. The AER requests that these output files be provided.*

We have already provided all raw data files in Excel or .csv format (.csv files can be opened directly in Excel).

The computer code was provided in SAS format so that it could be easily executed directly in SAS. The SAS files are not "black box" executable files, but are program files that set out every line of code and every command that is to be executed. The SAS program files can be easily saved in text format by opening them in SAS and then saving as text, but they cannot be executed from text format, which is why we provided them in SAS format. We have now saved them in text format and have provided these to the parties.

All of the output from the SAS programs is created by running the programs. All data files and all programs have been provided to the parties. The "log" files that have been requested by the AER contain system information such as the time taken to run the program and the amount of CPU memory that was used in the execution of the program.

Accompanying the Final Report are pdf versions of the results files and pdf versions of the log files associated with the compilation of those results files.

Response to Applicants' comments on Draft Report

126. *Applicants Issue 1.1a-b: Please specify which databases were used to compile the dataset and the way in which each database was used. To the extent the databases of Datastream, SIRCA and / or FinAnalysis were not used, please provide an explanation as to why these databases were not used and any potential implications of this on the conclusions contained the report. Please confirm that the process of cross-referencing between the three databases (referred to in paragraph 2 of the terms of reference) was undertaken. Please also set out the results of this process in your report, in the manner described in paragraph 2 of the terms of reference. To the extent that the cross-referencing between the three databases was not undertaken, please provide an explanation as to why and any potential implications of this on the conclusions contained in the report.*

This point is dealt with in our response in Paragraph 104 above.

127. *Applicants Issue 1.1c: Please provide reasons for the decision to use data up to 30 September 2010, rather than up to 31 December 2009 as set out in the ToR. If it is your opinion that, in the relevant circumstances, a larger dataset provides for more robust "state-of-the-art" estimates of theta, please state this in your report. Please set out any potential implications of using data up to 30 September 2010 (as opposed to 31 December 2009) on the conclusions contained in the report.*

It is our view that a larger dataset does provide for more robust and statistically reliable results. Consequently, we have used the most recent data that was available to us. We note this in Paragraph 4 of the Final Report.

We have also computed a set of estimates using data up to 31 December 2009 only. Table 11 below shows that the extension of the data period does not have a material impact on the estimates of theta. We refer to this result in Footnote 13 in the Final Report.

Table 11
Estimates using different sample end points

Estimation method	**OLS/GLS**		**Robust regression**	
Sample end date	30/09/2010	31/12/2009	30/09/2010	31/12/2009
Model 1				
Cash dividend	0.80	0.82	0.86	0.89
Franking credit	0.16	0.14	0.34	0.30
Model 2				
Cash dividend	0.81	0.82	0.89	0.90
Franking credit	0.41	0.39	0.38	0.38
Model 3				
Cash dividend	0.89	0.91	0.91	0.92
Franking credit	0.19	0.17	0.27	0.27
Model 4				
Cash dividend	0.91	0.92	0.93	0.94
Franking credit	0.31	0.31	0.37	0.38

128. *Applicants Issue 1.1d: Please provide reasons for the aggregation of dividends described in Paragraph 4(c) of the Draft Report. Please explain what impact this aggregation has, if any, on the conclusions contained in the Draft Report.*

For some of the observations in the sample, a single company simultaneously paid an ordinary and a special dividend. For example, a company may pay an ordinary dividend of 10 cents per share and a special dividend of 5 cents per share, with both having the same ex-dividend date. This is treated as a single dividend of 15 cents per share because it involves the company paying 15 cents of cash to the equity holder. The appropriate measurement for dividend drop-off analysis is the amount of cash that the company pays to the equity holders. The terminology that is applied to components of that total cash amount (e.g., whether some of it is labelled as "ordinary" and some is labelled as "special" is irrelevant).

In practice, when a company pays a 15 cent dividend, the share price falls by approximately 15 cents on the ex-dividend date. This occurs whether that dividend is labelled as ordinary, special, or some mixture.

If the "special" part of the dividend were ignored in the analysis, the 10 cent ordinary dividend in the example above would be compared with a 15 cent stock price decline, and this would distort the results of the drop-off analysis.

If all observations that included a special dividend were omitted altogether, the sample size would be reduced unnecessarily and this would have a detrimental effect on statistical reliability. This would also be inconsistent with the ToR.

In summary, the only impact that the aggregation of ordinary and special dividends has on the results is to properly align the dividend amount and the stock price effect. Any other treatment would either introduce bias or reduce statistical reliability.

129. *Applicants Issue 1.1e: Please report the number of observations (if any) excluded due to missing data items listed in Paragraphs 5(h), (i) and (j) of the Draft Report.*

A number of observations were excluded because stock prices were missing on the cum- or ex-dividend days, as summarised in Table 1 of the report. There were no incremental observations removed because historical or market returns were unavailable. In other words, if we could observe prices on the cum- and ex-dividend dates, we could also observe historical returns and market returns.

130. *Applicants Issue 1.1f: Please explain why the mean excess stock return is calculated over trading days beginning one year and six days prior to the ex-dividend day and ending six days prior to the ex-dividend day.*

We have included some additional explanation on this point in Paragraph 7 of the Final Report.

131. *Applicants Issue 1.1g: Please confirm that the Equation in Paragraph 6 is accurate.*

We have made changes to the formulas in Paragraph 7 and 8 of the Final Report to clarify that stock return volatility was computed over a one-year period ending six days before the relevant ex-dividend date.

132. *Applicants Issue 1.2a: Please provide further explanation of the process described in Paragraph 9(d), including how you identified "outliers" and why you considered this process to be necessary.*

This is explained in Paragraph 116 above. The Final Report also contains a more detailed discussion of this process at Paragraph 17.d.

133. *Applicants Issue 1.2b: In Footnote 3, please state how many observations had inconsistencies between the ex-dividend date contained in the raw data and the data four days prior to the record date.*

We identified 20 observations for which the ex-dividend date in DatAnalysis was not exactly four days prior to the record date. These observations were checked against the relevant company announcement and the date reported in the announcement was used.

134. *Applicants Issue 1.2c,d: Please explain why the process in Paragraph 10(b) is necessary in light of the exclusion set out in Paragraph 4(f). Please confirm that the filter for capitalisation changes is applied to the entire sample as implied by Paragraph 4(b). It is unclear from Paragraph 11 whether this filter is only applied to the approximately 900 "top and bottom" observations. If the filters in Paragraphs 4(b) and 11 are different, then please explain how.*

The filter for stapled securities; shares whose primary listing is overseas; CHESS depositary interests; CHESS units of foreign securities; or exchange-traded funds was applied to the entire sample. Every observation that we identified to be one of the types listed above was removed from the sample.

Paragraph 10(b) of the Draft Report explained in more detail how this filter was implemented. The reason for the application of these manual steps is that we are unaware of a field in DatAnalysis which identifies whether a company is an exchange-traded fund, a stapled security, has a primary listing overseas or is a CHESS Depository Instrument. Hence, we manually-compiled this information by reviewing company disclosures and information from the ASX.

The filter for capitalisation changes is also applied to the entire sample. Every observation for which we identified a capitalisation change within the ±5 day window was removed from the sample.

Paragraph 11 of the Draft Report explained in more detail how this filter was implemented. The reason for the application of the filter in this manner is explained further in Paragraph 112 above.

We have clarified these issues in the Final Report.

135. *Applicants Issue 1.2e: If the process in Paragraph 11 confirms that a capitalisation change has taken place, does this result in removal of the observation? If so, please clearly state this.*

It does – if any capitalisation change is identified within the ±5 day window, the observation is removed from the dataset. Paragraph 15 in the Final Report documents that this is the case.

136. *Applicants Issue 1.3(a): The Draft Report states that SFG identified a number of additional announcements that had been flagged as price sensitive by the ASX but which were not included in the SIRCA file. If you are aware of an explanation as to how this may occur please provide this explanation and set out why it was appropriate to further examine these announcements.*

The SIRCA database contains a company announcement file that contains a record of corporate announcements to the ASX. This file contains information including the company's ticker symbol (e.g., ANZ, BHP), the date of the announcement and a flag for announcements that were labelled as price sensitive.

The FinAnalysis database and the ASX web site contain the full text of every announcement and detailed information about the time of the announcement and its classification by the ASX.

In performing the various manual checks required under the ToR, we read the text of many announcements within the ±5 day window of ex-dividend dates. This led us to identify some detailed announcements in the FinAnalysis database that were classified by the ASX as being price sensitive, but which did not appear in the SIRCA summary file. These observations were treated in exactly the same manner as all other observations with price sensitive announcements.

We could not identify any systematic characteristic of the omissions from the SIRCA summary file, so we are unable to comment on why they might have occurred.

137. *Applicants Issue 1.3(b): The Draft Report uses a methodology called "event study" to manually review announcements for price sensitivity. Please explain whether this methodology captures price sensitive announcements which cause a drop in the price and if so, how. If not, please explain how negative price sensitive announcements can be assessed.*

The discussion about event studies in the Draft Report was included as an illustration of how the price impact of important corporate announcements can occur over a number of days. The role of this discussion was set out in Paragraph 23 of the Draft Report:

> This analysis of event studies is relevant to the present drop-off study insofar as it illustrates that the stock price effect of an important corporate announcement can occur over many days and is certainly not limited to the day on which the announcement is made. Indeed, not only *can* the effect of the announcement occur over many days, on average it *does* occur over many days.

It is not correct to say that the Draft Report uses the event study methodology. Rather, the Draft Report discusses the event study literature by way of illustrating one reason why there may be little stock price reaction on the day that an announcement is made, even though that announcement contains text that might sound as though it is relevant to the price of the stock.

The approach that is adopted in relation to price sensitive announcements was set out in Paragraphs 22-28 of the Draft Report, with additional sensitivity analysis in Paragraphs 64-67. The discussion in Paragraph 118 of this Final Report is also relevant.

The Applicants also ask whether the methodology that has been employed in relation to price sensitive announcements symmetrically captures the effects of "negative" announcements that might be expected to result in a decline in the stock price. It does. We examine the magnitude of the change in stock price on the cum-and ex-dividend days and compare the *magnitude* of those price changes to the distribution of daily price changes over the previous year. The *direction* of the price change is not relevant to this consideration – positive and negative price changes that are, say, 2.5 times the standard deviation of price changes over the previous year are treated symmetrically. This should be clear from Paragraphs 34 and 35 of the Final Report.

138. *Applicants Issue 1.3(c): Were any observations materially affected by price sensitive announcements able to be corrected (per Paragraph 8 of the ToR) or were all these observations excluded?*

Paragraph 8 of the ToR states that if the check that is performed as a result of there being an announcement that was labelled as price sensitive happens to uncover a data error (e.g., the dividend amount or ex-dividend date were in error) then that error can be corrected if it is possible to do so. This is independent of the materiality of the price sensitive announcement.

In practice, none of our checks in relation to price sensitive announcements led us to find an observation that was in error. All of the observations that were in error and were either corrected or eliminated from the dataset were identified from other (prior) checks. Consequently Paragraph 87 of the ToR had no substantive effect.

This means that the observations with price sensitive announcements were retained in, or eliminated from, the sample on the basis of the materiality of their effect on the stock price. It is not the case that they were all excluded, as the Applicants' question might imply. Table 7 of the Final Report contains a range of estimates according to different treatments of observations with price sensitive announcements. Only one version of the estimates involves the elimination of all observations with price sensitive announcements.

139. *Applicants Issue 1.4(a)(i): In Table 1, Please confirm that the sample size numbers are correct, including those for Data4 and Data5.*

We have updated the sample size numbers in Table 1 of the Final Report.

140. *Applicants Issue 1.4(a)(ii): In Table 1, Please explain why observations were excluded where "franking >100% or dividend <=0" (Table 1 first line). If this was to correct for obvious data errors, please clearly state this.*

These observations were excluded to remove obvious data errors. We have made this clear in a note to Table 1 in the Final Report.

141. *Applicants Issue 1.4(a)(iii): In Table 1, The removal of observations for stock splits and bonus issues (referred to in Paragraph 4(b)) is not identified. Similarly, the removal of observations for CHESS units of foreign securities and shares listed overseas (referred to in Paragraph 4(f)) is not identified. Please clearly identify the point at which all of these exclusions occur.*

Observations for which there was a stock split or bonus issue are recorded in Table 1 of the Draft Report as "Capitalisation change within 5 days of ex-date." Stock splits and bonus issues are types of capitalisation change.

In Table 1 of the Draft Report, foreign securities of any form are eliminated along with stapled securities, exchange traded funds and CHESS depository instruments. In the Final Report, we expand the descriptions in Table 1 to be clearer about the point at which various filters are applied.

142. *Applicants Issue 1.4(b): In relation to Paragraph 32 it is stated that the inclusion of Coal and Allied leads to a lower estimate of theta. Please specify the materiality of this impact.*

When Coal and Allied is included in the sample, the estimates of theta are uniformly lower. We set out the relevant estimates of theta with and without Coal and Allied in the sample in Table 12 below, and include a reference to this table in Paragraph 41 of the Final Report.

Table 12
Summary of estimates with and without Coal and Allied Ltd

	Excluding CNA		Including CNA	
	Estimate	**Std Err (Firm clustering)**	**Estimate**	**Std Err (Firm clustering)**
Model 1				
Cash	0.7964	0.0673	0.7976	0.0673
Franking credits	0.1640	0.1808	0.0846	0.1980
Package	0.8667	0.0322	0.8338	0.0464
R-squared	0.0003		0.0000	
N	3107		3108	
Model 2				
Cash	0.8070	0.0333	0.8070	0.0333
Franking credits	0.4096	0.0945	0.4084	0.0945
Package	0.9826	0.0223	0.9820	0.0223
R-squared	0.5808		0.5691	
N	3107		3108	
Model 3				
Cash	0.8861	0.0352	0.8865	0.0352
Franking credits	0.1936	0.1018	0.1656	0.1063
Package	0.9690	0.0232	0.9575	0.0265
R-squared	0.0009		0.0004	
N	3107		3108	
Model 4				
Cash	0.9129	0.0232	0.9129	0.0232
Franking credits	0.3113	0.0696	0.3108	0.0696
Package	1.0463	0.0183	1.0462	0.0183
R-squared	0.7049		0.6997	
N	3107		3108	

Cash represents the estimated value of a one dollar cash dividend; *Franking credits* represents the estimated value of a one dollar franking credit; *Package* represents the estimated combined value of a one dollar cash dividend plus the associated 43 cent franking credit. The *package* value is estimated as the sum of the *cash* coefficient and 0.43 times the *franking credits* coefficient. The standard error for the *package* estimate is computed as a function of the standard errors of the *cash* and *franking credits* coefficients, and the correlation between them.

143. *Applicants Issue 2.1(a): Please provide further explanation of why each of the functional forms in Table 4 is used, including:*

i. *Why Model 1 is specified in the way that it is (besides the fact that this form was prescribed in the ToR);*
ii. *Why dividend yield is used as a scaling variable in Model 2;*
iii. *Why inverse stock return variance is used in Model 3 and Model 4.*

Where relevant, please include explanations of relevant theoretical concepts and/or graphical illustrations of observed patterns in residuals.

Model 1 is the standard dividend drop-off equation. The left-hand-side variable is the ex-dividend day stock price change

The selection of potential GLS scaling variables is drawn from the relevant literature, as discussed in Paragraph 120 above. These two scaling variables are also motivated by the pattern in the residuals from Model 1, as set out in Figure 3 and Figure 4 of the Draft Report.

One of the assumptions of OLS regression analysis is that the residuals are homoscedastic. This means that all of the residuals have the same variance. This in turn means that there should be no relationship between the variance of the residuals and any relevant variable. Whether such a relationship exists can be determined by dividing the sample into groups ranked on the variable in question and computing the variance of the residuals for each group. If there is a clear relationship between the variable in question and the resulting variances, the residuals are not homoscedastic and one of the assumptions of regression analysis is violated. This can be remedied by dividing all terms in the regression equation by the variable in question.

Mathematically, the residuals are homoscedastic if they all have the same variance:

$$var(\varepsilon_i) = \sigma^2 \; for \; all \; observations \; i.$$

But suppose the variances of the residuals are a function of some variable X_i:

$$var(\varepsilon_i) = \sigma^2 X_i^2 \; for \; all \; observations \; i,$$

where σ^2 is a constant. If we then divide all terms in the regression equation by X_i, the new residual term is:

$$\varepsilon_i' = \frac{\varepsilon_i}{X_i}$$

in which case:

$$var(\varepsilon_i') = var\left(\frac{\varepsilon_i}{X_i}\right) = \frac{1}{X_i^2} \; var(\varepsilon_i) = \frac{1}{X_i^2} \; \sigma^2 X_i^2 = \sigma^2.$$

That is, the variance of the residuals, after all terms are scaled by X_i is a constant. Consequently, the residuals of the scaled equation are homoscedastic, satisfying the relevant assumption of regression analysis.

Figure 3 and Figure 4 of the Draft Report show that there is a relationship between the variance of the residuals and dividend yield and stock return volatility, respectively. Specifically, the variance of the residuals is higher for observations with low dividend yield and for observations with high stock return volatility. This occurs because, for both types of observation, the dividend is small relative to other factors that might cause the stock price to change on the ex-dividend date.

We have expanded the discussion of GLS estimation and the selection of GLS scaling variables in Paragraphs 54 to 58 in the Final Report.

144. *Applicants Issue 2.1(b): Please clarify which of the functional forms in Table 4 are OLS estimations and which are GLS.*

This is set out in the right-hand column of Table 1. The regression equations in the centre column are all estimated using OLS regression. Regression Equation (1) estimated using GLS with dividend yield as the scaling variable is econometrically identical to the estimation of Equation (2) using OLS, and so on.

145. *Applicants Issue 2.1(c): To the extent that you may expect any of the functional forms in Table 4 to be more stable than others, please state this a priori expectation and your reasons for it.*

We have no *a priori* expectation about the relative stability of the functional forms in Table 4 of the Draft Report. This is determined statistically, depending on the particular dataset that is being analysed.

Our experience with this particular data set is that the estimates from Model 4 are more stable and more resistant to influence from outliers than the estimates from other models.

146. *Applicants Issue 2.2(a): In the Notes to Table 9, reference is made to "significant excess returns." Please explain this term, and whether it is related to the event study analysis in Paragraphs 19-27.*

Column E of the table explains that we investigated datasets that excluded observations for which observations with significant excess returns on the cum- or ex-dividend days can be removed, whether or not the company makes an announcement that is labelled as price sensitive. For these datasets, "significance" is defined as the magnitude of the excess return on either the cum-or ex-dividend day exceeding two standard deviations of excess returns computed over the previous year, as set out in Column D of the same table. We have augmented the note to the table to make this clear.

147. *Applicants Issue 2.2(b): Please confirm the accuracy of "0.86 for unfranked dividends" reported in Paragraph 50.*

All figures have been updated in the Final Report.

148. *Applicants Issue 2.2(c): Please provide reasons for your conclusion in Paragraph 80 that an appropriate estimate for theta is 0.35. Is this based on the range of values produced by Model 4? Would there be one particular estimate from Model 4 that should be preferred over the others, such as the estimate from robust regression (Table 6)?*

We have expanded our discussion of the reasoning behind our conclusions in Paragraphs 90 to 102 of the Final Report.

149. *Applicants Issue 2.2(d): Other than the statistical reasons stated in Paragraph 79, are there any other reasons why Model 4 might be preferred over the others? Is there any theoretical or other explanation why this model produces more stable estimates?*

See our response in Paragraph 145 above. There is no *a priori* theoretical reason to prefer Model 4, only the statistical reasoning referred to above – there is a relationship between the variance of residuals and both dividend yield and stock return volatility, and Model 4 effectively accounts for this relationship. The effect of Model 4 is to down-weight observations for which dividend yield is very low or stock return volatility is very high. That is, it down-weights observations that have the highest degree of noise, either because the effect being examined is small (small dividend yield) or because extraneous effects are large (high stock return volatility). The down-weighting of noisy observations is likely to improve the stability of the results.

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Appendix 1: Terms of reference

Terms of reference for dividend drop-off analysis

Re: Application by Energex Limited (No 2) [2010] ACompT 7

22 December 2010

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Introduction

SFG Consulting has been engaged jointly by Energex Limited (ACN 078 849 055), Ergon Energy Corporation Limited (ACN 078 646 062) and ETSA Utilities (ABN 13 332 330 749) to undertake a dividend-drop off study (the **Study**) further to reasons for decision published by the Australian Competition Tribunal on 13 October 2010. The terms of reference for the Study are set out below.

Construction of data set

Raw data source

1. Raw data will be compiled using data from Datastream, SIRCA, and FinAnalysis (the **Databases**) relating to cash dividend distribution events over the period commencing 1 July 2000 and ending 31 December 2009 for companies and trusts listed on the Australian Stock Exchange (**ASX**). The data required for each observation is:

   a. ASX Code;

   b. Ex-dividend date;

   c. Cum dividend (closing) share price;

   d. Ex-dividend (closing) share price;

   e. Dividend amount;

   f. Franking credit amount;

   g. Trading volume on each of the cum-dividend and ex-dividend days; and

   h. Return on All Ordinaries price index on ex-dividend day.

In addition, all data necessary to perform the data filtering and checking described below will also be obtained.

The raw data from the Databases, all computer code written for performing data reconciliation, filtering and checking and the corresponding output files (in text or Excel format, as appropriate) will be made available as part of the Study.

Ex-ante data reconciliation, filters and checking

2. The raw data items will be cross-referenced between the Databases and any discrepancies between the Databases will be manually investigated. Where a discrepancy between databases cannot be resolved, the observation will be removed. The Study will identify:

   a. all data for which a discrepancy was identified;

   b. if the discrepancy was able to be resolved, how it was resolved; and

   c. if the discrepancy was unable to be resolved, a summary list of the observations which were removed.

3. The resulting data set will be subjected to secondary filters. Specifically an observation will be omitted if:

   a. Any of the required data items is unavailable; or

   b. The company in question conducted a stock split, bonus issue, or other capitalization change within five trading days of the ex-dividend date; or

   c. The stock did not trade on either the cum-dividend or the ex-dividend day; or

   d. The company in question has a market capitalization that is less than 0.03% of the market capitalization of the All Ordinaries index at the time of the ex-dividend date; or

   e. The security in question falls into any one of the following categories: stapled securities; shares whose primary listing is overseas; CHESS depositary interests; CHESS units of foreign securities; or exchange-traded funds.

Manual checking for data errors

4. A subset of the observations that remain in the sample after the application of the secondary filters will be subjected to further manual checking on an ex ante basis.
The following observations will be further checked:

   a. All observations in the top and bottom 2.5 per cent based on dividend drop-off ratio;

   b. All observations in the top and bottom 2.5 per cent based on dividend amount; and

   c. All observations in the top and bottom 2.5 per cent based on grossed-up dividend yield.

The manual check that will be performed is to examine whether there is an apparent error in a relevant observation.

If an apparent error is identified in a relevant observation and the observation can be corrected on a verifiable basis, the observation will be corrected and retained. If an apparent error is identified and the observation cannot be corrected on a verifiable basis, the observation will be removed.

The Study will also identify each observation that has been checked manually, and indicate the basis for the correction or omission of any checked observation.

Screening and manual review for price-sensitive announcements

5. The remaining data will be screened automatically to identify observations where a market announcement is made in respect of the company in question on either the cum-dividend or the ex-dividend day that is flagged as a price-sensitive announcement on the ASX company announcements platform. Company announcement information will be obtained from the SIRCA company announcement file.

6. The observations identified by the automatic screening for ASX-flagged price sensitive announcements will then be manually reviewed to confirm whether the announcement(s) made on the cum-dividend or the ex-dividend days would reasonably be expected to have had a material effect on the price or value of the securities concerned.

7. Observations identified by the automatic screening step in paragraph 5 will be omitted from the data set, unless it is determined on the manual review in paragraph 6 that the relevant announcement(s) would not reasonably be expected to have been materially price-sensitive. The Study will include an explanation of the criteria and the methodology that have been applied in manually reviewing announcements for price-sensitivity, and will indicate:

a. all observations which have been identified by the automatic screening process; and

b. all of those observations which it is determined would not be expected to have been materially price-sensitive and the basis for each such determination.

8. For clarity, any apparent data errors identified during the manual review in paragraph 6 will be treated in the manner set out in paragraph 4.

9. The raw company announcement data and all computer code written for performing automatic screening will also be made available as part of the Study.

Final sample

10. The set of observations resulting from the processes set out in paragraphs 2 to 7 above will be referred to as the *final sample*. For clarity, special dividends will be included unless one of the processes set out in paragraphs 2 to 7 has resulted in its exclusion.

The final sample will be made available as part of the Study.

Econometric analysis

11. The Tribunal has stated (Paragraph 148) that:

> The Tribunal would expect that, unless compelling reasons to the contrary are adduced: The dependant variable will be the share price drop-off ratio rather than the drop-off itself.

12. In accordance with the Tribunal's statement, and there being no compelling reason not to use the drop-off ratio as the dependent variable, the model to be estimated is of the following form:

$$\frac{P_{i,t-1} - P^*_{i,t}}{D_i} = \delta + \theta \frac{FC_i}{D_i} + \varepsilon_i \qquad (1)$$

where $P_{i,t-1}$ is the cum-dividend stock price for observation *i*; $P^*_{i,t} = \frac{P_{i,t}}{1+r_{m,t}}$ is the market-adjusted ex-dividend stock price (where $r_{m,t}$ is the return on the All Ordinaries index on day *t*); D_i is the amount of the dividend for observation *i*; and FC_i is the amount of franking credits associated with observation *i*.

13. The two parameters to be estimated are δ and θ where:

a. δ represents the estimated market value of cash dividends as a proportion of their face value; and

b. θ represents the estimated market value of distributed franking credits as a proportion of their face value.

14. The econometric model in Equation (1) will be estimated using regression analysis applied to the final sample. The econometric model will be estimated using ordinary least squares, generalised least squares and robust regression methods. The standard set of outputs, statistical tests and regression diagnostics will be presented.

15. All computer code written for performing econometric analysis and the corresponding output files (in text format) will be made available

Appendix 2: Research Team

Professor Stephen Gray
B. Com (Hons), LL.B. (Hons), Ph.D (Stanford)

Professor of Finance at UQ Business School, University of Queensland
Director of Strategic Finance Group (SFG)

Responsible for development of the Terms of Reference and study design. Involved in all aspects throughout the study. Author of final report.

Dr. Jason Hall
B. Com (Hons), Ph.D (Queensland), CFA

Senior Lecturer in Finance at UQ Business School, University of Queensland
Director of Strategic Finance Group (SFG)

Detailed computer coding and statistical analysis. Manual checking of data items.

Mr. David Costello
B. Com (Hons)

Analyst at Strategic Finance Group (SFG)

Manual checking of data items, under instruction and supervision.

Updated dividend drop-off estimate of theta

Report for the Energy Networks Association

Professor Stephen Gray

7 June 2013

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Contents

1. Executive summary

Background and context

1. In the Australian regulatory setting, the regulator requires an estimate of a parameter that reflects the implied market value of dividend imputation tax (or "franking") credits at the time those credits are created by the payment of corporate tax. This parameter is known as "gamma." Gamma, in turn, is a function of two other parameters. One of these is the implied market value of imputation credits at the time they are distributed to shareholders – a parameter known as "theta."

2. One method of estimating theta is known as "dividend drop-off analysis." This is an econometric (statistical) technique that estimates the value of distributed imputation credits (theta) by observing the change in stock prices around ex-dividend events (days when the dividend and imputation credit separate from the share).

3. In a recent case, the Australian Competition Tribunal (the **Tribunal**) directed that a "state of the art" dividend drop-off study should be performed to assist with its deliberations[1]. That study was performed by SFG Consulting (**SFG**) and concluded that the best estimate of theta was 0.35. The Tribunal endorsed and adopted[2] that estimate. Since the date of that decision, the AER has consistently set theta to 0.35.

Instructions

4. I have been retained by the Energy Networks Association (**ENA**) to update the "state-of-the-art" dividend drop-off estimate of theta. I have applied the same econometric methodologies and applied the same statistical, diagnostic and robustness tests as in the study performed for the Tribunal. I have updated the data set from September 2010 to October 2012.

Summary of conclusions

5. The conclusion from the 2011 SFG study was that:

> For the reasons set out in detail in this report, we conclude that the appropriate estimate of theta from the dividend drop-off analysis that we have performed is 0.35 and that this estimate is paired with an estimate of the value of cash dividends in the range of 0.85 to 0.90.[3]

6. In my view, the conclusions from that earlier study remain valid when tested against the updated data set.

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[1] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 146.
[2] Application by Energex Limited (Distribution Ratio (Gamma)) (No 3) [2010] ACompT 9 (24 December 2010).
[3] SFG (2011), Paragraph 3.

2. Background and context

Effect of dividend imputation tax credits and the role of gamma

7. In a dividend imputation tax system, such as has operated in Australia since 1987, dividends paid by Australian companies out of profits that have been taxed in Australia have tax credits attached to them. For example, a company that earns a profit of \$100 and pays \$30 corporate tax and then distributes the remaining \$70 as a dividend to shareholders, can attach \$30 of dividend imputation tax credits to the \$70 dividend. Those tax credits can be used by resident investors to reduce their personal tax obligations by \$30, but cannot be used by non-resident investors under the dividend imputation legislation.

8. The "gamma" parameter has an important effect on the grossing up for corporate tax. Continuing the example above, suppose a regulator determines that shareholders require a return of \$70. In the absence of dividend imputation, a pre-tax profit of \$100 would be required. The firm would then pay \$30 in corporate tax and distribute the remaining \$70, as required.

9. In an imputation system, however, the \$70 dividend comes with \$30 of tax credits attached to it. The gamma parameter effectively acknowledges that those tax credits have a potential value. This is a market value, that is, how much the market price of a share will increase as a result of the credits attached to the dividend stream. Suppose, for example, that the regulator determines that the \$30 of tax credits have a value of \$7.50.[4] In that case, the shareholders would have received a \$70 cash dividend and tax credits with a value of \$7.50, and would therefore have been over-compensated.

10. In this case, the firm's pre-tax revenue requirement should have been set at \$90.32, in which case the firm would pay tax of \$27.10 (30%) and pay a cash dividend of \$63.23 (its after tax profit). Attached to that cash dividend would be \$27.10 of tax credits (equal to the amount of corporate tax paid), which I continue to assume are valued by the regulator at 25% of face value – \$6.77. The total of the cash dividend (\$63.23) and the assumed value of the tax credits (\$6.77) provides shareholders with the \$70 return that they require.[5]

Estimation

11. In the regulatory setting, gamma is estimated as the product of two components:

$$\gamma = F \times \theta$$

where F is the distribution ratio (the proportion of created imputation credits that are distributed to shareholders) and θ is the value of a distributed credit. Imputation credits are created whenever a firm pays a dollar of Australian corporate tax. But to distribute all of the imputation credits it creates, a firm would have to distribute 100% of its (Australian) profits as dividends. The average firm does not do this, because it retains some profits to finance future capital expenditure.

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[4] That is, imputation credits are assumed to be valued at 25% of face value.

[5] The revenue requirement is calculated by back-solving from the return requirement. Let the revenue requirement be X. For a corporate tax rate of 30%, the cash dividend that can be paid out of pre-tax profit of X is $X(1\text{-}0.30)$. The amount of imputation credits that are created by the payment of corporate tax is $0.30X$. At 25% of their face value, these imputation credits are valued at $0.25(0.30)X$. The sum of the cash dividend and the imputation credit must provide shareholders with the \$70 they require. Hence: $X(1\text{-}0.30)+0.25(0.30)X=70$, and the implied value of X is 90.32.

12. If firms distribute 70% of the imputation credits they create and if those credits are each valued at 35% of face value, then gamma would be:

$$\gamma = F \times \theta = 0.7 \times 0.35 = 0.25 .$$

13. This would mean that 25% of the corporate tax that the firm pays is assumed to flow back to shareholders, so the grossing up for corporate tax would be reduced accordingly, as in the example above.

14. In summary, the regulatory setting requires estimates of the distribution ratio (F) and the value of a distributed credit (θ).

Australian Competition Tribunal review – background

15. Prior to the last process for setting the AER's Statement of Regulatory Intent (**SoRI**), the long-standing regulatory precedent was to set gamma equal to 0.5. In its SoRI in May 2009, the AER set gamma to 0.65. This estimate was based on:

    a) Setting F to 100%. The AER's consultant on this issue proposed that F should be set on the basis of theoretical assumption rather than market evidence; and

    b) Setting θ to 0.65 as the mid-point of two estimates:

       i) A dividend drop-off estimate of 0.57 whereby one compares the prices of shares immediately before the ex-dividend date with the prices of the same shares immediately after, as a means of inferring the implied value of dividends and the tax credits that are attached to them[6]; and

       ii) An estimate based on ATO tax statistics about the proportion of imputation credits that are redeemed.[7]

16. The first three businesses to be regulated under the AER's SoRI estimate of 0.65 were ENERGEX, Ergon Energy and ETSA Utilities, all of whom sought a review by the Australian Competition Tribunal (the **Tribunal**). This review took place under the National Electricity (Distribution) Rules and has become known as the *Gamma Case*[8].

Issues and Tribunal findings

Estimating the distribution rate

17. Recall that the distribution rate (F) is the ratio of (a) the total amount of franking credits distributed to shareholders in a given year, to (b) the total amount of franking credits created in a given year. In the

[6] Beggs, D.J., and C.L. Skeels, 2006. "Market arbitrage of cash dividends and franking credits," *The Economic Record,* 82 (258), 239 – 252.

[7] Handley, J.C., and K. Maheswaran, 2008. "A measure of the efficacy of the Australian imputation tax system," *The Economic Record,* 84 (264), 82 – 94.

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

Gamma Case[9], the AER abandoned its contention that F should be set to 100% before the Tribunal hearing. In its submissions to the Tribunal prior to the hearing, the AER then acknowledged that an estimate above 0.7 was unsupportable, as there was no evidence for it, and therefore that the distribution rate should be set to 0.7. In summarising the AER's position on this issue, the Tribunal stated that:

> The AER accepts that on the material presently before the Tribunal, there is no empirical data that is capable of supporting an estimated distribution ratio higher than 0.7. The AER therefore accepts that it is open to the Tribunal to adopt a substitute distribution ratio of 0.7.[10]

18. The Tribunal then concluded and ordered that:

> In light of these submissions and the material before the Tribunal, the Tribunal concludes that the distribution ratio is 0.7 for the calculation of gamma.[11]

Estimating Theta

19. The theta parameter estimates the value, to the relevant shareholder, of a dollar of franking credits that has been distributed to them. Different shareholders will place a different value on the franking credits that are distributed to them. Resident shareholders can use franking credits to reduce their personal tax obligations, whereas non-resident shareholders obtain no benefit from franking credits. Theta represents the extent to which trading among all market participants results in some value in relation to franking credits being impounded into the stock price.

20. Two techniques for empirically estimating theta were considered by the Tribunal:

    a) Tax statistics about the proportion of distributed imputation tax credits that had been redeemed by shareholders, obtained from the Australian Taxation Office (**ATO**); and

    b) Dividend drop-off analysis, whereby the implied value of imputation tax credits is inferred from the price change that occurs over ex-dividend days.

21. The Tribunal held that the ATO tax statistic approach did not produce an estimate of market value and that the AER was wrong to have interpreted tax statistic estimates in that way. In particular, the Tribunal held that the ATO tax statistic approach provides no more than an upper bound check on estimates of theta obtained from the analysis of market prices, and that the AER was wrong to have interpreted such an estimate as a point estimate rather than as an upper bound:

> The AER accepted that utilisation rates derived from tax statistics provide an upper bound on possible values of theta. Setting aside the manner in which the AER derived a value from the tax statistics study, it correctly considered that information from a tax statistics study was relevant. However, its relevance could only be related to the fact that

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[9] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010).
[10] Application by Energex Limited (Distribution Ratio (Gamma)) (No 3) [2010] ACompT 9 (24 December 2010), Paragraph 2.
[11] Application by Energex Limited (Distribution Ratio (Gamma)) (No 3) [2010] ACompT 9 (24 December 2010), Paragraph 4.

> it was an upper bound. No estimate that exceeded a genuine upper bound could be correct. Thus the appropriate way to use the tax statistics figure was as a check.[12]

22. The Tribunal also held that the AER was wrong to take upper bound estimates from two different sub-periods and then interpret their average as a point estimate:

> But this simple averaging adjustment has no logic to it and fails to accord each Handley and Maheswaran (2008) estimate its correct interpretation as an upper bound applying to a period…[13]

and that:

> …any downward adjustment to a properly derived upper bound would be inappropriate as a means of deriving an estimate of theta.[14]

23. This left the Tribunal with dividend drop-off analysis. On this point, the AER had sought to rely entirely on a single study by Beggs and Skeels (2006)[15]. The Tribunal held[16] that the AER was wrong to rely on an out-dated and methodologically unsound dividend drop-off study. The Tribunal then directed that a "state-of-the-art" dividend drop-off study should be conducted to assist the Tribunal.[17] The Tribunal also directed that the dividend drop-off study to be performed by SFG "should employ the approach that is agreed upon by SFG and the AER as best in the circumstances."[18]

24. In summary, the Tribunal ruled that:

    a) The AER had erred in using tax statistics estimates for any purpose other than as an upper bound;

    b) The AER had erred in its reliance on the Beggs and Skeels (2006) dividend drop-off estimate of theta; and

    c) SFG should be retained to prepare a "state-of-the-art" dividend drop-off analysis with terms of reference to be agreed with the AER.

The SFG "state-of-the-art" dividend drop-off study

25. After agreement could not be reached between the parties, the Tribunal ruled that:

    a) The four variations of the econometric specification of dividend drop-off analysis drawn by SFG from the literature should be used; and

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[12] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 91.
[13] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 95.
[14] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 95.
[15] Beggs, D. J. and Skeels, C.L., (2006), "Market arbitrage of cash dividends and franking credits," Economic Record, 82 (258), 239 – 252.
[16] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraphs 66, 145.
[17] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 146.
[18] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 147.

b) The results for the full updated period should be used rather than sub-periods.

26. SFG then conducted the dividend drop-off study and circulated a draft report to all parties. The AER and the regulated businesses that were parties to the *Gamma Case*[19] provided detailed comments on the draft report and these were taken into account in a revised report that was provided to all parties and to the Tribunal.

27. Although the AER submitted[20] that the SFG study had departed from the Terms of Reference, the Tribunal disagreed and accepted the estimates from the SFG dividend drop-off study:

> The Tribunal is satisfied that the procedures used to select and filter the data were appropriate and do not give rise to any significant bias in the results obtained from the analysis. Nor was that suggested by the AER.[21]
>
> In respect of the model specification and estimation procedure, the Tribunal is persuaded by SFG's reasoning in reaching its conclusions. Indeed, the careful scrutiny to which SFG's report has been subjected, and SFG's comprehensive response, gives the Tribunal confidence in those conclusions. [22]

28. The Tribunal went on to conclude that:

> The Tribunal is satisfied that SFG's March 2011 report is the best dividend drop-off study currently available for the purpose of estimating gamma in terms of the Rules.[23]

and

> The Tribunal finds itself in a position where it has one estimate of theta before it (the SFG's March 2011 report value of 0.35) in which it has confidence, given the dividend drop-off methodology. No other dividend drop-off study estimate has any claims to be given weight vis-à-vis the SFG report value.[24]

Final estimate of Gamma

29. Having determined that the appropriate distribution rate is 70% and that the best dividend drop-off estimate of theta is 0.35, the Tribunal multiplied these two estimates together to obtain a gamma estimate of 0.25:

> Taking the values of the distribution ratio and of theta that the Tribunal has concluded should be used, viz 0.7 and 0.35, respectively, the Tribunal determines that the value of gamma is 0.25.[25]

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[19] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010).
[20] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 16.
[21] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraphs 18-19.
[22] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 22.
[23] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 29.
[24] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 38.
[25] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 42.

30. In every subsequent case where the AER has had to determine a value for gamma, it has adopted a value of 0.25.

31. In the remainder of this report, I update the work that was provided to the Tribunal in the *Gamma case*.

3. Compilation of data

Initial data set

32. I begin with the sample of ex-dividend events that was used in the 2011 SFG Final Report for the Tribunal.[26] This sample consists of 3,107 observations from the period of July 2001 to September 2010. The construction of the sample is explained in detail in the 2011 SFG report.

Extend sample of ex-dividend events

33. I extend the sample of ex-dividend events from September 2010 to October 2012. To do this, I begin by identifying all ex-dividend events in each of two independent data bases – DatAnalysis and Thompson Reuters Tick History (**TRTH**). DatAnalysis is operated by Aspect Huntley, which is a wholly-owned subsidiary of Morningstar Inc. It is commonly used as the basis for papers published in the academic and practitioner literature relating to empirical finance. The TRTH database is compiled by Reuters and made available by the Securities Industry Research Centre of Asia-Pacific (**SIRCA**). This data is also commonly used as the basis for papers published in the academic and practitioner literature relating to empirical finance.

34. From each data base, I obtain records of all ex-dividend events for all firms listed on the Australian Securities Exchange (**ASX**). Information obtained includes the following fields:

    a) Company name;

    b) ASX ticker symbol (three digit code used by the ASX);

    c) Dividend amount;

    d) Currency in which the dividend was paid;

    e) Franking percentage (the proportion of the dividend that was franked);

    f) Ex-dividend date; and

    g) Type of dividend:

        i) Ordinary (interim, final, quarterly, or monthly);

        ii) Special-cash;

        iii) Special-scrip; or

        iv) Return of capital.

[26] See SFG (2011), Table 1, p. 14.

Apply preliminary screens and conversions

35. I then apply a number of preliminary screens, as follows:

    a) I eliminate observations where the dividend amount is missing (or set to zero) or where the ex-date is missing;

    b) I eliminate observations for which the ticker symbol has more than three letters, as this indicates that the security is not an ordinary share;

    c) I eliminate dividends that are defined to be a capital return or a special scrip dividend;

    d) I eliminate dividends with a currency defined to be "PCT." This indicates "per cent" rather than a currency and is used for in specie distributions rather than cash dividends;

    e) I eliminate all duplicate records. The TRTH database in particular contains a number of duplicated observations; and

    f) I eliminate all observations for which there was a corporate event/capitalisation change (such as a rights or bonus issue or other issuance or cancellation of shares) within five days of the ex-dividend event identified in the DatAnalysis Corporate Events file.

36. I convert all foreign currency dividends into Australian dollars using exchange rates provided by the Reserve Bank of Australia.[27] I retain a record of the dividend currency so that the drop-off analysis can be applied to samples that include, and exclude, foreign currency dividends.

37. In cases where a database indicates that the same company paid two different dividends with the same ex-date, I add those dividends to obtain a single record for each ex-date for each company. For example, if a company paid a 15 cent fully franked dividend and a 5 cent unfranked special dividend with the same ex-date, a single record is retained with:

    a) Dividend amount set to 20 cents; and

    b) Franking percentage set to $\frac{15}{20}\times 100+\frac{5}{20}\times 0=75$.

38. I retain a record of observations that have been summed in this manner so that the drop-off analysis can be applied to samples that include, and exclude, these summed observations.

Match ex-dividend events across databases

39. I then seek to match ex-dividend events from the two data bases on the following four fields:

    a) ASX ticker symbol/company identifier;

    b) Ex-dividend date;

[27] http://www.rba.gov.au/statistics/hist-exchange-rates/index.html?accessed=2013-06-07-12-31-03.

c) Australian dollar dividend amount; and

d) Franking percentage.

40. A number of observations match on ASX ticker symbol, ex-dividend date and dividend amount, but not franking percentage. In most of these cases, the franking percentage is missing in one of the databases. In these cases, I manually checked the ASX web site and company annual reports for franking percentage information. In cases where I was able to find two independent sources that agreed on the franking percentage, I treated the observation as a match.

41. Those observations that matched across databases were allocated to my "Matched" sample. Other observations were allocated to the "Unmatched DatAnalysis" or the "Unmatched TRTH" samples if data is available on the following fields:

a) ASX ticker symbol/company identifier;

b) Ex-dividend date;

c) Australian dollar dividend amount; and

d) Franking percentage,

otherwise they are eliminated from the sample.

Add ASX share price data

42. All observations in all three subsamples were then supplemented with additional data sourced from Datastream, which is commonly used as the basis for papers published in the academic and practitioner literature relating to empirical finance. The following data items were added to each observation:

a) The closing cum-dividend day stock price;

b) The closing cum-dividend day trading volume;

c) The closing ex-dividend day stock price;

d) The closing ex-dividend day trading volume;

e) The total return on the All Ordinaries Accumulation Index over the ex-dividend day;

f) The market capitalisation for the firm on the ex-dividend day;

g) The total market capitalisation for the All Ordinaries index on the ex-dividend day;

h) The mean of the daily excess returns (total stock return less All Ordinaries Accumulation Index return) computed over the year ending six trading days before the ex-dividend day; and

i) The standard deviation of the daily excess returns (total stock return less All Ordinaries Accumulation Index return) computed over the year ending six trading days before the ex-dividend day.

43. The mean and standard deviation of daily excess returns were calculated in the same way as in the 2011 SFG report:

a) **Mean excess return**: I use a period of one year, ending six days prior to the ex-dividend date, so that the historical period does not overlap with the ±5 day window around the ex-dividend date. The mean excess stock return was measured over the trading days beginning one year and six days prior to the ex-dividend day and ending six days prior to the ex-dividend day. The excess stock return for each day is defined as the stock return for a particular company *i* less the return on the All Ordinaries index. Formally, the mean excess stock return for company *i* at time *t* is defined as:

$$\overline{er}_{i,t} = \frac{1}{N}\sum_{j=1}^{N} er_{i,t-5-j}$$

where

$$er_{i,t} = r_{i,t} - r_{m,t},$$

and N represents the number of trading days over the relevant year-long period.

b) **Standard deviation of excess returns**: The volatility of excess stock returns was computed as the standard deviation of the excess stock return, measured over the same period. Formally, the volatility of excess stock returns for company *i* at time *t* is defined as:

$$\sigma_{i,t} = \sqrt{\frac{1}{N}\sum_{j=1}^{N}\left(er_{i,t-5-j} - \overline{er}_{i,t}\right)^2}.$$

Add other data fields

44. I then augment each observation with the following fields:

a) An indicator of whether the dividend was an ordinary or special dividend. In cases where a company paid an ordinary and special dividend with the same ex-date, the dividend is classified as special;

b) An indicator of whether the company made any announcement to the ASX on the cum-dividend day or the ex-dividend day that was classified as price sensitive. I obtain information about announcements and the classification of price sensitivity from the SIRCA company announcement file, which is a direct feed from the ASX;

c) A field that indicates whether the ASX classifies the security as:

i) ordinary shares of company;

ii) a listed fund;

iii) a real estate investment trust (REIT); or

iv) a stapled security; and

d) A field that indicates whether there was any capitalisation change for the firm within five days of the ex-dividend date, sourced from the SIRCA "dilutions" (capitalisation change) file.

4. Econometric methods

Primary data set

45. Our primary data set is compiled as follows:

a) I begin with my matched sample – a set of ex-dividend events for which all relevant items are consistent across the two independent data bases;

b) I eliminated observations where the stock did not trade on the cum-dividend day or the ex-dividend day;

c) I eliminated observations where there was a capitalisation change within five days of the ex-dividend date;

d) I eliminated observations where the company made an announcement that was classified as price sensitive on the cum-dividend day or the ex-dividend day;

e) I eliminated observations where the company in question had a market capitalisation that was less than 0.03% of the market capitalisation of the All Ordinaries index at the time of the ex-dividend date; and

f) I eliminated observations where the security in question falls into any one of the following categories: stapled securities; shares whose primary listing is overseas; CHESS depositary interests; CHESS units of foreign securities; or exchange-traded funds.

46. In compiling the primary data set in this manner, I am following the procedures adopted in the 2011 SFG study. The rationale for compiling the primary data set in this manner is to ensure that the required data exists and is timely and reliable and uncontaminated by material events that are unrelated to the payment of the dividend. The objective of this process is to produce a final estimate of theta that is as statistically reliable and precise as possible.

Robustness tests and sensitivity analysis

47. In addition to my primary data set, I also examined the following variations:

a) Different definitions of stock return volatility (variance and standard deviation) for the purposes of GLS estimation;

b) Including and excluding dividends paid in a foreign currency;

c) Including and excluding observations where the firm made an announcement that was classified as being price sensitive;

d) Including and excluding observations that appear in the DatAnalysis sample but did not match the TRTH sample (and which pass the other requirements set out above); and

e) Including and excluding observations that appear in the TRTH sample but did not match the DatAnalysis sample (and which pass the other requirements set out above).

Econometric models

48. As in the 2011 SFG study (and in accordance with Paragraph 12 of the 2011 Terms of Reference of that study) I estimated the parameters of the following model:

$$\frac{P_{i,t-1} - P^*_{i,t}}{D_i} = \delta + \theta \frac{FC_i}{D_i} + \varepsilon_i \qquad (1)$$

where $P_{i,t-1}$ is the cum-dividend stock price for observation i; $P^*_{i,t} = \frac{P_{i,t}}{1 + r_{m,t}}$ is the market-adjusted ex-dividend stock price (where $r_{m,t}$ is the return on the All Ordinaries index on day *t*); D_i is the amount of the dividend for observation i; and FC_i is the amount of franking credits associated with observation *i*.

49. The two parameters to be estimated are δ and θ where:

    a) δ represents the estimated market value of cash dividends as a proportion of their face value; and

    b) θ represents the estimated market value of distributed franking credits as a proportion of their face value.

50. The econometric model in Equation (1) was estimated using regression analysis applied to the final sample (and subsequently to the samples used for the purposes of robustness checks and sensitivity analysis). It was estimated using ordinary least squares, generalised least squares and robust regression methods.

51. Generalised least squares estimation involves multiplying all terms in the original econometric model by the same variable. This would be done if the researcher was concerned about a potential relationship between the variance of the residuals (ε_i) and a particular variable. Suppose, for example, that there is a potential relationship between the variance of the residuals in Equation (1) and dividend yield, $\frac{D_i}{P_{i,t-1}}$, such that the variance of residuals is inversely related to dividend yield. This would be the case if the model in Equation (1) provided a closer fit to the data and generally smaller residuals for observations with a higher dividend yield. If this were actually the case, the coefficient estimates in Equation (1) would be consistent and unbiased, but the usual procedures for conducting statistical inference (e.g., *t*-statistics) may be inaccurate.

52. Generalised least squares estimation is designed to eliminate any relationship between the variance of residuals and the variable in question. This is done by scaling every term in the original model by the variable in question. If, for example, all terms in Equation (1) are multiplied by dividend yield, $\frac{D_i}{P_{i,t-1}}$, then Equation (1) becomes:

$$\frac{P_{i,t-1} - P^*_{i,t}}{D_i} \times \frac{D_i}{P_{i,t-1}} = \delta \times \frac{D_i}{P_{i,t-1}} + \theta \frac{FC_i}{D_i} \times \frac{D_i}{P_{i,t-1}} + \varepsilon_i \times \frac{D_i}{P_{i,t-1}}$$

which is equivalent to:

$$\frac{P_{i,t-1}-P^{*}_{i,t}}{P_{i,t-1}}=\delta'\frac{D_i}{P_{i,t-1}}+\theta'\frac{FC_i}{P_{i,t-1}}+\varepsilon'_i\,. \tag{2}$$

53. The idea behind generalised least squares estimation in this example is that if the variance of the original residuals (ε_i) is inversely related to dividend yield, the scaled residuals (ε'_i) are not related to the dividend yield, and standard statistical inference can be performed (i.e., the *t*-statistics will be correct).

54. Consequently, Equation (2) can be thought of as GLS estimation of Equation (1), where the scaling variable is dividend yield, or as OLS estimation of a model in which the percentage stock return is regressed on dividend yield and franking credit yield.

55. The prior literature (e.g., Michaely, 1991; Bellamy and Gray, 2004) identifies dividend yield and stock return volatility as variables that might be related to the variance of the residuals in Equation (1) and I am not aware of any dividend drop-off analysis that uses GLS scaling variables other than dividend yield and stock return volatility. Other things equal, the magnitude of the residuals may be greater for high-volatility stocks because stock price changes tend to be greater for these stocks. In this case, the relevant GLS adjustment would be to scale by the inverse of the volatility of stock returns for the company in question. This adjustment would produce the following econometric specification:

$$\frac{P_{i,t-1}-P^{*}_{i,t}}{D_i\sigma_i}=\delta''\frac{1}{\sigma_i}+\theta''\frac{FC_i}{D_i\sigma_i}+\varepsilon''_i\,. \tag{3}$$

56. If both GLS adjustments are applied, the econometric specification is:

$$\frac{P_{i,t-1}-P^{*}_{i,t}}{P_{i,t-1}\sigma_i}=\delta'''\frac{D_i}{P_{i,t-1}\sigma_i}+\theta'''\frac{FC_i}{P_{i,t-1}\sigma_i}+\varepsilon'''_i\,. \tag{4}$$

57. In accordance with the Terms of Reference for the 2011 SFG study (Paragraphs 12 and 14), I estimate the four model specifications set out in Equations (1) to (4) above using OLS regression analysis, noting that the models in Equations (2) to (4) can be thought of as GLS estimates (with different scaling adjustments) of the basic model in Equation (1). In summary, I estimate each of the four models that are set out in Table 1 below. Even though I refer to the four specifications as "Models" 1 to 4 for convenience, I note that they are actually just different econometric specifications of the one model in which cash dividends and franking credits are posited as the only systematic factors in driving the ex-dividend day change in stock prices.

Table 1
Econometric models to be estimated

Model	Specification	Interpretation
Model 1	$\frac{P_{i,t-1} - P^*_{i,t}}{D_i} = \delta + \theta \frac{FC_i}{D_i} + \varepsilon_i$	Basic model.
Model 2	$\frac{P_{i,t-1} - P^*_{i,t}}{P_{i,t-1}} = \delta' \frac{D_i}{P_{i,t-1}} + \theta' \frac{FC_i}{P_{i,t-1}} + \varepsilon'_i$	GLS estimation of (1) with weighting variable dividend yield, $\frac{D_i}{P_{i,t-1}}$.
Model 3	$\frac{P_{i,t-1} - P^*_{i,t}}{D_i \sigma_i} = \delta'' \frac{1}{\sigma_i} + \theta'' \frac{FC_i}{D_i \sigma_i} + \varepsilon''_i$	GLS estimation of (1) with weighting variable inverse stock return volatility, $\frac{1}{\sigma_i}$.
Model 4	$\frac{P_{i,t-1} - P^*_{i,t}}{P_{i,t-1} \sigma_i} = \delta''' \frac{D_i}{P_{i,t-1} \sigma_i} + \theta''' \frac{FC_i}{P_{i,t-1} \sigma_i} + \varepsilon'''_i$	GLS estimation of (1) with weighting variables dividend yield, and inverse stock return volatility.

Estimation results

58. The results of my estimations are set out in Table 2 below. The key results are:

a) The point estimate of the value of a dollar of cash dividends ranges from 81 cents to 91 cents;

b) The point estimate of the value of a dollar of imputation credits ranges from 14 cents to 38 cents; and

c) The point estimate of the value of the package of a one dollar cash dividend and the associated 43 cent franking credit ranges from 87 cents to 104 cents.

59. I use two methods to estimate standard errors:

a) The White method for computing heteroscedasticity-consistent standard errors (which allows for unspecified heteroscedasticity in the residuals); and

b) A method that allows for clustering at the firm level (i.e., allows for the variance of residuals to differ by firms).[28]

60. The two methods produce standard error estimates that are similar in magnitude and generally indicate that the estimates of the value of cash dividends are significantly less than one and franking

[28] As mentioned previously I have reason to believe that standard errors vary systematically with firm characteristics, namely higher standard errors for volatile stocks with low dividend yields. I observe a number of firms appearing multiple times in examination of outliers. Hence, this is my preferred technique for estimating standard errors but I present White's (1984) adjusted standard errors for completeness. For a review of estimation techniques for standard errors refer to Petersen (2009).

credits are significantly greater than zero. The standard errors for the estimated value of a fully-franked dividend (i.e., the package of cash dividend and the associated franking credit) are considerably lower than the standard errors for the estimated values of cash or franking credits separately, meaning there is reliable evidence that the value of one dollar of a fully-franked dividend is approximately one dollar.

61. The R^2 statistics measure how much of the variation in the dependent variable is explained by variation in the independent variables. For Models (2) and (4), the R^2 statistics are substantial – 59% and 71% (respectively) of the variation in the ex-day percentage price change can be explained by variation in the cash dividend and franking credit.[29]

62. For Models (1) and (3), however, the explanatory power of the cash dividend is moved from the right-hand side of the regression to the left-hand side – the cash dividend appears only on the left-hand side as part of the dependent variable. For these models, the R^2 statistic must be interpreted as a measure of the extent to which the franking percentage is able to explain the ex-day price change – beyond that which can be explained by the cash dividend.

63. That is, for Models (2) and (4) the R^2 statistic measures the combined explanatory power of the cash dividend and the franking credit. For Models (1) and (3) it measures only the incremental explanatory power of the franking credits – the cash dividend is effectively given full opportunity to explain whatever it can of the ex-day price change and the R^2 statistic measures only what the franking credit can explain beyond this. Consequently, it would be wrong to compare R^2 statistics across models or to use them as a basis for selecting a preferred model.

[29] I refer to the *R*-squared statistic throughout, rather than the adjusted *R*-squared statistic, because the robust regression analysis considered later only generates an *R*-squared statistic and I want to present explanatory power on a consistent basis throughout.

Table 2
Estimation results: OLS/GLS estimation

Model 1			
	Estimate	**Std Err (White)**	**Std Err (Firm clustering)**
Cash	0.8133	0.0580	0.0729
Franking credits	0.1405	0.1546	0.1912
Package	0.8735	0.0298	0.0288
R-squared	0.0002		
Adjusted R-Squared	0.0000		
N	3,642		

Model 2			
	Estimate	**Std Err (White)**	**Std Err (Firm clustering)**
Cash	0.8193	0.0261	0.0311
Franking credits	0.3815	0.0704	0.0868
Package	0.9828	0.0164	0.0195
R-squared	0.5971		
Adjusted R-Squared	0.5968		
N	3,642		

Model 3			
	Estimate	**Std Err (White)**	**Std Err (Firm clustering)**
Cash	0.9098	0.0399	0.0480
Franking credits	0.1381	0.1080	0.1263
Package	0.9690	0.0200	0.0206
R-squared	0.0004		
Adjusted R-Squared	0.0002		
N	3,642		

Model 4			
	Estimate	**Std Err (White)**	**Std Err (Firm clustering)**
Cash	0.9136	0.0203	0.0209
Franking credits	0.3044	0.0557	0.0645
Package	1.0440	0.0139	0.0157
R-squared	0.7193		
Adjusted R-Squared	0.7192		
N	3,642		

Cash represents the estimated value of a one dollar cash dividend; *Franking credits* represents the estimated value of a one dollar franking credit; *Package* represents the estimated combined value of a one dollar cash dividend plus the associated 43 cent franking credit. The *package* value is estimated as the sum of the *cash* coefficient and 0.43 times the *franking credits* coefficient. The standard error for the *package* estimate is computed as a function of the standard errors of the *cash* and *franking credits* coefficients, and the correlation between them.

Robust regression estimates

64. In accordance with the Terms of Reference (Paragraphs 12 and 14) for the 2011 SFG study, I also estimate the four models set out in Equations (1) to (4) above using robust regression analysis. Robust regression analysis uses automated statistical adjustments to down-weight the influence of extreme data points or outliers. I use the SAS procedure ROBUSTREG to implement the MM robust regression method. The MM method was developed by Yohai (1987) and accounts for imprecision in the dependent and independent variables. Of the four alternative techniques available

in the ROBUSTREG procedure it provides the most comprehensive analysis of outliers. The application of these methods in the SAS package is explained in detail in Chen (2002).

65. When implementing the MM robust regression method in SAS, the user is able to over-ride default values and impose values for certain parameters. For example, the INEST option allows the user to impose a prior expectation for the values of the regression coefficients, rather than using values from a first stage estimation procedure. In my implementation, I use the default (neutral) values for all options.

66. The results of my estimation using the ROBUSTREG-MM procedure are summarised in Table 3 below. The estimates of theta for Models 2 and 4 are very similar to those reported in Table 2 above. The robust regression estimates of theta for Models 1 and 3 are higher than the estimates in Table 2, and more consistent with the estimates from Models 2 and 4.

67. The ROBUSTREG procedure available in SAS does not permit the calculation of White heteroscedastic-consistent standard errors or standard errors based on firm clustering. The procedure only allows for estimates of the standard covariance matrix of parameters. The result is that the "regular" standard errors in Table 3 are lower than the heteroscedastic-consistent and firm clustering standard errors reported in Table 2. This should not be seen as an improvement in the precision of estimates, but rather that a different definition of standard error is being reported.

Table 3
Estimation results: Robust regression

Model 1		
	Estimate	**Std Err**
Cash	0.8747	0.0309
Franking credits	0.2876	0.0820
Package	0.9980	0.0159
R-squared	0.0021	
N	3,642	
Model 2		
	Estimate	**Std Err**
Cash	0.8932	0.0234
Franking credits	0.3488	0.0630
Package	1.0427	0.0131
R-squared	0.5218	
N	3,642	
Model 3		
	Estimate	**Std Err**
Cash	0.9111	0.0213
Franking credits	0.2418	0.0580
Package	1.0147	0.0124
R-squared	0.0023	
N	3,642	
Model 4		
	Estimate	**Std Err**
Cash	0.9297	0.0150
Franking credits	0.3516	0.0420
Package	1.0804	0.0093
R-squared	0.6567	
N	3,642	

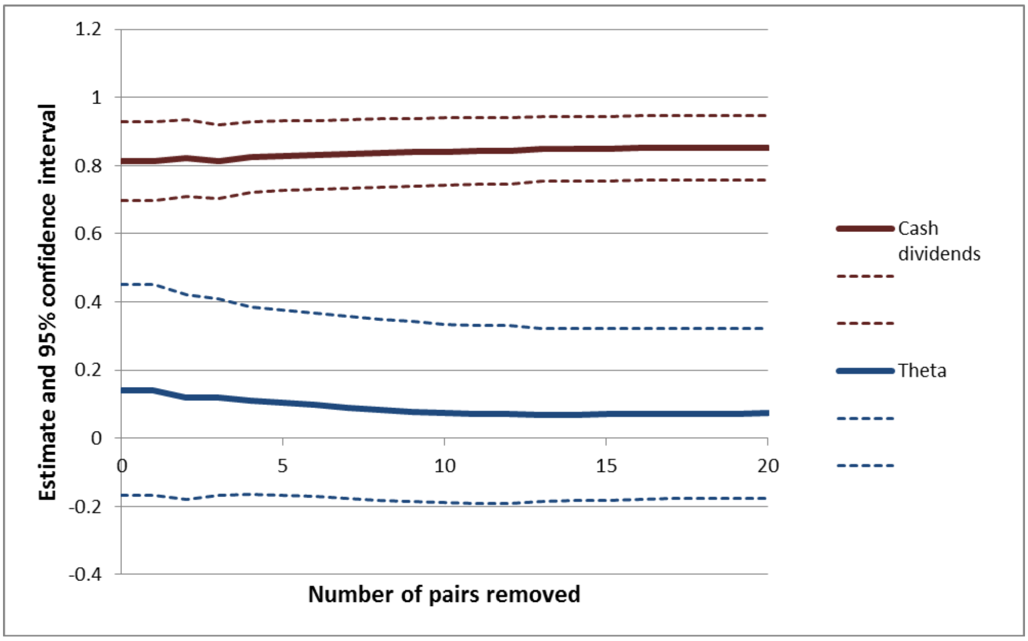
Cash represents the estimated value of a one dollar cash dividend; *Franking credits* represents the estimated value of a one dollar franking credit; *Package* represents the estimated value of a one dollar cash dividend plus the associated 43 cent franking credit.

Stability analysis: Robustness to influential observations

68. Our data compilation methods (e.g., eliminating from the sample very small firms or firms that do not trade on the cum-dividend and ex-dividend dates) are designed to eliminate outlier data points that are erroneous in some respect and which are likely to have a disproportionate influence on the estimate of theta. Even after having performed this screening and checking process, it is inevitable that some of the remaining data points will be more influential than others. Consequently, I have quantified the sensitivity of the estimates of theta to influential observations by conducting a stability analysis. I do this by first determining which single observation, if removed, would result in the greatest increase in the estimate of theta. I then determine which single observation, if removed, would result in the greatest decrease in the estimate of theta. I then remove both observations and re-estimate theta. I then repeat this process by removing another pair of observations. I continue in this manner, removing pairs of observations, until 20 pairs have been removed.

69. The results of applying this process to Model 1 are summarised in Figure 1. The solid lines represent the estimates of the value of cash dividends and theta, as indicated. In each case, the corresponding dashed lines represent the 95% confidence interval around the point estimate.

Figure 1
Sensitivity to removal of influential observations: Model 1



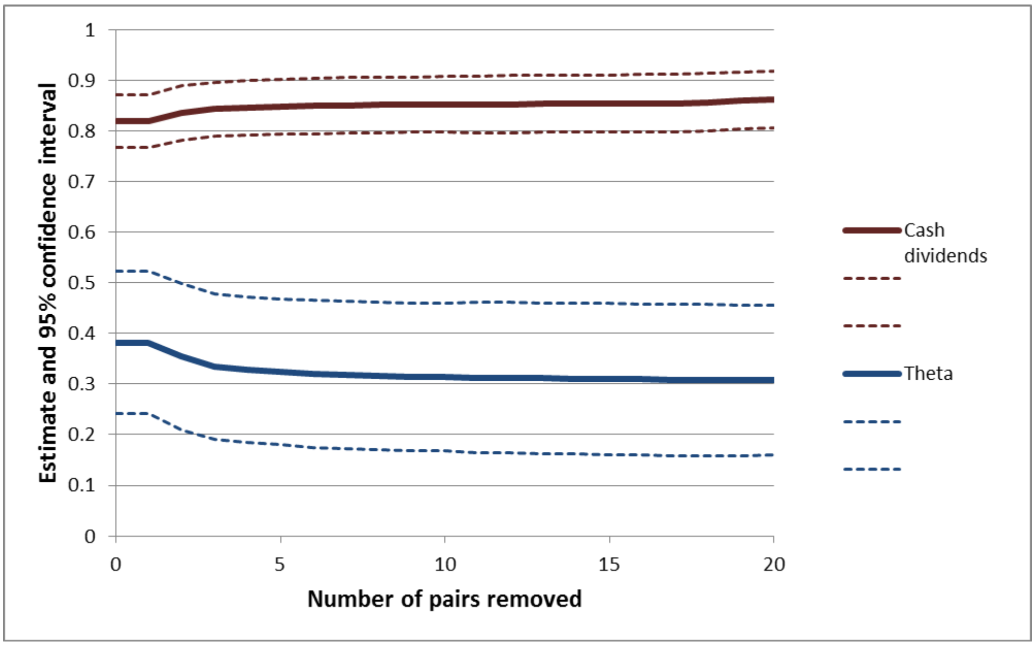
70. Figure 1 shows that the original point estimate of theta from Model 1 was 0.14. When the first pair of observations (i.e., one observation that would maximally increase the estimate of theta and one that would maximally decrease the estimate of theta) is removed, there is a negligible change in the point estimate of theta. As further pairs of observations are removed, the point estimate of theta falls marginally before levelling off at approximately 0.07.

71. The point estimates of the value of cash dividends move in the opposite direction. As pairs of influential observations are removed, the estimate increases slightly before settling at approximately 0.86.

72. The combined value of dividend plus franking credit is stable throughout, taking a constant value (between 0.873 and 0.883) whether the influential observations are included or excluded.

73. The result of applying the same process of removing pairs of influential observations to Model 2 is summarised in Figure 2 below. These results are similar to those for Model 1 above. The point estimate of theta falls slightly as the first pairs of influential observations are removed before stabilising at a constant level – approximately 0.31 in this case.

Figure 2
Sensitivity to removal of influential observations: Model 2



74. The stability analysis for Models 3 and 4 are set out in Figure 3 and Figure 4 respectively.

Figure 3
Sensitivity to removal of influential observations: Model 3

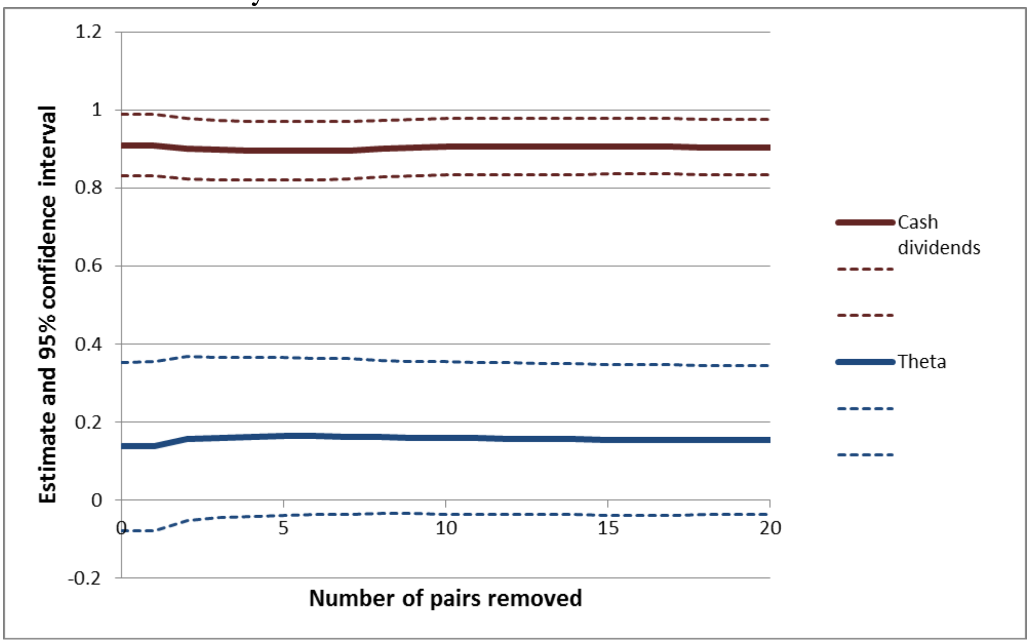
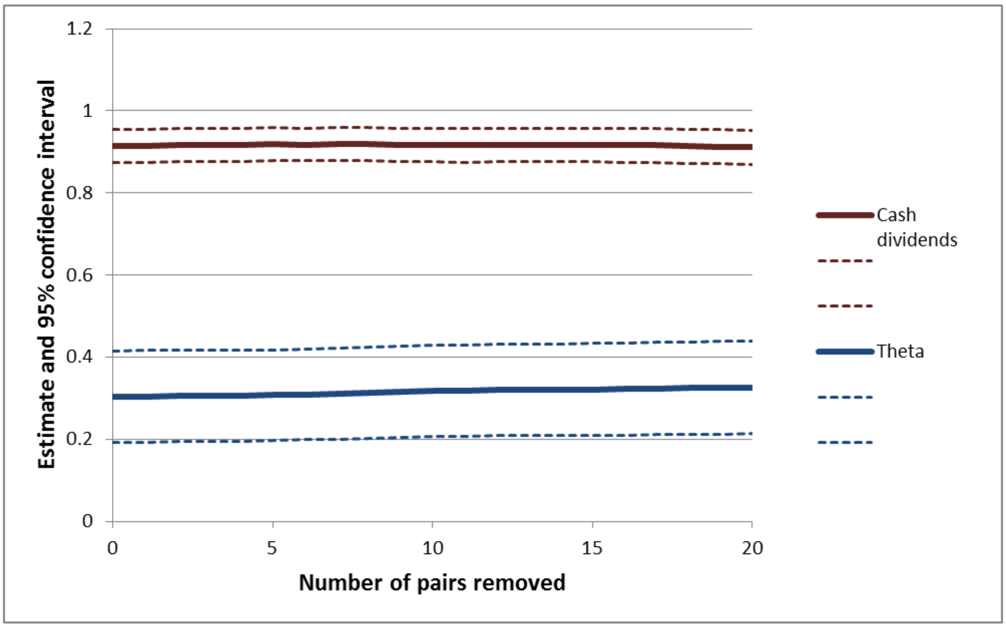


Figure 4
Sensitivity to removal of influential observations: Model 4



75. The stability analysis for Model 4, in Figure 4 above, shows that the estimates of the value of cash dividends, the value of theta, and the value of the combined package are very stable and robust to the removal of pairs of influential data points. That is, the estimates from Model Specification 4 are less sensitive to the effects of influential observations.

76. In summary, the stability analyses demonstrate that the estimates of theta are either maintained or slightly lowered when pairs of influential observations are removed from the data set.

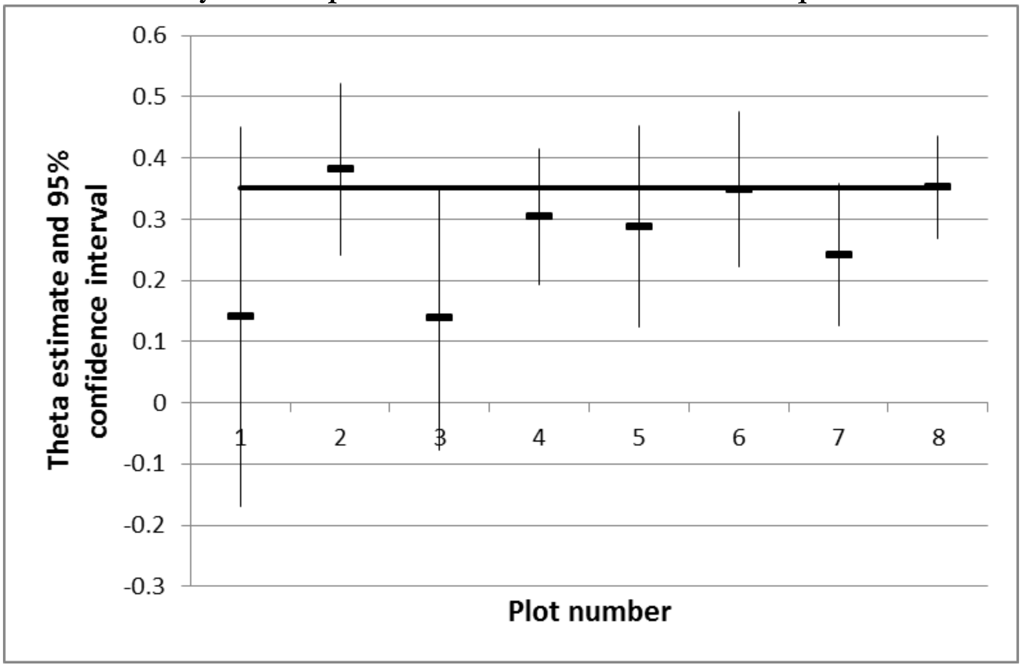
Sensitivity analysis

77. In this section, I examine the sensitivity of the results to variations in the model specifications, estimation methods, and construction of the data sets. In each case, I compare the theta estimate of 0.35 from the 2011 SFG study with the updated results.

0.35 is consistent with results from different model specifications and estimation techniques

78. I note that 0.35 lies within the standard statistical 95% confidence interval for all the estimations I have performed. I illustrate this in Figure 5 below, which shows that the 2011 SFG estimate of 0.35 is within the 95% confidence interval for every estimation. Figure 5 plots estimates for Model Specifications 1-4 estimated by OLS/GLS (Plots 1-4 in the figure) and then the corresponding robust regression estimates (Plots 5-8 in the figure). For none of these estimations can the proposed estimate of 0.35 be statistically rejected.

Figure 5
Summary of point estimates and confidence intervals for theta by model specification and estimation technique



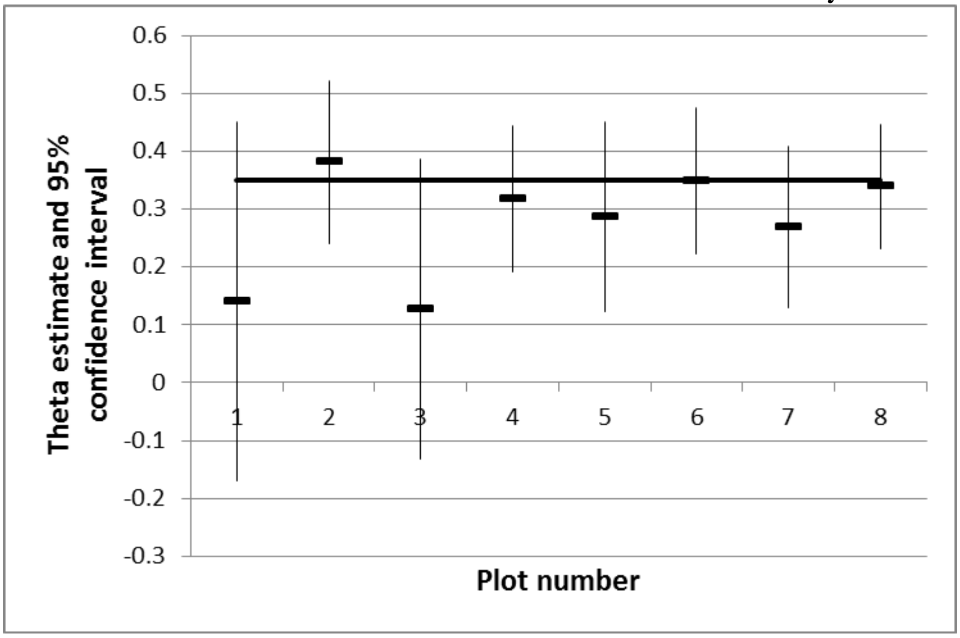
For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35.

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

0.35 is consistent with results from different measures of volatility

79. Model specifications 3 and 4 involve scaling by stock return volatility as part of the GLS estimation methodology. Volatility can be defined in terms of the standard deviation of stock returns or the variance of stock returns. Figure 6 shows that the estimates of theta are largely insensitive to the definition of volatility that is used – the estimates of theta from a particular model are immaterially different across definitions of volatility.

Figure 6
Summary of point estimates and confidence intervals for theta based on different definitions of stock return volatility



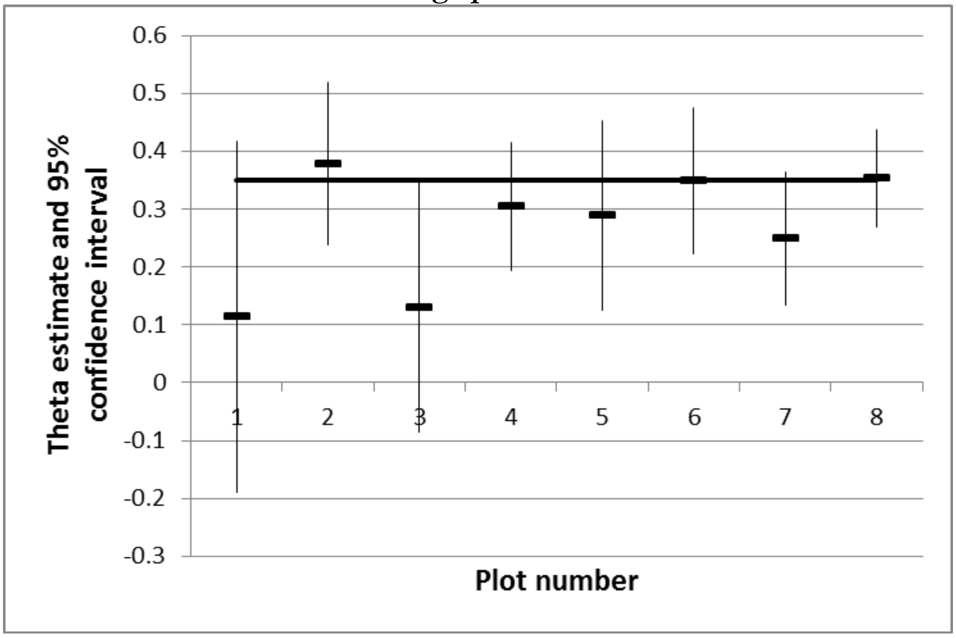
For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35. For all models, all observations for which the firm made a "market sensitive" announcement are removed.

Plot 1: Model specification 3, OLS, variance; Plot 2: Model specification 4, OLS variance;
Plot 3: Model specification 3, OLS standard deviation; Plot 4: Model specification 4, OLS, standard deviation;
Plot 5: Model specification 3, RR, variance; Plot 6: Model specification 4, RR, variance;
Plot 7: Model specification 3, RR standard deviation; Plot 8: Model specification 4, RR, standard deviation.

0.35 is consistent with results when special dividends are omitted

80. In my view, there is no conceptual reason to omit special dividends from the analysis, however the AER has previously expressed concern about their inclusion. Figure 7 shows that the estimates of theta are largely insensitive to the inclusion or exclusion of special dividends.

Figure 7
Summary of point estimates and confidence intervals for theta after omitting special dividends



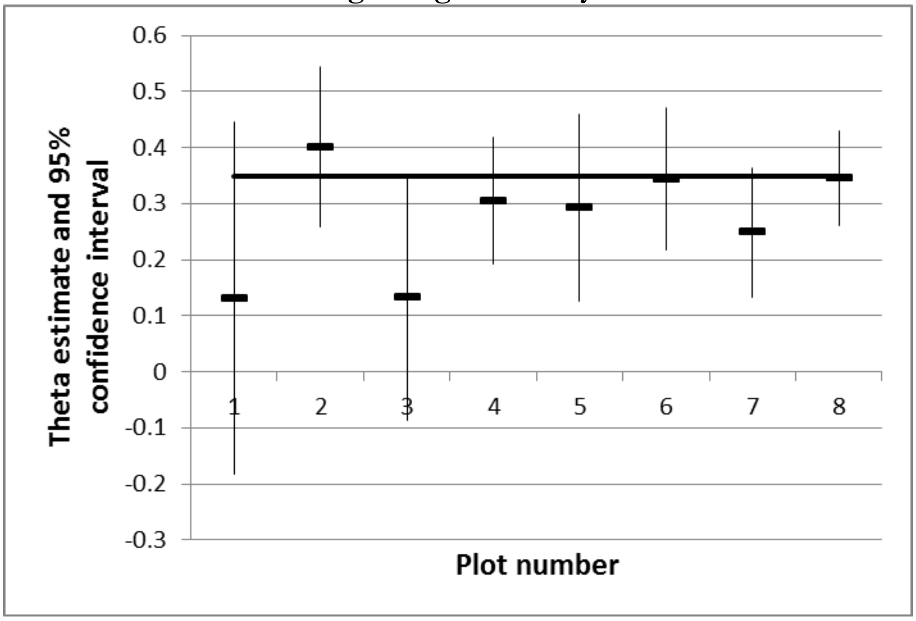
For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35.

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

0.35 is consistent with results when foreign currency dividends are omitted

81. Figure 8 shows that the estimates of theta are largely insensitive to the inclusion or exclusion of foreign currency dividends. The exclusion of 56 foreign currency dividends has no material effect on the estimates of theta.

Figure 8
Summary of point estimates and confidence intervals for theta after omitting foreign currency dividends



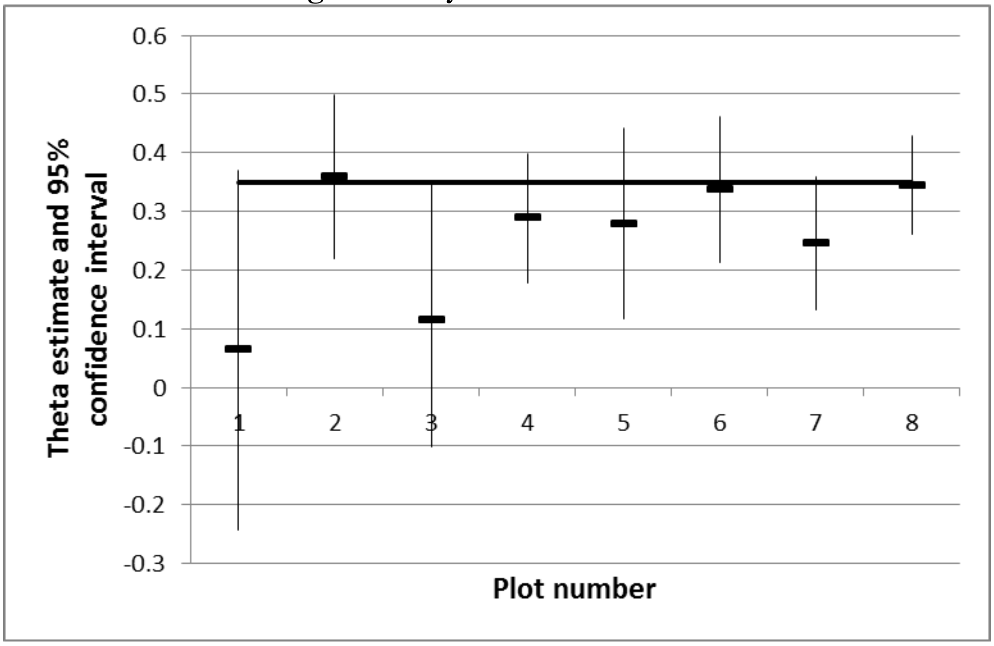
For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35.

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

0.35 is consistent with results when unmatched DatAnalysis dividend events are included

82. To ensure that the results are robust to the process used to identify ex-dividend events, I perform an analysis that includes the dividend events that appear in the DatAnalysis database, but which do not match a dividend event in the TRTH database. The inclusion of these 80 observations has no material effect on the results. Figure 9 shows that the estimates of theta are largely insensitive to the inclusion or exclusion of unmatched DatAnalysis dividend events.

Figure 9
Summary of point estimates and confidence intervals for theta including DatAnalysis unmatched dividends



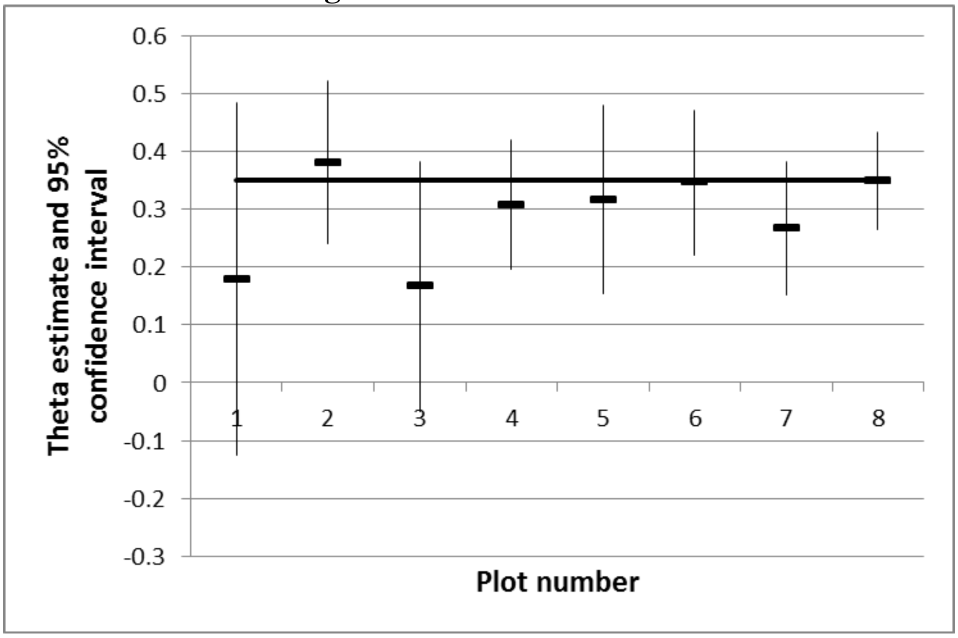
For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35.

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

0.35 is consistent with results when unmatched TRTH dividend events are included

83. To ensure further that the results are robust to the process used to identify ex-dividend events, I also perform an analysis that includes the dividend events that appear in the TRTH database, but which do not match a dividend event in the DatAnalysis database. The inclusion of these 113 observations has no material effect on the results. Figure 9 shows that the estimates of theta are largely insensitive to the inclusion or exclusion of unmatched TRTH dividend events.

Figure 10
Summary of point estimates and confidence intervals for theta including TRTH unmatched dividends

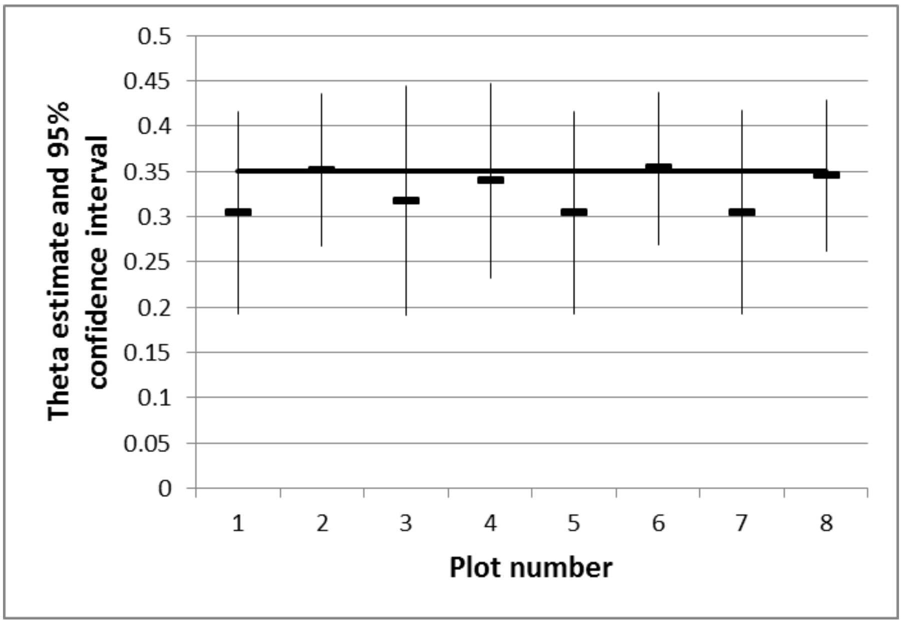


For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35.
Plot 1: Model specification 1, OLS estimation; Plot 2: Model specification 2, OLS estimation;
Plot 3: Model specification 3, OLS estimation; Plot 4: Model specification 4, OLS estimation;
Plot 5: Model specification 1, RR estimation; Plot 6: Model specification 2, RR estimation;
Plot 7: Model specification 3, RR estimation; Plot 8: Model specification 4, RR estimation.

0.35 is consistent with results for Model 4

84. The 2011 SFG report noted that the theta estimates from Model 4 tended to be the most stable across different sensitivity analyses and to have relatively smaller standard errors. Consequently, I collated those estimates into a single figure (Figure 11 in the 2011 SFG report). I follow that same practice with the updated data set and display the results in Figure 11 below, which shows that the proposed estimate of 0.35 is squarely within the confidence interval, and close to the point estimate of theta, in all cases.

Figure 11
Summary of point estimates and confidence intervals for theta for Model 4



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

Plot 1: Base case, OLS estimation; Plot 2: Base case, RR estimation;
Plot 3: Vol=Standard deviation, OLS estimation; Plot 4: Vol=Standard deviation, RR estimation;
Plot 5: No specials, OLS estimation; Plot 6: No specials, RR estimation;
Plot 7: No foreign currency dividends, OLS estimation; Plot 8: No foreign currency dividends, RR estimation.

5. Conclusions

85. The conclusion from the 2011 SFG study was that:

> For the reasons set out in detail in this report, we conclude that the appropriate estimate of theta from the dividend drop-off analysis that we have performed is 0.35 and that this estimate is paired with an estimate of the value of cash dividends in the range of 0.85 to 0.90.[30]

86. In my view, the conclusions from the earlier study remain valid when tested against the updated data set.

87. This report has been authored by Professor Stephen Gray. 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.

[30] SFG (2011), Paragraph 3.

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An appropriate regulatory estimate of gamma

Report for Jemena Gas Networks, ActewAGL, APA, Networks NSW (Ausgrid, Endeavour Energy and Essential Energy), ENERGEX, Transend, TransGrid and SA Power Networks

13 May 2014

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Contents

1. Background and conclusions

Overview and instructions

1. SFG Consulting (**SFG**) has been retained by Jemena Gas Networks, ActewAGL, APA, Networks NSW (Ausgrid, Endeavour Energy and Essential Energy), ENERGEX, Transend, TransGrid and SA Power Networks to provide our views on the estimation of the gamma parameter in the context of regulatory weighted-average cost of capital (**WACC**) estimation.

2. In particular, we have been asked to:

    a) Describe the conceptual economic / finance basis for accounting for the value of imputation credits when estimating the cost of corporate income tax as part of a post-tax building block revenue framework where the building blocks are as set out in rule 76 (for gas distribution and transmission), clause 6A.5.4(a) (for electricity transmission), and clause 6.4.3(a) (for electricity distribution);

    b) Assess each of the methods identified by the AER for estimating the value of imputation credits in the Rate of Return Guideline, as well as any other methods we consider to be relevant, in terms of:

        i) their suitability for estimating the value of imputation credits within the building block revenue framework, in light of the conceptual economic / finance basis for this parameter; and

        ii) the reliability and robustness of estimates produced by each method;

    c) Provide our opinion on the best method, or combination of methods, for estimating the value of imputation credits within the building block revenue framework; and

    d) Provide an estimate of the value of imputation credits, based on the recommended method, or combination of methods.

3. Our instructions are set out in Appendix 1 to this report.

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

5. My opinions set out in this report are based on the specialist knowledge acquired from my training and experience set out above.

6. I have read, understood and complied with the Federal Court of Australia Practice Note CM7 *Expert Witnesses in Proceedings in the Federal Court of Australia*.

Summary of conclusions

7. Our primary conclusions are set out below.

The economic role of gamma in the regulatory process

8. Gamma represents the value of imputation credits to investors. It determines the proportion of the return to shareholders that is assumed to come from imputation credits.[1]

9. The parameter estimates set out in the Guideline imply that the allowed revenue should be set so that the firm is able to provide 82% of the total return that is required by shareholders, the other 18% being assumed to come from the value of imputation credits. That is, the allowed return on equity is reduced by 18% in relation to the assumed value of imputation credits.

10. If shareholders value imputation credits less than the 18% reduction in their allowed return, they will be under-compensated for the risk they bear.

The economic role of theta in the regulatory process

11. Gamma is estimated as the product of the distribution rate (F) and the value of distributed credits (theta). This is standard regulatory practice.[2]

12. Theta represents the value (to the market) of a distributed imputation credit. It represents the extent to which a distributed credit is reflected in the share price.

The distribution rate

13. Our main conclusions in relation to the distribution rate are:[3]

    a) The accepted empirical approach consistently produces an estimate of 0.7;

    b) Standard Australian regulatory practice is to adopt a distribution rate of 0.7;

    c) All stakeholders have proposed a distribution rate of 0.7;

    d) The Lally small sample approach should receive no weight because:

        i) It produces highly variable estimates over time, including materially different recommendations two days apart, whereas the accepted approach produces stable estimates;

        ii) The Lally approach is motivated only by unspecified problems with the ATO data. Whereas there are known to be problems with ATO dividend flow data, no issues have been raised in relation to the franking account balance data that is used to estimate the distribution rate; and

        iii) The small sample of firms used in the Lally approach are not indicative of either the average firm or the benchmark regulated firm; and

    e) For the reasons set out above, we concur with the distribution rate of 0.7 that is proposed in the Guideline.

[1] See Section 2 of this report.
[2] See Section 2 of this report.
[3] See Section 3 of this report.

Value vs. redemption

14. Investors are likely to value imputation credits at less than their face value for a number of reasons:[4]

    a) Credits that are not redeemed (because they are distributed to non-residents, or they are excluded by the 45-day rule, or any other reason) are clearly of no value;

    b) The redemption of credits requires certain administrative costs;

    c) The redemption of credits involves a material time delay before payment is made;

    d) Like dividends, imputation credits are taxed at the shareholder's marginal rate; and

    e) The acquisition of imputation credits comes at the cost of foregone diversification opportunities.

15. If the redemption rate is used in the regulatory setting, and if the redemption rate is greater than the value of credits, this must lead to investors being under-compensated. This is because the reduction in the allowed return, which is based on the redemption rate, exceeds the value of the imputation credits that are received by shareholders.

The use of redemption rates via the equity ownership approach and ATO tax statistics

16. Our conclusions in relation to redemption rate estimates of theta are as follows:

    a) The redemption rate is the ratio of redeemed credits to distributed credits and can be estimated in two ways:

        i) Using aggregate tax statistics published by the ATO relating to the distribution and redemption of imputation credits; and

        ii) By estimating the proportion of Australian shares that are held by resident investors, and assuming that those resident investors will redeem any imputation credit they receive;

    b) If theta is interpreted as the value of a distributed credit, redemption rates cannot be used to estimate theta. The Tribunal has ruled that redemption rates cannot be used to estimate the value of a distributed credit;

    c) ATO tax statistics are unable to produce a precise estimate of the redemption rate due to data quality issues. However, this data suggests a range of 44% to 62%;

    d) Equity ownership estimates of the redemption rates are also highly unreliable. In particular, the 70% domestic ownership estimate that appears in the Guideline should not be relied upon because it is based on data from 2007, when the foreign ownership of Australian shares was at a temporary ebb. The same ABS data source that produced the 2007 estimate now produces an estimate of 55% domestic ownership. This estimate has been confirmed in ASX estimates of the proportion of domestic ownership in 2011 and again in 2013.[5]

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[4] See Section 2 of this report.

[5] The ASX reports an estimate of 54% domestic ownership.

Empirical estimates using observed prices from the market

Dividend drop-off studies

17. The AER concludes that the most relevant dividend drop-off studies are those by SFG (2011, 2013) and Vo et al (2013), and that the most relevant results from Vo et al are those that apply the standard market correction. SFG report a theta estimate of 0.35. The Vo et al estimate (using the standard market correction) is 0.34.

18. In our view, to the extent to which there is any difference between the two studies, there are two reasons to prefer the SFG studies to the Vo et al study:

    a) The SFG approach has been subjected to intense scrutiny. All data and computer code was supplied to the AER. All issues that the AER has identified have been considered by the Tribunal. And the Tribunal has endorsed and adopted the results. By contrast, the Vo et al study has not been subjected to such scrutiny;[6] and

    b) The SFG theta estimates have been shown to be stable and reliable in the face of a battery of stability and robustness checks, whereas Vo et al express concerns about the stability and reliability of its own results.

19. In any event, there is little evidence to support the Vo et al mid-point estimate of 0.45 from within its range of 0.35 to 0.55:

    a) The Vo et al estimates are overwhelmingly below 0.45 and a significant proportion of those estimates are below 0.35;

    b) The Vo et al study reports a theta estimate of 0.34 when the standard ex-day market correction is applied;

    c) The Vo et al estimate increases only to 0.4 when the standard ex-day market correction is removed; and

    d) The SFG (2013) estimates indicate that, if anything, the 0.35 estimate is towards the upper end of the reasonable range.

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

Other empirical evidence

21. In all of the alternative market value studies over the last five years, the authors have concluded that the evidence supports an estimate of theta between 0 and 0.35.[7]

The “conceptual goalposts” test

22. The “conceptual goalposts” test posits that the allowed return on equity should be set between two theoretical extremes:

[6] Although we understand that the Vo et al (2013) study has been submitted to an academic journal for publication.

[7] See, for example, the list of studies set out in AER Rate of Return Guideline, Explanatory Statement, Appendix H, Table H.8, pp. 173-174.

a) The allowed return on equity in a perfect segmentation world; and

b) The allowed return on equity in a perfect integration world.

23. Implementation of the conceptual goalposts test requires estimates of all return on equity parameters as they would be under perfect segmentation and under perfect integration. The task of estimating these parameters in the real world, where observable data is available, is involved and complex. The task of estimating what these parameters *would be* if no foreign investment was allowed, and what they *would be* if markets were perfectly integrated is impossible.

24. Setting aside the estimation problems, one of the most important aspects of the conceptual goalposts test is the assumption that the risk-free rate would not change in a segmented market. That is, the government bond yield would remain the same if all foreign investors (who currently own 80% of all Australian government bonds) were banned from investing. In our view, this assumption is untenable.

25. Moreover, if the perfect segmentation risk-free rate is increased by just 1% above the perfect integration risk-free rate, the empirical estimates based on market data pass the conceptual goalposts test.

26. In our view, the conceptual goalposts test is not fit for any purpose, let alone the purpose of excluding all of the available empirical evidence.

Estimates of theta and gamma

27. As set out above, neither redemption rates nor the conceptual goalposts test can be used to estimate theta. The only appropriate way to estimate theta is via the empirical analysis of observed market prices (the same way all other WACC parameters are estimated).

28. The empirical methods produce estimates of theta in the range of 0 to 0.35. We adopt an estimate of 0.35, based primarily on the results of the SFG (2011, 2013) studies that use an accepted methodology that has been accepted by the Tribunal.

29. Relative to the alternative market value studies, dividend drop-off analysis has a longer history, has been subjected to a higher level of scrutiny (especially the SFG 2011 study), and the strengths and weaknesses of the approach, and the econometric issues, are better understood. Consequently, we maintain a theta estimate of 0.35 – from dividend drop-off analysis – in this report noting that this is a conservative estimate in that the other relevant evidence produces lower estimates.

30. In our view the 70% estimate of the distribution rate is uncontroversial.

31. The product of these two components produces an estimate of gamma of 0.25. In our view, this remains the best available estimate of gamma.

Market practice

32. There is clear evidence that the dominant market practice is to make no adjustment for imputation credits, but rather to consider that the firm must generate the entire return that investors require and that there is no reduction due to imputation credits.

33. If one disregards this evidence on the basis that there is a "conventional" or "classical" approach that can be used to estimate the ex-imputation required return on equity without requiring an estimate of gamma, the estimate from that other approach should at least be compared with the corresponding

estimate from the regulatory approach. Good regulatory practice would then involve the regulator explaining why its estimate of the ex-imputation required return on equity (which forms the basis of the allowed revenue) differed from the "conventional" estimate.

Conceptual definition of theta

34. On the issue of the conceptual definition of theta, we conclude that:

a) The AER is alone in its conceptual interpretation of theta:

i) Prior to the current Guideline, the practice of all regulators was to interpret theta[8] as the value (to the market) of distributed imputation credits;

ii) This remains the practice of all other regulators;

iii) The AER now proposes to refer to theta as "the utilisation rate" and to conceptualise it as "the extent to which investors can use the imputation credits they receive to reduce their personal tax"[9];

b) None of the AER's proposed reasons for its conceptual redefinition of theta are valid, or supported by the advice that it has received:

i) The AEMC Rule change (which now specifically defines gamma to be "the value of imputation credits") does not support the AER's new conceptual definition. It seems clear that the intention of the AEMC was simply to tidy up the Rule to properly reflect the longstanding regulatory practice of adopting a market value interpretation of theta and gamma. The Rule change is quite inconsistent with the notion that the longstanding *value* interpretation should be replaced by a different interpretation;

ii) McKenzie and Partington (2013) identify two possible interpretations for theta – the standard value interpretation and the AER's utilisation interpretation. They express no opinion about which interpretation is correct or which should be preferred. However they do note that the "standard practice has been to measure the market value of theta"[10] and in a subsequent report they have stated that "theta is the value to the investor of the imputation credits distributed."[11];

iii) Handley (2008) has advised the AER that his redemption rate study provides a reasonable estimate of the utilisation of imputation credits, but that the utilisation of credits cannot be used to produce an appropriate estimate of gamma. Handley advises that since theta represents the value (to the market) of imputation credits, and since redemption rates provide only an upper bound for that value, they can only be used to produce an upper bound and not a point estimate;

iv) Officer (1994) refers to theta in terms of both value to shareholders and utilisation. However, the formulas and numerical calculations show, unambiguously, that gamma has a *value* interpretation whereby gamma represents the increase in the *value* of equity due to imputation credits, expressed as a proportion of the face value of imputation credits;

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[8] Or whatever term is used for "the parameter that must be multiplied by F to obtain gamma."
[9] AER Rate of Return Guideline, Explanatory Statement, p. 159.
[10] McKenzie and Partington (2013), p. 32.
[11] McKenzie and Partington (2013), p. 31.

v) The AER cites part of a paragraph of Hathaway and Officer (2004) as supporting its proposed interpretation of theta. However, the AER has misconstrued the point that was being made, which is simply that gamma is the product of the distribution rate and theta. The remainder of the same paragraph endorses the standard value interpretation of theta: "Gamma is not the value of distributed credits alone. It is the compounding of two factors – the fraction of tax distributed as credits multiplied by the *value of distributed credits*."[12]; and

vi) Lally (2013a) advises the AER that theta can be estimated as the weighted-average utilisation rate *only under certain assumptions*, which do not hold in the AER's framework. Indeed, Lally is highly critical of the AER for continuing to estimate theta as the weighted-average utilisation rate even though it departs from the assumptions that are required for that result to hold.

[12] Hathaway and Officer (2004), p. 7.

2. The role of gamma in the regulatory process

The definition of gamma under the Rules

35. The National Gas Rules and National Electricity Rules define gamma to be the value of imputation credits:

> γ is the value of imputation credits.[13]

Gamma determines the allowed return to shareholders

36. Under the Australian regulatory framework, the gamma parameter plays the role of determining:

    a) What proportion of the total return to equity must come from allowed revenues; and

    b) What proportion of the total return to equity is assumed to come from dividend imputation tax credits.

37. In particular, the proportion of the total return that is assumed to come from allowed revenues is:

$$\frac{1-T}{1-T(1-\gamma)}$$

where T is the corporate tax rate, the balance being assumed to come from the value of imputation credits.

38. By way of example, the Guideline proposes that γ = 0.50, which (together with a corporate tax rate of 30%) implies that 82%[14] of the total return to equity comes from allowed revenues and 18% is assumed to come from imputation credits. For example, suppose that the total required return on equity is 10%. The parameter estimates set out in the Guideline imply that the allowed revenue should be set so that the firm is able to provide a return of 8.2% to its shareholders, the other 1.8% being assumed to come from the value of imputation credits.

39. That is, every dollar of value that is ascribed to imputation credits reduces the regulatory allowed return to equity by a dollar. For example, consider a regulated firm with \$100 of equity capital in its regulatory asset base (RAB) and an allowed return on equity of 10%. This implies that equity holders require a return of \$10. If the regulator determines that the imputation credits received by shareholders are valued at \$1.80 (consistent with the parameter values proposed in the Guideline), the regulator will allow the firm to charge prices that enable it to pay a return of \$8.20 to shareholders.

40. In this case, shareholders lose \$1.80 of value from the return provided by the firm, but are assumed to gain \$1.80 of value from the imputation credits that they receive. That is, shareholders are assumed to be indifferent between:

    a) Receiving a return of \$10 from the firm; or

    b) Receiving \$8.20 from the firm and imputation credits that they value at \$1.80.

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[13] NER cls. 6.5.3, 6A.6.4 (current since version 53); NGR r. 87A(1) (current since version 14).

[14] $\frac{1-T}{1-T(1-\gamma)}=\frac{1-0.3}{1-0.3(1-0.5)}=0.82$.

41. In summary, the role of gamma in the regulatory process is to determine the *value* of imputation credits, such that this value can be deducted from the return that the regulated firm is able to pay to its shareholders.

42. By way of analogy, a casual fruit shop employee may be indifferent between receiving a \$100 wage or a \$90 wage and fruit that is worth \$10 to them. They are unlikely to be indifferent between a \$90 wage and 10 *grams* of fruit, or 10 *pieces* of fruit, or even a fruit basket that has a marked price of \$10 but which is not worth \$10 to *them*. If their pay is being reduced by \$10, they will need as compensation something that has equivalent monetary *value* to them.

43. The same applies in the regulatory setting. The estimate of gamma determines the amount of reduction in the monetary return that is paid to shareholders. It should be set to equate the monetary *value* of imputation credits with the monetary reduction in the allowed return that is paid to shareholders. Thus, the regulatory task is to determine the monetary value of imputation credits and to then reduce the allowed return on equity by that same monetary value.[15]

44. In our view, the relevant task in the regulatory setting is to:

    a) Determine the required return on equity having regard to all relevant evidence and the prevailing conditions in the market for equity funds; and to then

    b) Determine how much of that required return can be obtained from imputation credits, having regard to all relevant evidence and the prevailing conditions in the market for equity funds; and to then

    c) Set allowed prices so that the firm will be able to pay to its shareholders a return that is equal to the difference between (a) and (b) above.

45. In other words, gamma determines the *price* that shareholders would be prepared to pay to buy imputation credits. In the example above, shareholders are assumed to be willing to pay \$1.80 (by receiving a return that is \$1.80 lower than it would otherwise be) for the imputation credits that they receive. The regulator needs to determine the dollar value that shareholders would ascribe to imputation credits, and then reduce the return that they receive from the regulated firm by that amount. If the regulator reduces the allowed return by more than the true value of the credits, shareholders will end up being under-compensated. Conversely, if the regulator reduces the allowed return by less than the true value of the credits, shareholders will end up being over-compensated. Neither of these outcomes is appropriate.

46. In our view, it is clear that gamma represents the value (or worth or price) that shareholders ascribe to imputation credits. The only question then is how to best estimate that value.

General framework

47. The standard approach is to estimate gamma as the product of two parameters:

$$\gamma = F \times \theta$$

[15] The ENA (2013) submission contains a detailed explanation of this issue, including a fully-worked numerical example. See ENA (2013), *Response to the Draft Rate of Return Guideline of the Australian Energy Regulator*, 11 October, pp. 137-140.

where F represents the distribution rate and θ (**theta**) represents the value of a distributed imputation credit.[16]

48. Australian companies generate imputation credits via the payment of Australian corporate tax. Every dollar of corporate tax payment creates a dollar of imputation credits. These credits can then be distributed to shareholders by attaching them to dividends in the ratio of $\frac{T}{1-T}$ credits for every dollar of dividends, where T is the corporate tax rate. At the current 30% tax rate, 43 cents of credits can be attached to every dollar of dividends.[17]

49. To distribute all of the credits that are created in a given year, the firm would have to pay out 100% of its Australian profits as a dividend. For example, a company that earned a pre-tax profit of $100 would pay $30 of corporate tax, thus creating $30 of imputation credits. If it then paid out the entire post-tax profit of $70 as a dividend, it could attach $\frac{0.3}{1-0.3}\times 70=\$30$ of credits.

50. Of course, companies do not generally distribute 100% of their post-tax profits as dividends – they retain some profits for purposes such as financing future capital expenditure. In this case, some of the credits that are created will not be distributed. The distribution rate (*F*) represents the proportion of created credits that are distributed. We show in Section 3 of this report that there is widespread agreement that an appropriate estimate of this parameter is 70% – on average 70% of the credits that are created are attached to dividends and distributed to shareholders and 30% are not distributed.

51. The second parameter, theta, represents the value that shareholders place on those credits that *are* distributed. We expand upon the definition of the "value" of distributed imputation credits in the remainder of this section below. At this point, we simply note by way of example that if 70% of created credits are distributed, and if those distributed credits are valued at, say, 35% of their face value, the appropriate estimate of gamma would be:

$$\gamma = F \times \theta = 0.7 \times 0.35 = 0.25.$$

52. Defining gamma to be the product of two sub-parameters in this way is generally accepted. This approach was adopted by the AER in its 2009 WACC Review, it is consistent with the approach currently used by other regulators.

The role and definition of theta

Theta determines the extent to which imputation credits are reflected in stock prices

53. In a dividend imputation tax system, investors receive three potential benefits from owning shares:

    a) Dividends;

    b) Capital gains; and

    c) Imputation credits.

16 This standard approach is also adopted in the Guideline. See AER Guideline, p. 23. The Guideline refers to *F* as the "payout ratio" and to theta as the "utilisation rate."

17 $\frac{0.3}{1-0.3}=0.43.$

54. For example, an investor who bought a share today could sell it after one year at the market price at that time, and would also receive the benefits of any dividends and imputation credits that were paid during the course of the year. In this setting, the current stock price can be written as the present value of:

a) The expected stock price at the end of the year;

b) Any dividends paid during the year; and

c) The value of imputation credits distributed during the year.

55. For example, in his recent report for the AER, Lally (2013)[18] notes that the current stock price can be written as the present value (over the next year) of dividends, imputation credits and the end-of-year stock price:[19]

$$S_0 = \frac{Div_1 + \theta \times IC_1 + S_1}{1 + r_e}$$

where IC_1 represents the (per share) imputation credits that are distributed to shareholders.

56. This expression makes it clear that θ represents the extent to which the value of distributed imputation credits is reflected in the current stock price. That is, theta represents the extent to which the *value* of the stock price is higher as a result of the imputation credits that are to be distributed: Theta is the extent to which distributed imputation credits are capitalised into the stock price. For example, if the firm distributed a $1 imputation credit, and if the pending receipt of this credit caused the stock price to be 35 cents higher than it would otherwise have been, theta is 0.35.

57. Moreover, we show in Appendix 3 to this report that the proportion of the firm's equity market capitalisation that is due to imputation credits is:[20]

$$\frac{\theta T}{1 - T(1 - \theta)}.$$

58. For example, the parameter values proposed in the Guideline suggest that approximately one quarter of the value of the entire Australian market (more than $300 billion of the $1.5 trillion total market capitalisation) is attributable to imputation credits:

$$\frac{\theta T}{1 - T(1 - \theta)} = \frac{0.7 \times 0.3}{1 - 0.3(1 - 0.7)} = 23\%,$$

[18] Lally, M., 2013, *The Estimation of Gamma*, Report for the AER, 23 November.

[19] See Lally (2013a), Equation 3, p. 10. Note that we use θ rather than U and r_e rather than $R_f + \phi\beta_e$. We also define the post-tax cash flow to shareholders to be "dividends" so that $Div_1 = Y_1 - TAX_1$.

[20] To see this, note that for every dollar of dividends (which are assumed to be fully reflected in the stock price under the assumption that cash dividends are valued at 100% of face value), there will be $\frac{T}{1-T}$ dollars of imputation credits, which are valued at $\$\theta$ each. Thus, for every dollar of dividends, there are imputation credits that have a value of $\frac{\theta T}{1-T}$. Consequently, the imputation credits account for a relative proportion of $\frac{\theta T/1-T}{1+\theta T/1-T} = \frac{\theta T}{1-T(1-\theta)}$. A more formal derivation of this expression is set out in Appendix 3 to this report.

which is too high to be considered plausible.

Regulatory practice

59. The practice that has always been adopted by Australian regulators is consistent with theta representing the value of distributed imputation credits – the extent to which they are capitalised into the stock price.

60. For example, in its 2009 WACC Review, the AER stated that:

> θ (theta) is the per dollar value of a distributed credit.[21]

61. In its current Guideline materials the AER notes that it has previously:

> adopted the market value definition of the utilisation rate[22]

and evaluated all evidence:

> relative to the market value approach.[23]

62. Interpreting theta as the market value of a distributed credit is also the approach that is currently adopted by all other regulators. For example, in its recent Guideline under the NER and NGR, the ERA defines theta to be:

> …the market value of imputation credits distributed as a proportion of their face value (θ).[24]

noting that:

> This approach is widely accepted by Australian regulators.[25]

63. In addition, in its recent WACC Review IPART stated that:

> imputation credits have *value* to equity owners and this *value* is reflected in our revenue determination process.[26]

64. IPART also stated that the proportion of the total return that is assumed to come from allowed revenues is:

$$\frac{1-T}{1-T(1-\gamma)}$$

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[21] AER 2009 WACC Review Final Determination, p. 414.
[22] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 139.
[23] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 139.
[24] ERA Rate of Return Guideline, Explanatory Statement, Paragraph 922.
[25] ERA Rate of Return Guideline, Explanatory Statement, Paragraph 922.
[26] IPART 2013 WACC Review, p. 17, emphasis added.

with the balance being assumed to come from the value of imputation credits.[27]

The difference between the redemption rate and the value of distributed credits

65. There are a number of reasons why the value of distributed imputation credits that is reflected in share prices may be less than the face value of those credits, including:

    a) Some of the credits that are distributed to shareholders are never redeemed. There are, in turn, a number of reasons why a distributed credit might not be redeemed, including:

        i) Credits distributed to non-resident investors cannot be redeemed under the dividend imputation legislation;

        ii) Credits distributed to resident investors who sell the shares within 45 days of their purchase cannot be redeemed;[28] and

        iii) Some credits distributed to resident investors are not redeemed because some investors fail to keep the required records and simply do not claim them. For example, Handley and Maheswaran (2008) report that, on average 8% of the credits distributed to resident individuals are never redeemed.[29]

    b) There is a time delay in obtaining any benefit from imputation credits. Whereas dividends are available to the investor as soon as they are paid, the imputation credits that are attached to that dividend only have value after the investor's end-of-year tax return is filed and processed. This time delay can be in the order of two years for a credit that is distributed directly from a company to an individual shareholder. The time delay can be even greater when credits are distributed through other companies or trusts;

    c) There are administrative costs involved in the redemption of imputation credits. The investor must maintain records of all credits that are received and redeem them by preparing the necessary schedules for the investor's tax return. This involves time and expenses such as accountant fees. By contrast, when an investor buys shares, they provide bank account details and all dividends are automatically transferred into that account without any action required of the investor. That is, it is more costly to convert imputation credits into value;

    d) Imputation credits are taxed as income in the same way that dividends are taxed. When an investor receives a franked dividend, their taxable income is increased by the amount of the dividend plus the face value of the credit. Both components are then taxed at the investor's marginal tax rate; and

    e) If dividend imputation leads resident investors to hold more domestic dividend-paying shares than they otherwise would (because they are attracted by the possibility of receiving imputation credits) their portfolios will become more concentrated and the resulting loss of diversification comes at a cost. A rational investor would continue to increase the concentration of their portfolio until the marginal benefit of the last imputation credit

[27] IPART 2013 WACC Review, p. 17.

[28] The so-called "45 day Rule" took effect in July 1997. It prevents resident investors from redeeming imputation credits unless they own the shares for 45 days around the payment of the relevant dividend.

[29] This figure includes credits that are not redeemed due to the 45-day Rule and credits that are not redeemed because the shareholder has taxable income below the tax-free threshold. The latter is likely to be immaterial as it is unlikely that a material proportion of shares are owned by residents whose income is below the tax-free threshold.

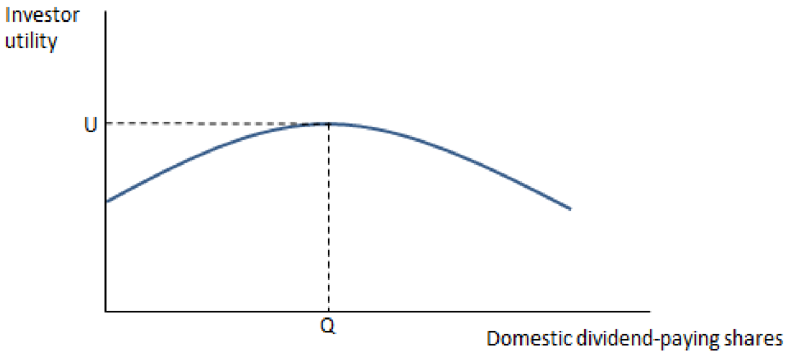
equalled the marginal cost of losing diversification. That is, the last imputation credit would be of no net benefit.[30]

66. This last point about portfolio diversification is particularly important and has been recognised by Lally (2013) and other regulators:

> The ERA (2013, page 5) goes even further and asserts that even domestic investors would value franking credits less than their face value because they must incur risk, pay transaction costs, and sacrifice international diversification opportunities by purchasing Australian stocks with imputation credits.[31]

67. To explore the portfolio diversification point in more detail, first consider Figure 1 below in a market with no dividend imputation. That figure shows the utility[32] of a particular investor as a function of the proportion of their wealth that is invested in domestic dividend-paying shares (as opposed to domestic shares that do not pay dividends, international shares, or other assets such as real property, term deposits, bank balances and so on). Figure 1 shows that the optimal investment in domestic dividend-paying shares is at Q, because this maximises the investor's utility at U.

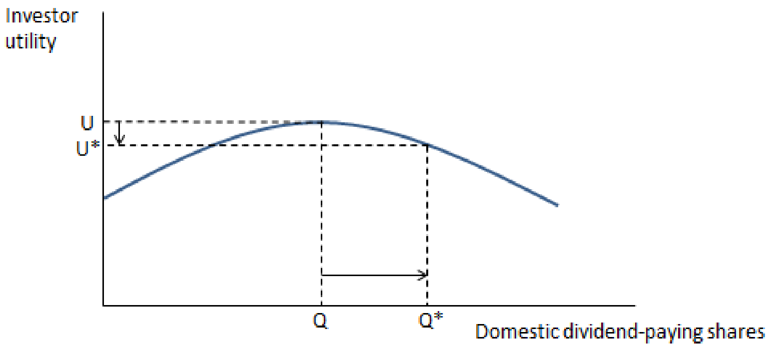
Figure 1
Optimal portfolio holding of domestic dividend-paying shares



68. If the investor moved away from their optimal investment in domestic dividend-paying shares (Point Q), the result would be a loss of utility, in which case the investor would be worse off. This is illustrated in Figure 2 below, which shows that an over-investment in domestic dividend-paying shares (at Q*) leads to a reduction in utility (U*).

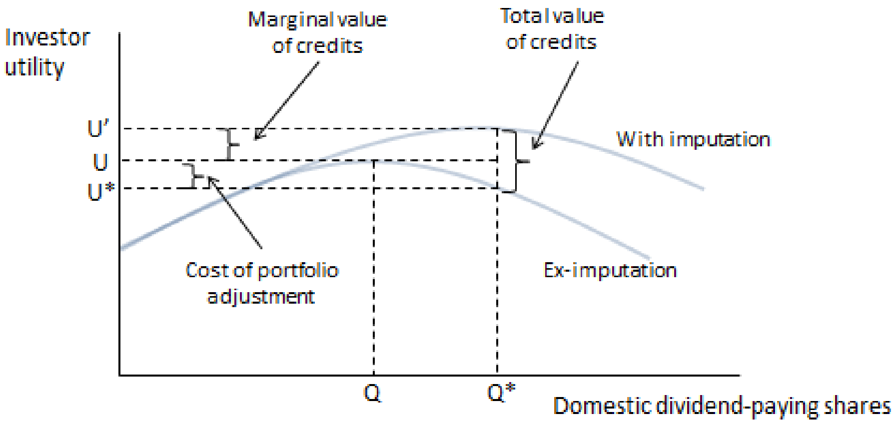
[30] This effect is explained in more detail in Paul Lajbcygier and Simon Wheatley (2012), "Imputation credits and equity returns," *The Economic Record*, 88, 283, 476-494.
[31] Lally (2013), p. 16. The reference to ERA (2013) appears to be a reference to Vo, Gellard and Mero (2013).
[32] Utility is the economic concept of well-being or satisfaction. The basis of most economic models is the notion that individuals will act to maximise their utility.

Figure 2
Sub-optimal portfolio holding of domestic dividend-paying shares



69. Now suppose that imputation is introduced into this market, as illustrated in Figure 3 below. The domestic investor is likely to alter their portfolio by increasing their investment in domestic dividend-paying shares. This causes the investor to move away from their optimal portfolio, which comes at a cost – reducing utility from U to U*. However, that cost is more than compensated by the value that the investor receives from imputation credits. When the value of imputation credits is included, the curve shifts and the optimal investment in domestic dividend-paying shares is at Q*, producing utility of U'. This optimum occurs at the point where the marginal benefit of the next imputation credit is exactly offset by the marginal cost of further concentration of the investor's portfolio. That is, the last dollar of imputation credits that the investor receives has a negligible marginal benefit.

Figure 3
Australian government bond yields and the proportion of domestic ownership



70. Figure 3 also shows clearly that the net benefit that this investor receives from imputation credits is to increase utility from U to U'. This net benefit is obtained by subtracting the cost of portfolio adjustment from the total value of the credits. In summary, the value that the investor obtains from imputation credits comes at a cost – the cost of concentrating the investor's portfolio into domestic dividend-paying shares.

Regulatory implementation

71. It is generally accepted that there is a difference between the redemption rate (the proportion of distributed credits that are redeemed by investors) and the value of those credits to investors. "Value" is likely to be less than "redemption" for a number of reasons, including those set out above. In other words, redemption might be considered to be an upper bound for value.

72. Suppose, for the purposes of this example, that the weighted-average redemption rate of distributed credits is 70% and the value of distributed credits is 35%. That is, of every dollar of distributed credits 70 cents is redeemed, and every dollar of distributed credits is valued by the market at 35 cents.

73. Now suppose a regulator reduces the allowed return to equity by 70 cents for every dollar of imputation credits that the benchmark firm would be able to distribute. This means that shareholders receive a reduction in their allowed return of 70 cents in relation to an imputation credit that is worth only 35 cents to them. Consequently, the shareholders are under-compensated – the total value of the allowed return and the imputation credits that they receive is less than the required return. This has obvious consequences for the incentive to engage in an efficient level of investment.

Empirical estimation techniques

74. Empirical estimation techniques have been developed for the purposes of estimating the weighted-average redemption rate and for the purpose of estimating the market value of distributed credits.

75. The weighted-average redemption rate can be estimated by:

    a) Estimating the proportion of credits that are distributed to resident investors and by assuming that all of those investors will redeem all of the credits that are distributed to them (the "equity ownership method"); and

    b) Using ATO tax statistic data to estimate the ratio of total credits redeemed to total credits distributed.

76. The market value of distributed credits can be estimated by:

    a) Dividend drop-off analysis, which estimates the market value of dividends and imputation credits as the difference between (a) the market value of a share including the dividend and credit, and (b) the market value of a share excluding the dividend and credit; and

    b) Simultaneous trade analysis, which estimates the market value of dividends and imputation credits as the difference between (a) the market value of a security that includes entitlement to the dividend and credit, and (b) the market value of a security that does not include entitlement to the dividend and credit.

Summary

77. The estimate of gamma determines the amount of reduction in the monetary return that is paid to shareholders. It should be set to equate the monetary *value* of imputation credits with the monetary reduction in the allowed return that is paid to shareholders. Thus, the regulatory task is to determine the monetary value of imputation credits and to then reduce the allowed return on equity by that same monetary value. Consistent with this interpretation, the Rules state that "γ is the value of imputation credits."[33]

78. Australian regulatory practice (including the practice of the AER) has always been to interpret gamma as the value (as in *market value* or *worth*) of imputation credits. All regulators other than the AER still adopt that interpretation.

[33] NER cls. 6.5.3, 6A.6.4 (current since version 53); NGR r. 87A(1) (current since version 14).

79. The standard approach is to estimate gamma as the product of two parameters:

$$\gamma = F \times \theta$$

where F represents the distribution rate and θ (**theta**) represents the value of a distributed imputation credit.[34]

80. Consistent with the value interpretation of gamma, theta represents the value of distributed imputation credits – the extent to which a distributed credit is capitalised into the stock price.

81. Investors are likely to value imputation credits at less than their face value for a number of reasons:

   a) Credits that are not redeemed (because they are distributed to non-residents, or they are excluded by the 45-day rule, or any other reason) are clearly of no value;

   b) The redemption of credits requires certain administrative costs and involves a material time delay before payment is made;

   c) Like dividends, imputation credits are taxed at the shareholder's marginal rate; and

   d) The acquisition of imputation credits comes at the cost of foregone diversification opportunities.

82. If the redemption rate is used in the regulatory setting, and if the redemption rate is greater than the value of credits, this must lead to investors being under-compensated. This is because the reduction in the allowed return, which is based on the redemption rate, exceeds the value of the imputation credits that are received by shareholders.

83. The weighted-average redemption rate can be estimated by the equity ownership method or by using aggregate tax statistics. The market value of distributed credits can be estimated by dividend drop-off analysis or by simultaneous trade analysis.

[34] This standard approach is also adopted in the Guideline. See AER Guideline, p. 23. The Guideline refers to F as the "payout ratio" and to theta as the "utilisation rate."

3. An assessment of the AER's approach for estimating the distribution rate

Definition

84. The distribution rate (*F*) is the ratio of (a) the total amount of franking credits distributed to shareholders in a given year, to (b) the total amount of franking credits created in a given year. The average distribution rate over a period can be estimated as the ratio of the total credits distributed during the period to the total credits created during that period. The Australian Tax Office (**ATO**) maintains statistics on both components of this ratio.

Current estimates

85. There is almost universal endorsement of 0.7 as an appropriate estimate of the distribution rate.[35]

Australian Competition Tribunal estimate is 0.7

86. The Australian Competition Tribunal has recently adopted a distribution rate of 0.7:

> the Tribunal concludes that the distribution ratio is 0.7 for the calculation of gamma.[36]

AER estimate is 0.7

87. The AER has reaffirmed its use of a distribution rate of 0.7 in its final Guideline. The AER uses the term "payout ratio" and states that:

> The payout ratio would be estimated using the cumulative payout ratio approach. The cumulative payout ratio is an estimate of the average payout rate from 1987, when the imputation system began, to the latest year for which tax data is available. Based on current evidence, this leads to an estimate of 0.7.[37]

88. The AER also states that some of the advantages of this accepted approach for estimating the distribution rate are that it:

> is simple and intuitive, uses long-term, published data, and is supported by stakeholders and an expert review from Lally.[38]

The ERA estimate is 0.7

89. In its final Guideline, the ERA also proposes to use an estimate of 70% for the distribution rate, or "payout ratio" as the ERA refers to it.[39]

McKenzie and Partington estimate is 0.7

90. In their recent report for the QRC, McKenzie and Partington (2013) use the term "access fraction" and state that:

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[35] The only current estimate that differs from 0.7 is the Lally (2013) back-of-the-envelope estimate based on a sample of only 10 firms. That estimate, and the reasons for assigning no weight to it, are set out in Appendix 4 to this report.
[36] Application by Energex Limited (Distribution Ratio (Gamma)) (No 3) [2010] ACompT 9 (24 December 2010), Paragraph 4.
[37] AER Rate of Return Guideline, p. 23.
[38] AER Rate of Return Guideline, Explanatory Statement, p. 160.
[39] ERA, Rate of Return Guideline, p. 9.

> There is less debate about the magnitude of the access fraction as this can be measured reasonably well from taxation statistics and a value of 70% is widely accepted as the proportion of credits created that are distributed.[40]

Conclusions and recommendations

91. Our main conclusions in relation to the distribution rate are:

    a) The accepted empirical approach consistently produces an estimate of 0.7;

    b) The standard Australian regulatory practice is to adopt a distribution rate of 0.7;

    c) All stakeholders have proposed a distribution rate of 0.7;

92. For the reasons set out above, we concur with the distribution rate of 0.7 that is adopted in the Guideline.

[40] McKenzie and Partington, p. 31.

4. An assessment of the AER's approach for estimating theta

The interpretation of theta in the Guideline

93. The Guideline refers to theta as the "utilisation rate" which is defined to be:

> the complex weighted average (by value and risk aversion) of individual investors' utilisation rates. In turn, these reflect each investor's expected ability to use imputation credits to reduce their tax (or get a refund).[41]

94. Thus, the utilisation rate[42] is defined to be the weighted-average of the extent to which investors are able to use imputation credits to reduce their tax or obtain a refund.

95. That is, the Guideline defines theta to be the aggregate proportion of distributed imputation credits that investors are able to redeem. This proportion is known as the *redemption rate* or *redemption ratio*. The Guideline materials note that this differs from the AER's previous approach, which was to define theta to be the value (as in *market value* or *worth*) of distributed credits.

96. The Guideline materials are not suggesting that the redemption rate can be used to estimate the value of imputation credits. Rather, the Guideline materials propose that the appropriate task is not to estimate the value of distributed credits at all, but that the appropriate task is to estimate the proportion of distributed credits that investors are able to redeem.

97. Appendix 5 and Appendix 6 to this report review the "re-evaluation of the conceptual task"[43] that led to the redefinition of theta in the Guideline. The general conclusions from these appendices is that none of the proposed reasons for the conceptual redefinition of theta that are set out in the Guideline materials are valid, or supported by advice or evidence.

Value vs. redemption

98. Section 2 of this report demonstrates why theta must be interpreted as the value of distributed imputation credits – the extent to which distributed credits are reflected in the stock price. By contrast, the Guideline materials propose that the appropriate task is not to estimate the value of distributed credits at all, but that the appropriate task is to estimate the proportion of distributed credits that investors are able to redeem – the redemption rate.

99. Section 2 of this report also sets out a number of reasons why the value of distributed credits (capitalised into the stock price) is likely to be materially lower than the redemption rate (the proportion of distributed credits that are redeemed).

100. In our view, theta represents the value of distributed imputation credits. Consequently, we require empirical methods for estimating that value – for estimating the extent to which distributed credits are reflected in the stock price.

Estimation approaches in the Guideline

101. The Guideline sets out four estimation approaches:[44]

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[41] AER Rate of Return Guideline, Explanatory Statement, p. 159, Footnote 530.
[42] Or "theta" or "the parameter that must be multiplied by F to obtain gamma."
[43] AER Rate of Return Guideline, Explanatory Statement, p. 160.
[44] AER Rate of Return Guideline, Explanatory Statement, p. 159.

a) The equity ownership approach;

b) Tax statistics studies;

c) Implied market value studies; and

d) The "conceptual goalposts" approach.

102. The first two of these approaches are designed to provide estimates of the redemption rate. The equity ownership approach estimates the proportion of Australian shares that are owned by resident investors, and then assumes that all imputation credits distributed to those resident investors will be redeemed. The tax statistic studies use ATO data to estimate the ratio of (a) the quantity of imputation credits redeemed in a given year, to (b) the quantity of imputation credits distributed in that year. Both of these methods are designed to estimate the redemption rate. The Guideline materials conclude that the evidence from these two approaches supports a redemption rate of 70% – that 70% of the credits that are distributed end up being redeemed by resident investors.[45]

103. Implied market value studies are designed to estimate the value of distributed imputation credits – the extent to which the value of distributed credits is capitalised into stock prices. These approaches all use stock price data – to determine the extent to which the value of imputation credits is reflected in the stock price. The AER concludes that this evidence supports a value of distributed credits of 0-50% of their face value.[46]

104. The conceptual goalposts approach is based on the Lally (2013) report commissioned by the AER. This approach constrains the estimate of theta by requiring it to produce an allowed return on equity that lies between (a) an estimate of the return on equity that investors would require if Australia was perfectly segmented from world capital markets, and (b) an estimate of the return on equity that investors would require if world capital markets were perfectly integrated. The Guideline materials conclude that estimates "in the range 0.8 to 1.0 meet this test."[47]

105. The AER has "less regard"[48] to the market value studies and conceptual goalposts approaches because these approaches do not produce estimates of the redemption rate, which the Guideline defines to be the correct interpretation of theta. The Guideline materials simply note that:

> the former suggests the utilisation rate might be lower than 0.7, and the latter suggests it might be higher than 0.7. In view of the limitations of these final two approaches, and the offsetting directional implications, we consider our estimate [of 0.7 from the two approaches for estimating the redemption rate] is reasonable.[49]

106. In relation to the use of these four approaches, we conclude that:

a) If theta is defined in the standard way as representing the value of distributed imputation credits, the only relevant evidence comes from the implied market value studies; and

[45] AER Rate of Return Guideline, Explanatory Statement, p. 160.
[46] AER Rate of Return Guideline, Explanatory Statement, p. 168.
[47] AER Rate of Return Guideline, Explanatory Statement, p. 160.
[48] AER Rate of Return Guideline, Explanatory Statement, p. 160.
[49] AER Rate of Return Guideline, Explanatory Statement, p. 160.

b) If theta is re-defined to represent the redemption rate, the only relevant evidence comes from the equity ownership approach and tax statistics studies – both of which provide estimates of the redemption rates.

107. In our view, there is no valid basis for mixing point estimates of entirely different things.

Issues with the estimation approaches in the Guideline

Overview

108. As set out above, we adopt the standard definition that theta represents the value of distributed imputation credits. Consequently, our view is that the implied market value studies provide the only relevant evidence – the other approaches do not purport to estimate the value of distributed credits, so they are not relevant in our view. We review and summarise the relevant market value studies in the subsequent section of this report.

109. The remainder of this sub-section of the report summarises a range of issues relating to the implementation of the other three approaches that are set out in the Guideline. That is, our view is that:

a) The equity ownership, tax statistic and conceptual goalposts approaches should not be considered because they are irrelevant – they purport to estimate something other than the value of distributed credits, so they cannot be used to estimate theta; and

b) Even if those approaches were to be considered, their implementation is so fraught with difficulty that the resulting estimates are likely to be unreliable.

The equity ownership approach

110. The equity ownership approach seeks to estimate the redemption rate by first estimating the proportion of Australian shares that are owned by resident investors, and then by assuming that all imputation credits distributed to those resident investors will be redeemed. Thus, the key requirement is an estimate of the proportion of Australian shares that are owned by resident investors. The Guideline adopts a final estimate of 70% based on data from a 2007 report produced by the Australian Bureau of Statistics (ABS).

111. The key problem with this estimate is that it is so dated that it is no longer relevant. In particular, that estimate is based on data from 2007, when the foreign ownership of Australian shares was at a temporary ebb. In recent years, the proportion of domestic ownership has been around 55%, not 70%. The same ABS data source that produced the 2007 estimate now produces an estimate of 55% domestic ownership. This estimate has been confirmed in ASX estimates of the proportion of domestic ownership in 2011 and 2013.[50]

112. These issues are addressed in more detail in Appendix 8 to this report.

Tax statistics studies

113. The equity ownership approach seeks to estimate the redemption rate by using ATO data to estimate the ratio of (a) the quantity of imputation credits redeemed in a given year, to (b) the quantity of imputation credits distributed in that year. There are a number of problems with estimates using this approach:

[50] The ASX reports an estimate of 54% domestic ownership.

a) Implementation of this approach requires the use of two separate ATO databases that are inconsistent in the amount of $87.5 billion;

b) Hathaway (2013) has used the tax statistic method in previous papers but now concludes that:

> I would caution anyone…against relying on those parts of my earlier reports which focused on ATO statistics;[51]

c) Lally (2013) notes the concerns that have been expressed in relation to the reliability of the tax statistics data and concludes that:

> the best that can be said of all this is that the redemption rate is uncertain;[52]

d) The ATO data does not discriminate between public and private companies. Many micro businesses are structured as private companies that routinely distribute all imputation credits to their owners who redeem them all. Thus, the redemption rate for these businesses will be higher than for the average exchange-listed business. In this regard, we note that all other WACC parameters are estimated with reference to exchange-listed businesses (and not private micro and small businesses) because exchange-listed businesses are more reflective of the efficient benchmark entity.

114. These issues are addressed in more detail in Appendix 8 to this report.

Conceptual goalposts approach

115. The conceptual goalposts approach constrains the estimate of theta by requiring it to produce an allowed return on equity that lies between (a) an estimate of the return on equity that investors would require if Australia was perfectly segmented from world capital markets, and (b) an estimate of the return on equity that investors would require if world capital markets were perfectly integrated. The main problems with the implementation of this approach are:

a) It requires estimates of what each WACC parameter would be in each of those theoretical scenarios, which is an impossible task.[53] For example, it is difficult to obtain precise estimates of beta and MRP as they are in the real world, where relevant data is available. The conceptual goalposts approach further requires estimates of what beta and MRP *would be* if no foreign investment was allowed, and what they *would be* if markets were perfectly integrated;

b) Even if it was possible to derive point estimates of beta and MRP as they would be in these theoretical scenarios, the reasonable ranges (or confidence intervals) around the point estimates would be so wide as to render the resulting estimates of no use whatsoever;

c) All of the Lally (2013) calculations are based on a mechanistic implementation of the Sharpe-Lintner CAPM where MRP is estimated solely from the historical arithmetic mean of excess stock returns, which is inconsistent with the Guideline's approach of having regard to other relevant evidence;

[51] Hathaway (2013), Paragraph 12.
[52] Lally (2013), p. 15.
[53] See Lally (2013a), Section 3.9.

d) The key assumption of the conceptual goalposts approach is that the risk-free rate would be the same in a perfect segmentation world as in a perfect integration world. In our view, the notion that the government bond yield would be unchanged if all foreign investment were withdrawn is implausible. If the perfect segmentation risk-free rate is increased by just 1% above the perfect integration risk-free rate, all of the empirical estimates based on market data satisfy the conceptual goalposts test. That is, even setting aside all of the other problems with such a test, none of the market-based empirical estimates are ruled out unless one assumes that government bond yields would be identical whether or not foreign investors are admitted; and

116. Moreover, the Guideline's 0.7 estimate of theta fails the conceptual goalposts test. According to Lally (2013), every estimate of theta fails the test other than his own theoretically reasoned estimate of 1. The Guideline materials cite Lally (2013, pp. 46-47) as supporting the conclusion that estimates "in the range 0.8 to 1.0 meet this test."[54] However, Lally (2013) makes no such conclusion. He never even considers an estimate of 0.8. Rather, his conclusion is that estimates "that are significantly less than 1 fail this test in virtually every case examined, and are therefore deficient"[55] and that "the only sensible estimate…is at or close to 1."[56]

117. The Guideline materials conclude that the conceptual goalposts test supports the proposed estimate of theta (0.7) on the basis that this estimate fails the test less severely than some standard empirical estimates. In our view, there are three difficulties with this conclusion:

a) The fact that the Guideline estimate fails the test would generally mean that the test does *not* support the Guideline estimate; and

b) Using the conceptual goalposts test to rule out the standard empirical estimates requires one to believe that:

i) It is not possible to reliably estimate the extent to which investors value imputation credits in the real world; but

ii) It is possible to reliably estimate (to three decimal places) the total return on equity that investors would require from the benchmark firm in a world where Australia was perfectly segmented from global capital markets, and in a world where Australia was perfectly integrated into global capital markets; and

c) The test requires that the government bond yield would remain unchanged whether or not foreign investors (who currently own 80% of those bonds) are excluded from the market.

118. These issues are addressed in more detail in Appendix 8 to this report.

Summary and conclusions

119. Our view is that:

a) The equity ownership, tax statistic and conceptual goalposts approaches should not be considered because they are irrelevant – they purport to estimate something other than the value of distributed credits, so they cannot be used to estimate theta; and

54 AER Rate of Return Guideline, Explanatory Statement, Footnote 533, p. 160.
55 Lally (2013), pp. 46-47.
56 Lally (2013), pp. 46-47.

b) Even if those approaches were to be considered, their implementation is so fraught with difficulty that the resulting estimates are likely to be unreliable.

120. In our view, theta represents the value of distributed credits and consequently it is only empirical estimates of the value of distributed credits that are relevant. We consider this evidence in the subsequent section.

5. Empirical estimates of the value of distributed imputation credits

Dividend drop-off analysis

121. Dividend drop-off analysis is the approach that is most commonly used to estimate the value of distributed imputation credits – specifically, the extent to which the value of distributed credits is reflected in the stock price. This approach involves a comparison of the price of a stock immediately before an ex-dividend date (which reflects the value of the dividend and the associated imputation credit) with the price immediately after the ex-dividend date (which no longer reflects the value of the dividend and the associated imputation credit). The difference in value reflects the implied value of the dividend and the associated imputation credit – in particular, the extent to which they were capitalised into the stock price.

122. As set out in Section 2 above, Lally (2013) shows that the current stock price can be written as the present value (over the next year) of dividends, imputation credits and the end-of-year stock price:[57]

$$S_0 = \frac{Div_1 + \theta \times IC_1 + S_1}{1 + r_e}$$

where IC_1 represents the (per share) imputation credits that are distributed to shareholders.

123. The rationale for dividend drop-off analysis can be explained with reference to the above equation. In particular, a simple rearrangement of that equation yields:

$$\frac{S_0(1 + r_e) - S_1}{Div_1} = 1 + \theta \frac{IC_1}{Div_1}$$

where the left hand side of that equation is the dividend drop-off ratio, which is regressed on the ratio of credits to dividends to obtain an estimate of theta – the extent to which imputation credits have been capitalised into the stock price.[58]

Current dividend drop-off estimates

124. The studies that provide recent dividend drop-off estimates of the value of distributed imputation credits are as follows:

a) The SFG (2011) study that was accepted by the Tribunal in the *Gamma* case;[59]

b) An updated study performed by SFG (2013) and recently submitted to the AER;[60] and

c) A drop-off analysis performed by ERA staff, Vo et al (2013).[61]

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57 See Lally (2013a), Equation 3, p. 10. Note that we use θ rather than *U* and r_e rather than $R_f + \phi\beta_e$. We also define the post-tax cash flow to shareholders to be "dividends" so that $Div_1 = Y_1 - TAX_1$.

58 There are a range of methodological specifications for dividend drop-off analysis. The purpose here is not to derive all of them in detail, but simply to demonstrate how the basic structure of drop-off analysis falls out of the framework of Lally (2013a).

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

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

61 Vo et al (2013).

125. In relation to dividend drop-off analysis, the Guideline materials conclude that "the most relevant dividend drop off studies" are those "by SFG and Vo et al."[62]

126. The SFG study that was accepted by the Tribunal and the updated version of that study both recommend a point estimate of 0.35 from within a range of point estimates around 0.35.

127. The ERA study performed by Vo et al (2013) concludes that:

> The appropriate range suggested by this study is between 0.35 and 0.55.[63]

Guideline conclusions

128. The Guideline materials conclude that the dividend drop-off evidence supports a range of 0.35 to 0.55. In our view, the Guideline is inconsistent in forming its range from the aggregation of:

    a) A *range* from the Vo et al study, and

    b) A *point estimate* (from within the reasonable range) from the SFG studies.

129. The SFG studies report a range of estimates with a confidence interval around each estimate. The final point estimate of 0.35 was selected from within a reasonable range. If the results of the two studies are to be combined, consistency would require either that the final point estimates from each study should be combined, or that the reasonable ranges from each study should be combined. Clearly, any combined reasonable range would extend below 0.35.

130. In our view, the SFG studies should be preferred to the Vo et al study for a number of reasons that are set out below.

The merits of the SFG studies

131. The SFG studies arose out of a direction from the Australian Competition Tribunal in what has become known as the *Gamma* Case. In that case, the AER had sought to rely on a dividend drop-off study by Beggs and Skeels (2006)[64]. The Tribunal held[65] that the AER was wrong to rely on an out-dated and methodologically unsound dividend drop-off study. The Tribunal then directed that a "state-of-the-art" dividend drop-off study should be conducted to assist the Tribunal.[66] The Tribunal also directed that the dividend drop-off study to be performed by SFG "should employ the approach that is agreed upon by SFG and the AER as best in the circumstances."[67]

132. After agreement could not be reached between the parties, the Tribunal ruled that:

    a) The four variations of the econometric specification of dividend drop-off analysis drawn by SFG from the literature should be used; and

    b) The results for the full updated period should be used rather than a number of sub-periods.

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[62] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 174.
[63] Vo et al (2013), Abstract.
[64] Beggs, D. J. and Skeels, C.L., (2006), "Market arbitrage of cash dividends and franking credits," *Economic Record*, 82 (258), 239 – 252.
[65] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraphs 66, 145.
[66] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 146.
[67] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 147.

133. SFG then conducted the dividend drop-off study and circulated a draft report to all parties. The AER and the regulated businesses that were parties to the *Gamma Case*[68] provided detailed comments on the draft report and these were taken into account in a revised report that was provided to all parties and to the Tribunal.

134. The Tribunal accepted the estimates from the SFG dividend drop-off study:

> The Tribunal is satisfied that the procedures used to select and filter the data were appropriate and do not give rise to any significant bias in the results obtained from the analysis. Nor was that suggested by the AER.[69]
>
> In respect of the model specification and estimation procedure, the Tribunal is persuaded by SFG's reasoning in reaching its conclusions. Indeed, the careful scrutiny to which SFG's report has been subjected, and SFG's comprehensive response, gives the Tribunal confidence in those conclusions.[70]

135. The Tribunal went on to conclude that:

> The Tribunal is satisfied that SFG's March 2011 report is the best dividend drop-off study currently available for the purpose of estimating gamma in terms of the Rules.[71]

and

> The Tribunal finds itself in a position where it has one estimate of theta before it (the SFG's March 2011 report value of 0.35) in which it has confidence, given the dividend drop-off methodology. No other dividend drop-off study estimate has any claims to be given weight vis-à-vis the SFG report value.[72]

136. The SFG study concluded that:

> For the reasons set out in detail in this report, we conclude that the appropriate estimate of theta from the dividend drop-off analysis that we have performed is 0.35 and that this estimate is paired with an estimate of the value of cash dividends in the range of 0.85 to 0.90.[73]

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

> the conclusions from that earlier study remain valid when tested against the updated data set.[74]

Problems with the ERA approach

138. Vo, Gellard and Mero (2013) from the Economic Regulation Authority of Western Australia (**ERA**) have recently produced a drop-off study that essentially follows the methodology of the SFG studies.

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68 Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010).
69 Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraphs 18-19.
70 Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 22.
71 Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 29.
72 Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 38.
73 SFG (2011), Paragraph 3.
74 SFG (2013), Paragraph 6.

One important deviation from the SFG methodology is that the ERA study also presents results that are based on analysis that omits the standard market adjustment. The standard approach in dividend drop-off studies is to assume that, but for the dividend, the stock price would have followed the movement in the broad market over the ex-dividend day. That is, if the broad market index increases by 2% over the ex-dividend day, it is assumed that, but for the dividend, the particular stock would also have increased by 2%.

139. We are unaware of any recent paper in a peer-reviewed journal that does not make such an adjustment. It is not surprising, therefore, that the ERA would have to make the adjustment to "enable a comparison of results to those from other studies." [75]

140. However, the ERA study also reports results in the absence of this standard market adjustment on the basis that, but for the dividend, a particular stock price might have moved (over the ex-dividend day) by somewhat more or less than the market. For example, it is possible that when the broad market increases by 2%, a particular stock might have moved (but for the dividend) by 1.8% or by 2.2%.

141. Omitting the market adjustment entirely is certain to be an inferior estimate on average. Whereas individual stocks might have moved by somewhat more or less than the broad market, on average stocks will move exactly in accordance with the market index, by definition.[76] That is, the standard market adjustment produces estimates of "but for the dividend" stock price movements that are unbiased on average – in the sense that it is equally likely that (but for the dividend) the stock might have moved somewhat more or somewhat less than the broad market index. Omitting the market adjustment entirely is to assume that (but for the dividend) the stock price would not have moved at all. Such an omission creates a bias. If the broad market increased by 2% over the ex-dividend day, the assumption that the stock price would have been 0% is clearly likely to be a material under-estimate, on average.

142. The reason the ERA authors provide for reporting results that omit the standard market correction is that "applying the market correction is an unnecessary complication to an already complex econometric task." [77] However, the correction is necessary to produce unbiased and reliable estimates and it is *not* difficult to implement. Indeed the ERA has already implemented the standard approach in its own study. In fact, the only new information provided by the ERA study is to also show how the results would have looked if a non-standard and inferior methodology had been employed. For these reasons, our view is that the subset of the results in the ERA paper that are based on analysis that omits the standard market adjustment should receive no weight.

143. We note that the Guideline materials appear to agree with our submission on this point when concluding that:

> We consider the most relevant results from the Vo et al study relate to regressions with the market adjustment.[78]

144. When the standard market adjustment is performed, the ERA study confirms the results from the SFG studies. In particular, the SFG studies conclude that an appropriate value for theta is 0.35. The ERA study reports that, when the standard market correction is applied, the average estimate of theta

[75] ERA Rate of Return Guideline, Explanatory Statement, Paragraph 956.
[76] This is because the market portfolio is an average taken over all stocks.
[77] Vo, Gellard and Mero (2013), p. 32.
[78] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 174.

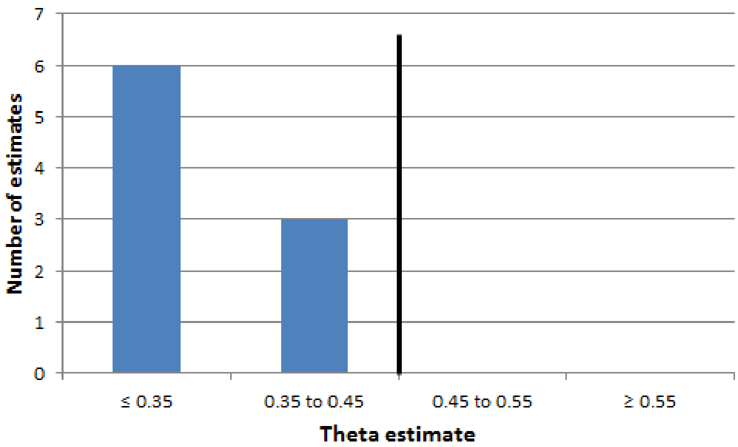
is 0.34. The estimate using robust regression and Model Specification 4 (which the ERA considers to be the most reliable estimate) is 0.33.[79]

145. Figure 4 below shows the distribution of all theta estimates where the market correction has been applied (except for the OLS estimates, which the ERA deems to be inappropriate.)[80] That figure also shows the mid-point of the proposed range, marked as a line. All of the estimates are below the mid-point and the majority are below the lower bound of the proposed range. From this, the Guideline materials conclude that:

> We consider the most relevant results from the Vo et al study relate to regressions with the market adjustment. From this basis, the sensitivity analysis (including different forms of the regression calculation) in the Vo et al paper still provides grounds to select an equity beta (sic) in the range 0.35–0.55, contrary to the ENA's submission.[81]

146. In our view, there is no basis for such a conclusion.

Figure 4. Distribution of ERA theta estimates: With market correction

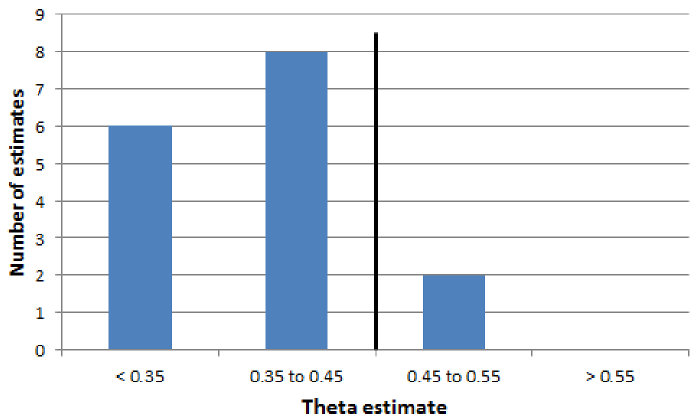


Source: Vo et al (2013), Table 5.

147. Even when no market correction is applied, Vo et al reports an average theta estimate of 0.40 and a robust regression estimate from Model Specification 4 of 0.32. In fact, there is very little evidence to support the Vo et al mid-point estimate of 0.45 at all. The Vo et al estimates of theta, with and without the market adjustment, are summarised in Figure 5 below. The figure shows that the vast majority of estimates fall below the ERA's mid-point estimate (marked as a line). Moreover, whereas a material number of estimates fall below the bottom of the range (less than 0.35) there are no estimates above the top end of the range (0.55).

[79] Vo, Gellard and Mero (2013), Table 5.
[80] Vo et al (2013), p. 9.
[81] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 174.

Figure 5. Distribution of ERA theta estimates



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

148. Finally, the ERA's sensitivity analysis (which is considered in some detail below) would seem to be irrelevant to the AER's Guideline given that the AER concludes that the relevant results are those that apply the standard market correction,[82] and the ERA's sensitivity analysis is applied exclusively to the results that do *not* apply the standard market correction.

Issues raised in relation to dividend drop-off analysis

149. The Guideline materials raise several issues in relation to dividend drop-off analysis, each of which is addressed in turn below.

Effect of additional trading around the ex-dividend event

150. The Guideline materials note that trading volumes tend to increase around ex-dividend dates and that dividend drop-off studies will estimate the value of imputation credits to those investors who are active in the market, in which case:

> By largely reflecting the abnormal trading conditions on the two relevant trading days, dividend drop off studies may not identify the market value for the representative investor.[83]

151. The ENA submission on the draft Guideline contained a detailed discussion on this point,[84] none of which has been addressed or acknowledged in the final Guideline materials. In that discussion, the ENA demonstrated that the empirical evidence shows that the increase in trading volume around ex-dividend dates is driven by a subset of investors who value imputation credits highly. These investors purchase shares to capture the dividend and imputation credit, causing a run-up in the cum-dividend price.[85]

152. To the extent that this effect is material, it results in the dividend drop-off being higher than it would otherwise be, which in turn results in the estimate of theta being higher than it would otherwise be.

[82] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 174.
[83] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 170.
[84] ENA Submission, 11 October 2013, Section 7.9, pp. 119-123.
[85] The same point is made by McKenzie and Partington (2011), pp. 9-10.

That is, to the extent that the increase in trading volume around the ex-dividend date has an effect, it is likely to result in an over-estimate of theta.

153. In our view, this evidence is relevant to the proper empirical estimation of theta.

Trading by "low valuation" shareholders.

154. The Guideline materials state that:

> if short term traders are highly involved in trading around the cum-dividend/ex-dividend dates, dividend drop off studies would underestimate the value of dividends and franking credits to those traders. This is because transaction costs are relatively higher as a proportion of expected returns for short term traders.[86]

155. The argument here is that short-term traders face relatively higher transactions costs and may therefore be willing to pay less for an imputation credit. If such traders dominate trading around the ex-dividend day, it can result in drop-off analyses underestimating theta.

156. The ENA submission on the draft Guideline contained a detailed discussion on this point,[87] none of which has been addressed or acknowledged in the final Guideline materials. In that discussion, the ENA demonstrates that:

a) This argument is illogical. Suppose there was a set of "low value" investors who were willing to pay a lower price to buy shares cum-dividend. Why would anyone sell to them? Why wouldn't trades occur between sellers and those investors who were willing to pay a higher price?; and

b) It is inconsistent with the relevant evidence. Whereas the low-value investor conjecture would lead to cum-dividend prices being depressed, there is evidence of a cum-dividend price run-up.[88]

157. In our view, this evidence is relevant to the proper empirical estimation of theta.

Allocation

158. The Guideline materials note that:

> Dividend drop off studies only 'directly' identify the combined value of dividends and the attached imputation credit. In order to determine an estimate of the utilisation rate, this combined value of dividends and attached imputation credits must be allocated between the two components. This is called 'the allocation problem' and is a critical issue with dividend drop off studies.[89]

159. The ENA submission on the draft Guideline contained a detailed discussion on this point,[90] none of which has been addressed or acknowledged in the final Guideline materials. In that discussion, the ENA establishes that the empirical literature has established a very consistent result – the combined

[86] AER Rate of Return Guideline, Explanatory Statement, Appendix H. p. 170.
[87] ENA Submission, 11 October 2013, Section 7.9.3, pp. 121-122.
[88] See, for example, McKenzie and Partington (2011), pp. 9-10.
[89] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 167.
[90] ENA Submission, 11 October 2013, Section 7.10, pp. 123-127.

value of a one dollar dividend and the associated imputation credit is one dollar. The ENA submission shows that this result is reported by the dividend drop-off studies of SFG (2011), SFG (2013), Vo et al (2013), the futures studies of Cannavan, Finn and Gray (2004), Cummins and Frino (2008) and SFG (2013), and with the hybrid securities study of Feuerherdt, Gray and Hall (2010).

160. Moreover, in its 2009 WACC Review, the AER concluded that the relevant evidence at the time supported a combined value of one dollar.[91]

161. By contrast, the Guideline materials state that "dividends should be worth their face value"[92] and that "[a]ll Australian regulators assume that dividends are at face value within calculation of the cost of equity."[93] Thus, a $1 dividend is assumed to be valued at $1. Attached to that $1 dividend will be a 43 cent imputation credit that the AER assumes to be valued at 70% of its face value. The combined value is therefore $1 + 0.7 \times 0.43 = 1.30$. This combined value is materially higher than, and contradicted by, every empirical estimate of the combined value.

162. In our view, this evidence is relevant to the proper empirical estimation of theta.

163. Moreover, the ENA submission notes that the allocation of the combined value of one dollar between the dividend and the associated imputation credit is of little moment so long as it is applied consistently throughout a determination:

> For example, if the regulator determines that a particular value of cash dividends should be used, that value should be applied consistently throughout the determination. The value of theta that should be used is then that value that would result in the combined value being $1 – consistent with all of the available evidence.[94]

Stability and the effect of influential observations

164. The Guideline materials note that, whereas the SFG estimates have been shown to be stable and robust to the removal of influential observations, Vo et al (2013) report that:

> the estimate of theta is highly sensitive to the choice of the underlying sample of dividend events. Removing just 30 observations from a sample of 3309 can result in a dramatically different estimate of theta.[95]

165. The SFG (2011) study contained an extensive section on stability analysis[96] whereby observations are removed in pairs consisting of the observations that have the most influential upward and downward effects on the estimate of theta, respectively. As pairs of observations are removed, theta is re-estimated to determine the sensitivity of the theta estimate to influential observations. The result is a figure such as that replicated below for Model Specification 4.[97]

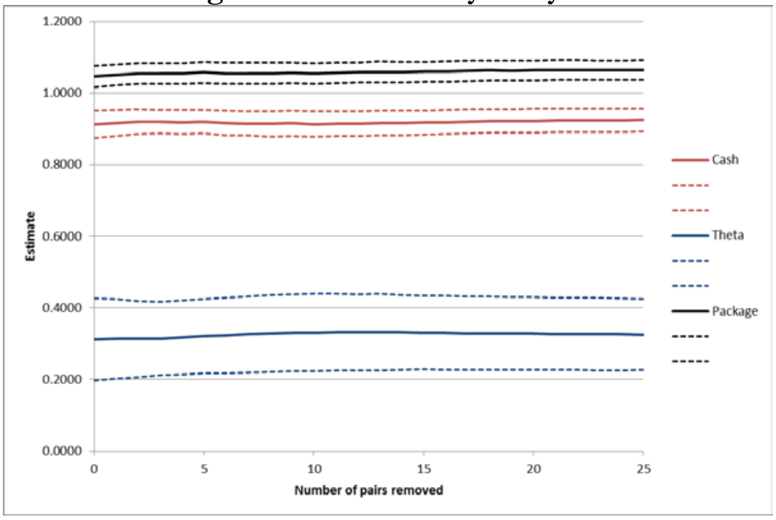
166. SFG (2011) conclude, on the basis of this stability analysis, that:

[91] AER 2009 WACC Review, Final Determination, p. 461.
[92] AER Draft Rate of Return Guideline, Explanatory Statement, p. 123.
[93] AER Draft Rate of Return Guideline, Explanatory Statement, p. 123, Footnote 338.
[94] ENA Submission, 11 October 2013, Section 7.10, p. 127.
[95] Vo et al (2013), p. 30.
[96] SFG (2011), pp. 28-32.
[97] This appeared as Figure 8, p. 31 in SFG (2011).

> The stability analysis for Model 4, in Figure 8 above, shows that the estimates of the value of cash dividends, the value of theta, and the value of the combined package are very stable and robust to the removal of pairs of influential data points…In summary, the stability analyses demonstrate that the estimates of theta are either maintained or lowered when pairs of influential observations are removed from the data set.[98]

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

Figure 6. SFG stability analysis



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

168. Because the stability of theta estimates is clearly a key issue for Vo et al (2013) and for the AER's Guideline we conduct an even more extensive stability analysis, reporting the results in Appendix 9 to this report. The additional stability analyses corroborate the results from SFG (2011) and SFG (2013) – the SFG estimates of theta are stable and robust to the removal of influential outliers and even to the removal of up to 5% of the data sample.

Other econometric issues

169. The Guideline materials state that:

> There are a number of other well documented econometric problems with dividend drop off studies.[99]

and then proceeds to set out a bullet point list.

170. Every one of these issues was specifically addressed point-by-point in the ENA submission on the draft Guideline,[100] but none of that response has been addressed or acknowledged in the final Guideline materials. In our view, the ENA submission establishes that none of the issues set out in the Guideline materials are a cause for concern, and they certainly do not provide a basis for effectively disregarding the entire body of dividend drop-off evidence when estimating theta.

[98] SFG (2011), p. 31.
[99] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 168.
[100] ENA Submission, 11 October 2013, Section 7.11, pp. 127-132.

Difference between Lally and van Zijl (2003) "utilisation" and theta

171. Lally (2013, pp. 20-21) notes that asset pricing models such as Lally and van Zijl (2003) allow for dividends and capital gains to be differentially valued by investors. Specifically, these models provide for the possibility that dividends are relatively less valuable, in which case high-dividend-paying stocks require higher returns, other things being equal.

172. One reason why dividends may be less valuable than capital gains is that they are taxed more heavily for some investors. In a dividend imputation system, imputation credits are taxed in the same way as dividends – the dividend and the imputation credit are both included in taxable income and taxed at the investor's marginal rate. That is, to the extent that personal taxes result in dividends being less valuable than capital gains, the same would apply to imputation credits.

173. Of course there are many reasons why imputation credits would be even less valuable to investors than dividends, as set out in Section 2 above. These reasons include the fact that imputation credits are worthless to non-resident investors, there is a time delay in receiving them, there are administrative costs in redeeming them and there are portfolio diversification costs in acquiring them.

174. In summary, there are three categories of reasons why imputation credits are likely to have a value (as in "worth" or "price") that is less than their face value:

   a) Reasons that also apply to dividends (e.g., the possible effects of personal taxes);

   b) The fact that not all credits will be utilised; and

   c) Other reasons (e.g., there is a time delay in receiving them, there are administrative costs in redeeming them and there are portfolio diversification costs in acquiring them).

175. Dividend drop-off estimates of theta reflect the combined effect of all three categories. Models such as Lally and van Zijl (2003) separate out the first category of reasons when they specifically provide for the possibility that dividends might be less valuable than their face value. In these models, the value of dividends is defined to be δ. Lally (2013a, pp. 20-21) proposes that a similar disaggregation should be performed in the current setting whereby the dividend drop-off estimate of theta is disaggregated into two components:

$$\theta = \delta \times U .$$

176. For example, if theta is estimated to be 0.35 and if δ is estimated to be 0.875, the implied estimate of U is 0.40.[101] In this case, imputation credits are estimated to be worth 35% of their face value, part of which (0.875) is for reasons that are common to dividends and part of which (0.40) is for reasons that are unique to imputation credits.

177. Lally (2013a) recognises that if an estimate of theta (which already includes the effect of δ) is inserted into the model of Lally and van Zijl (2003), it would be multiplied by δ again (because such models separately deal with the reasons that are common to dividends), resulting in double-counting.

178. However, the Australian regulatory practice, and the approach that is proposed in the Guideline, is to use a model that does *not* separate theta into various components. The Guideline does not consider models such as Lally and van Zijl (2003) that allow for dividends to be valued at less than their face value. Rather,

[101] See Lally (2013), p. 21.

the Guideline approach is to make a single all-encompassing adjustment for the extent to which imputation credits are valued at less than face value.

179. In summary, whereas the model of Lally and van Zijl (2003) requires separate estimates of δ and U, the Guideline approach requires only a single combined estimate of theta. The Australian regulatory framework that is adopted in the Guideline determines gamma as $\gamma = F \times \theta$. It is exactly such an all-encompassing estimate of theta that is produced by dividend drop-off analysis.

180. Lally (2013a) proposes that U should be set to 1 by "ignoring foreigners."[102] This theoretically assumed utilisation rate could then be multiplied by an estimate of δ to obtain the estimate of theta that is required for implementation of the Australian regulatory framework that is adopted in the Guideline – whereby gamma is determined as $\gamma = F \times \theta$.

Conclusions in relation to dividend drop-off analysis

181. The Guideline materials conclude that the most relevant dividend drop-off studies are those by SFG and Vo et al, and that the most relevant results from Vo et al are those that apply the standard market correction. SFG report a theta estimate of 0.35. The Vo et al estimate (using the standard market correction) is 0.34.

182. In our view, to the extent to which there is any difference between the two studies, there are two reasons to prefer the SFG studies to the Vo et al study:

   a) The SFG approach has been subjected to intense scrutiny. All data and computer code was supplied to the AER. All issues that the AER has identified have been considered by the Tribunal. And the Tribunal has endorsed and adopted the results. By contrast, the Vo et al study has not been subjected to such scrutiny;[103] and

   b) The SFG theta estimates have been shown to be stable and reliable in the face of a battery of stability and robustness checks, whereas Vo et al express concerns about the stability and reliability of its own results.

183. In any event, there is little evidence to support the Vo et al mid-point estimate of 0.45 from within its range of 0.35 to 0.55:

   a) The Vo et al estimates are overwhelmingly below 0.45 (see Figure 5 above), and a significant proportion of those estimates are below 0.35;

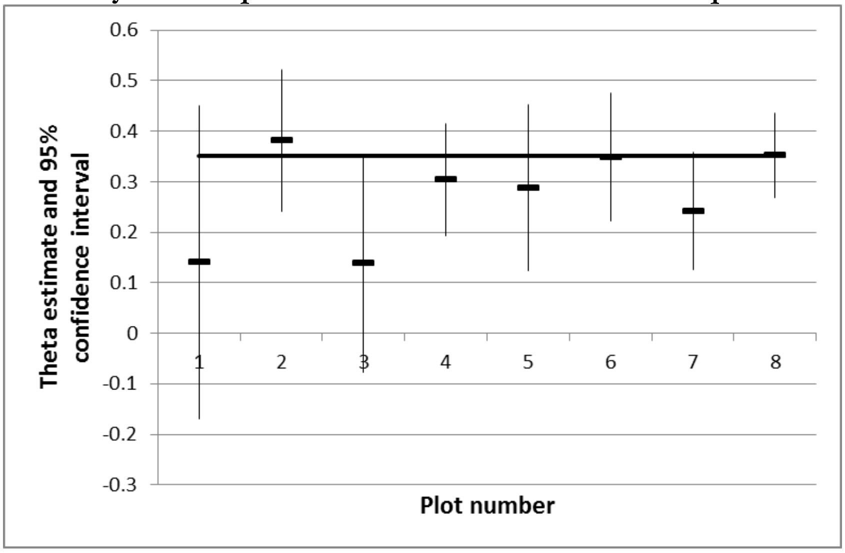
   b) The Vo et al study reports a theta estimate of 0.34 when the standard ex-day market correction is applied;

   c) The Vo et al estimate increases only to 0.4 when the standard ex-day market correction is removed; and

184. The SFG (2013) estimates indicate that, if anything, the 0.35 estimate is towards the upper end of the reasonable range. See for example Figure 7 below, which is reproduced from SFG (2013), Figure 5.

[102] Lally (2013), p. 3.
[103] Although we understand that the Vo et al (2013) study has so far been submitted to two academic journals.

Figure 7
Summary of point estimates and confidence intervals for theta by model specification and estimation technique



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

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

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

Other empirical evidence

186. In addition to the dividend drop-off studies above, there are a number of studies that employ alternative methodologies to estimate the value of distributed imputation credits. Like dividend drop-off studies, these studies also seek to determine the extent to which the value of imputation credits is capitalised into stock prices.

187. Dividend drop-off studies estimate the capitalised value of imputation credits by observing how stock prices change around ex-dividend events. The pre-dividend price reflects the value of the dividend and the associated credit whereas the ex-dividend price does not, so the change in price reflects the extent to which the dividend and imputation credit were capitalised into the stock price.

188. Simultaneous price studies compare the prices of securities that entitle the holder to receive dividends and imputation credits (such as ordinary shares) with the simultaneous prices of securities on the same firm that do not entitle the holder to receive any dividends or imputation credits (such as futures contracts). SFG (2013) report an estimate of 0.13 using this approach.

189. Two more recent studies test whether (other things being equal) firms with higher imputation credit yields are valued more highly by investors. Both find that they are not. This implies that equilibrium stock prices are independent of the amount of imputation credits that they generate, which leads the authors to conclude that theta is not materially different from zero, in equilibrium.[104]

[104] Labcygier and Wheatley (2012) and Siau, Sault and Warren (2013).

190. In all of the alternative market value studies over the last five years, the authors have concluded that the evidence supports an estimate of theta between 0 and 0.35.[105]

191. We note that, relative to these alternative market value studies, dividend drop-off analysis has a longer history, has been subjected to a higher level of scrutiny (especially the SFG 2011 study), and the strengths and weaknesses of the approach, and the econometric issues, are better understood. Consequently, we maintain a theta estimate of 0.35 – from dividend drop-off analysis – in this report noting that this is a conservative estimate in that the other relevant evidence produces lower estimates.

[105] See, for example, the list of studies set out in AER Rate of Return Guideline, Explanatory Statement, Appendix H, Table H.8, pp. 173-174.

6. Market practice

Evidence of market practice

Survey evidence and independent expert reports

192. When determining an appropriate value for gamma, one of the relevant pieces of evidence is the practice of market professionals. This section reviews the most recent regulatory analysis of market practice in relation to gamma.

193. As part of its consideration of the gamma parameter during its 2009 WACC Review, the AER considered a range of evidence about the practice of market professionals. That evidence showed that:

    a) The great majority of independent expert valuation reports make no adjustment at all to either cash flows or discount rates to reflect any assumed value of franking credits (Lonergan, 2001[106]; KPMG, 2005[107]);

    b) The great majority of CFOs of major Australian companies (who between them account for more than 85% of the equity capital of listed Australian firms) make no adjustment at all to either cash flows or discount rates to reflect any assumed value of franking credits (Truong, Partington and Peat, 2008[108]);

    c) Published Queensland Government Treasury valuation principles require government entities to make no adjustment at all to either cash flows or discount rates to reflect any assumed value of franking credits (OGOC, 2006[109]); and

    d) Credit rating agencies make no adjustments in relation to franking credits to any quantitative metric that they compute when developing credit ratings for Australian firms.

194. In a recent report for the ENA, SFG (2013)[110] reviewed independent expert reports from 2008 to 2013 and concluded that:

> None of the reports in our sample make any adjustment in relation to dividend imputation. No adjustments of any kind were made to any cash flows and no adjustments of any kind were made to any discount rates.[111]

195. This confirms that the long-established practice of independent expert valuation professionals making no adjustment in relation to imputation credits remains the current practice.

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[106] Lonergan, W., 2001. "The Disappearing Returns: Why Imputation Has Not Reduced the Cost of Capital," *JASSA*, Autumn 1, 1–17.
[107] KPMG, 2005. "The Victorian Electricity Distribution Businesses Cost of Capital - Market practice in relation to imputation credits Victorian Electricity Distribution Price Review 2006 – 10."
[108] Truong, G., G. Partington, and M. Peat, 2008. "Cost of Capital Estimation and Capital Budgeting Practice in Australia," *Australian Journal of Management,* 33, 95 – 121.
[109] Queensland Government Treasury, 2006, "Government owned corporations – Cost of capital guidelines," www.ogoc.qld.gov.au.
[110]http://www.aer.gov.au/sites/default/files/Report%204%20-%20Use%20of%20Independent%20Expert%20Reports%20%28Final%29%20-%2026%20June.pdf.
[111] SFG (2013), p. 2.

196. By contrast, Lally (2013a) concludes that "there is a trend amongst practitioners towards explicit adjustments for imputation credits."[112] This appears to be based on a small survey conducted by KPMG (2013), which includes responses from six banks, six professional services firms, and six infrastructure funds.[113] No information is provided about which organisations responded to the survey, what the response rate was, which individuals within each organisation completed the survey or their qualifications or roles within the organisation. It is difficult to imagine that any survey could fare worse when compared against the criteria set out by the Tribunal for the use of survey information.[114]

197. Moreover, the largest group in the survey was infrastructure funds, who reported that they account for imputation credits in cash flows. Of course, the cash flows of any regulated infrastructure asset *are* adjusted for imputation credits – according to the regulator's estimate of gamma. To ignore this adjustment would be to misestimate the allowed cash flows. Consequently, it is far from clear that these responses should be treated as independent evidence.

198. In our view, there is strong evidence to support the notion that market practitioners generally make no adjustments in relation to imputation credits.

Equity imputation funds

199. Lally (2013a) notes that the AER has recently highlighted the existence of managed funds that focus on firms with high imputation credit payout rates. He concludes that "the existence of the funds implies that *U* is positive." [115]

200. The AER's Draft Explanatory Statement refers to an "informal survey"[116] that identifies the existence of a number of managed funds with a focus on investing in firms with a high imputation credit payout ratio. The Explanatory Statement does not indicate how many of these funds the AER has identified, the dollar volume of assets under management, the proportion of all funds that have an imputation yield focus, or any quantitative information whatsoever. The questions were not disclosed before the survey was conducted to enable comments from interested parties to be considered. Moreover, the Explanatory Statement does not indicate whether this evidence about the existence of imputation funds would cause its estimate of theta (or gamma) to be higher or lower than it would otherwise be, and by how much.

201. The existence of such funds suggests nothing more than that there exists a group of investors who value imputation credits higher than the value that is incorporated into market prices. A theta of 1 would imply that the full face value of imputation credits is capitalised into share prices, in which case shareholders would have to pay for the full face value of imputation credits when buying the shares. In this scenario, there would be zero demand for an imputation-focused fund. By contrast, a theta of 0 would imply that imputation credits are not reflected in stock prices at all, in which case it is investors (rather than firms) who benefit from imputation. In this scenario, an individual investor who valued imputation credits may benefit from investing in a fund that focused on firms with high imputation yields. That is, the demand for imputation-focused funds will be inversely related to theta – a higher theta means that more of the value of imputation credits is already capitalised into the stock price, in which case investors would be paying for the benefit that they might receive from those credits.

[112] Lally (2013a), p. 32.

[113] http://www.kpmg.com/AU/en/IssuesAndInsights/ArticlesPublications/valuation-practices-survey/Documents/valuation-practices-survey-2013-v3.pdf.

[114] Application by Envestra Ltd (No 2), ACompT 3, Paragraphs 162-163.

[115] Lally (2013a), p. 37.

[116] AER Draft Rate of Return Guideline, Explanatory Statement, p. 136.

202. The mere fact that we observe that a number of imputation funds exist tells us nothing more than that there exists a group of investors who value imputation credits higher than the equilibrium value that is incorporated into market prices. It is not clear that anything can be concluded from this evidence, other than that theta must not be equal to 1.

Dividend washing

203. The AER's Draft Explanatory Statement refers to the change in tax policy to prevent certain investors from being able to effectively double the amount of imputation credits they receive via a process known as "dividend washing." The AER notes that some investors did engage in the practice of dividend washing, which "suggests that imputation credits are significantly valuable to these particular investors."[117] Of course, this tells us nothing at all about the equilibrium value of imputation credits, just that a very small subset of investors[118] have some positive valuation.

Summary

204. In relation to market practice, our view is that the clear evidence is that the majority of market practitioners do not make any adjustment for the value of imputation credits.

Regulatory consideration of market practice

205. In its 2009 WACC Review Final Decision, the AER concluded that:

> The AER agrees that the clear evidence is that the majority of market practitioners do not make any adjustment for the value of imputation credits.[119]

206. However, the AER concluded that there are at least two reasons why market professionals might not make any adjustment in relation to imputation credits:

a) No adjustment would be observed if market professionals considered that imputation credits had no material effect on the equilibrium stock price or on the equilibrium cost of equity; or

b) No adjustment would be observed if market professionals were using an approach that enabled them to bypass the need to estimate gamma.

207. The second alternative was raised in Handley (2008), a report commissioned by the AER.[120] Handley notes that the ultimate task of the regulator is to estimate the ex-imputation required return on equity, defined as:

$$r_e^* = r_e\left[\frac{1-T}{1-T(1-\gamma)}\right]$$

208. For example, if the total required return on equity is estimated to be $r_e = 10\%$ and if $T = 30\%$ and $\gamma = 0.5$, the ex-imputation required return is $r_e^* = 8.2\%$. In this case, shareholders require a total

117 AER Draft Rate of Return Guideline, Explanatory Statement, p. 136.

118 The AER Draft Rate of Return Guideline, Explanatory Statement (p. 136) notes that the total effect is anticipated to be only $20 million per year.

119 AER 2009 WACC Review, Final Decision, p. 407.

120 Handley, J., 2008." A note on the value of imputation credits," December, www.aer.gov.au/content/index.phtml/itemId/722190.

return of 10%, but the regulator sets prices or revenues so that the firm can provide a return of 8.2%, with the remaining 1.8% assumed to come from the value of imputation credits.

209. The regulatory approach for estimating r_e^*, the ex-imputation required return on equity (which determines the regulated firm's revenue allowance), involves two steps. First, the regulator estimates r_e, the total return on equity, including imputation credits. The AER's proposed approach is to estimate r_e using the Sharpe-Lintner CAPM with an estimate of MRP that is grossed-up to incorporate the assumed value of imputation credits. Then, the regulator removes the assumed effect of imputation credits via the adjustment formula set out above.[121]

210. Handley (2008) advised the AER that market professionals may be using what he called the "conventional" or "classical" approach to estimate r_e^* directly, without the need for an estimate of gamma at all. Under the SL CAPM, for example, r_e^* could be estimated directly in a single step by simply using an estimate of MRP that had not been grossed-up to reflect the assumed value of imputation credits.

211. In summary, the regulated firm's revenue requirement must be set so that the firm is able to pay a return of r_e^* to its shareholders. According to Handley (2008), there are two ways to estimate r_e^*:

a) Use the two-step regulatory approach to estimate r_e^*; or

b) Use the direct conventional (or classical) approach to estimate r_e^* that is used by market professionals.

212. In its 2009 WACC Review, the AER accepted the advice of Handley (2008), concluding that:

> On this basis the AER considers it is clear that there is a valid valuation framework (i.e. the classical approach) that would avoid the need to directly estimate gamma. It is quite possible and plausible that market practitioners are consciously choosing to adopt this simpler approach to estimating the cost of equity. To reiterate, as the NER require the AER to estimate gamma in calculating the tax building block (i.e. the 'assumed utilisation of imputation credits'), the classical valuation approach is not available.[122]

213. The AER approach has been to estimate r_e^* using only the two-step approach set out above. Information about the conventional or classical approach for estimating r_e^* has been used only for the purpose of explaining away the evidence about the dominant market practice being to make no adjustment for imputation credits.

214. In our view, the AER should at least compare its estimate of r_e^* with the estimate of r_e^* that would be obtained using the conventional or classical approach. It would not be appropriate for a regulator to raise the existence of the conventional or classical approach for the purpose of explaining away

[121] It is well known that the effect of the Australian regulatory framework is to reduce the allowed return to equity according to the formula above. This reduction in return is implemented by adjusting the taxation component of the revenue requirement.
[122] AER 2009 WACC Review, Final Decision, p. 409.

evidence of market practice, but then to not compare its own estimate of r_e^* with the corresponding estimate obtained under the conventional or classical approach.

215. Lally (2013) also addresses this point. He confirms that the conventional approach is to use an ex-imputation required return on equity (defined as r_e^* above) that market professionals may estimate directly and that the regulatory approach is to first gross-up this required return to include the assumed value of imputation credits and to then remove their assumed value when calculating the regulated revenue requirement.[123]

216. Again, the conclusion is that the AER should at least compare its estimate of r_e^* with the estimate of r_e^* that would be obtained using the conventional or classical approach.

Conclusions in relation to market practice

217. There is clear evidence that the dominant market practice is to make no adjustment for imputation credits – to consider that the firm must generate the entire return that investors require and that there is no reduction due to imputation credits.

218. If the AER disregards this evidence on the basis that there is a "conventional" or "classical" approach that can be used to estimate the ex-imputation required return on equity without requiring an estimate of gamma, the estimate from that approach should at least be compared with the corresponding estimate from the regulatory approach. Good regulatory practice would then involve the AER explaining why its estimate of the ex-imputation required return on equity (which forms the basis of the allowed revenue) differed from the "conventional" estimate.

[123] Lally (2013), p. 27.

7. Conclusions and recommendations

219. As set out in Section 3 of this report, our view is that the best available estimate of the distribution rate is 0.7.

220. As set out in Section 4 of this report, our view is that the best available estimate of theta (from dividend drop-off analysis) is 0.35 and that that this is a conservative estimate in that the other relevant evidence (which has not yet been subjected to the same degree of scrutiny) suggests lower estimates.

221. Consequently, it is our view that the best available estimate of gamma at the current time is 0.25:

$$\gamma = F \times \theta = 0.7 \times 0.35 = 0.25.$$

Declaration

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

Professor Stephen Gray

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Appendix 1: Instructions

Jemena

Expert Terms of Reference

Estimating the value of imputation credits

Jemena Gas Networks
2015-20 Access Arrangement Review

AA15-570-0054

Version B – 7 May 2014

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Contents

1 Background

Jemena Gas Networks (**JGN**) is the major gas distribution service provider in New South Wales (**NSW**). JGN owns more than 25,000 kilometres of natural gas distribution system, delivering approximately 100 petajoules of natural gas to over one million homes, businesses and large industrial consumers across NSW.

JGN is currently preparing its revised Access Arrangement proposal (**Project**) with supporting information for the consideration of the Australian Energy Regulator (**AER**). The revised access arrangement will cover the period 1 July 2015 to 30 June 2020 (July to June financial years).

As with all of its economic regulatory functions and powers, when assessing JGN's revised Access Arrangement under the National Gas Rules and National Gas Law, the AER is required to do so in a manner that will or is likely to contribute to the achievement of the National Gas Objective, which is:

> "to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas."

For electricity networks, the AER must assess regulatory proposals under the National Electricity Rules and the National Electricity Law in a manner that will or is likely to achieve the National Electricity Objective, as stated in section 7 of the National Electricity Law.

The AER must also take into account the revenue and pricing principles in section 24 of the National Gas Law when exercising a discretion in relation to those parts of JGN's revised Access Arrangement relating to reference tariffs. The revenue and pricing principles include the following:

> "(2) A service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs in—
>
> (a) providing reference services; and
>
> (b) complying with a regulatory obligation or requirement or making a regulatory payment.
>
> (3) A service provider should be provided with effective incentives in order to promote economic efficiency with respect to reference services the service provider provides. The economic efficiency that should be promoted includes—
>
> (a) efficient investment in, or in connection with, a pipeline with which the service provider provides reference services…
>
> […]
>
> (5) A reference tariff should allow for a return commensurate with the regulatory and commercial risks involved in providing the reference service to which that tariff relates.

(6) Regard should be had to the economic costs and risks of the potential for under and over investment by a service provider in a pipeline with which the service provider provides pipeline services."

Some of the key rules that are relevant to an access arrangement and its assessment are set out below.

Rule 74 of the National Gas Rules, relating generally to forecasts and estimates, states:

"(1) Information in the nature of a forecast or estimate must be supported by a statement of the basis of the forecast or estimate.

(2) A forecast or estimate:

(a) must be arrived at on a reasonable basis; and

(b) must represent the best forecast or estimate possible in the circumstances."

Rule 76 of the National Gas Rules sets out how total revenue for a regulated service provider is to be calculated adopting a "building block approach". it provides:

"Total revenue is to be determined for each regulatory year of the *access arrangement period* using the building block approach in which the building blocks are:

(a) a return on the projected capital base for the year (See Divisions 4 and 5);

(b) depreciation on the projected capital base for the year (See Division 6);

(c) the estimated cost of corporate income tax for the year (See Division 5A);

(d) increments or decrements for the year resulting from the operation of an incentive mechanism to encourage gains in efficiency (See Division 9); and

(e) a forecast of operating expenditure for the year (See Division 7)."

The equivalent National Electricity Rules are in clauses 6A.5.4(a) (for electricity transmission) and 6.4.3(a) (for electricity distribution).

Rule 87 of the National Gas Rules, relating to the allowed rate of return, states:

(1) Subject to rule 82(3), the return on the projected capital base for each regulatory year of the access arrangement period is to be calculated by applying a rate of return that is determined in accordance with this rule 87 (the allowed rate of return).

(2) The allowed rate of return is to be determined such that it achieves the allowed rate of return objective.

(3) The allowed rate of return objective is that the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar

degree of risk as that which applies to the service provider in respect of the provision of reference services (the allowed rate of return objective).

(4) Subject to subrule (2), the allowed rate of return for a regulatory year is to be:

(a) a weighted average of the return on equity for the access arrangement period in which that regulatory year occurs (as estimated under subrule (6)) and the return on debt for that regulatory year (as estimated under subrule (8)); and

(b) determined on a nominal vanilla basis that is consistent with the estimate of the value of imputation credits referred to in rule 87A.

(5) In determining the allowed rate of return, regard must be had to:

(a) relevant estimation methods, financial models, market data and other evidence;

(b) the desirability of using an approach that leads to the consistent application of any estimates of financial parameters that are relevant to the estimates of, and that are common to, the return on equity and the return on debt; and

(c) any interrelationships between estimates of financial parameters that are relevant to the estimates of the return on equity and the return on debt.

Return on equity

(6) The return on equity for an access arrangement period is to be estimated such that it contributes to the achievement of the allowed rate of return objective.

(7) In estimating the return on equity under subrule (6), regard must be had to the prevailing conditions in the market for equity funds.

[Subrules (8)–(19) omitted].

The equivalent National Electricity Rules are in clauses 6A.6.2 (for electricity transmission) and 6.5.2 (for electricity distribution).

Rule 87A of the National Gas Rules, relating to the estimated cost of corporate income tax, states:

“The estimated cost of corporate income tax of a service provider for each regulatory year of an access arrangement period (ETC_t) is to be estimated in accordance with the following formula:

$ETC_t = (ETIt \times r_t)\ (1 – \gamma)$

Where

ETI_t is an estimate of the taxable income for that regulatory year that would be earned by a benchmark efficient entity as a result of the provision of reference services if such an entity, rather than the service provider, operated the business of the service provider;

r_t is the expected statutory income tax rate for that regulatory year as determined by the AER; and

γ is the value of imputation credits."

The equivalent National Electricity Rules are in clauses 6A.6.4 (for electricity transmission) and 6.5.3 (for electricity distribution).

In this context, the independent opinion of SFG, as a suitably qualified independent expert (**Expert**), is sought on the value of imputation credits (γ or gamma) to be applied in estimating the cost of corporate income tax. JGN seeks this opinion on behalf of itself, ActewAGL, APA, Energex, Networks NSW, Transend, TransGrid, and SA PowerNetworks.

2 Scope of Work

The Expert will provide an opinion report that:

1. Clearly describes the conceptual economic / finance basis for accounting for the value of imputation credits when estimating the cost of corporate income tax as part of a post-tax building block revenue framework where the building blocks are as set out in rule 76 (for gas distribution and transmission), clause 6A.5.4(a) (for electricity transmission), and 6.4.3(a) (for electricity distribution);

2. Assesses each of the methods identified by the AER for estimating the value of imputation credits in the rate of return guidelines, as well as any other methods the Expert may consider to be relevant, in terms of:

   (a) their suitability for estimating the value of imputation credits within the building block revenue framework, in light of the conceptual economic / finance basis for this parameter; and

   (b) the reliability and robustness of estimates produced by each method;

3. Provides the Expert's opinion on the best method, or combination of methods, for estimating the value of imputation credits within the building block revenue framework; and

4. Provides an estimate of the value of imputation credits, based on the recommended method, or combination of methods.

In preparing the report, the Expert will:

A. consider possible alternative positions to what measure is sought to be captured in the gamma parameter, in particular the position of the AER in the rate of return guidelines;

B. consider possible alternative methods and approaches to estimating the value of imputation credits, including those previously considered by the AER and other regulators;

C. consider the theoretical and empirical support for each of the possible approaches;

D. consider any comments raised by the AER and other regulators, and experts engaged by those regulators on (a) the appropriateness of alternative methods for estimating the value of imputation credits; and (b) the statistical reliability of the estimates produced by those approaches; and

E. use robust methods and data in producing any statistical estimates.

3 Information to be Considered

The Expert is also expected to consider the following information:

- such information that, in Expert's opinion, should be taken into account to address the questions outlined above;
- relevant literature on the value of imputation credits;
- the AER's Rate of Return Guideline, including explanatory statements and supporting expert material;
- material submitted to the AER as part of its consultation on the Rate of Return Guidelines; and
- previous decisions of the AER, other relevant regulators and the Australian Competition Tribunal on the value of imputation credits and any supporting expert material.

4 Deliverables

At the completion of its review the Expert will provide an independent expert report which:

- is of a professional standard capable of being submitted to the AER;
- is prepared in accordance with the Federal Court Practice Note on Expert Witnesses in Proceedings in the Federal Court of Australia (CM 7) set out in Attachment 1, and includes an acknowledgement that the Expert has read the guidelines [1];
- contains a section summarising the Expert's experience and qualifications, and attaches the Expert's curriculum vitae (preferably in a schedule or annexure);
- identifies any person and their qualifications, who assists the Expert in preparing the report or in carrying out any research or test for the purposes of the report;
- summarises JGN's instructions and attaches these term of reference;
- includes an executive summary which highlights key aspects of the Expert's work and conclusions; and

[1] Available at: http://www.federalcourt.gov.au/law-and-practice/practice-documents/practice-notes/cm7.

- (without limiting the points above) carefully sets out the facts that the Expert has assumed in putting together his or her report, as well as identifying any other assumptions made, and the basis for those assumptions.

The Expert's report will include the findings for each of the five parts defined in the scope of works (Section 2).

5 Timetable

The Expert will deliver the final report to Jemena Regulation by **9 May 2014**.

6 Terms of Engagement

The terms on which the Expert will be engaged to provide the requested advice shall be:

- as provided in accordance with the Jemena Regulatory Consultancy Services Panel arrangements applicable to the Expert.

ATTACHMENT 1: FEDERAL COURT PRACTICE NOTE

Practice Note CM 7

EXPERT WITNESSES IN PROCEEDINGS IN THE FEDERAL COURT OF AUSTRALIA

Commencement

1. This Practice Note commences on 4 June 2013.

Introduction

2. Rule 23.12 of the Federal Court Rules 2011 requires a party to give a copy of the following guidelines to any witness they propose to retain for the purpose of preparing a report or giving evidence in a proceeding as to an opinion held by the witness that is wholly or substantially based on the specialised knowledge of the witness (see **Part 3.3 - Opinion** of the *Evidence Act 1995* (Cth)).

3. The guidelines are not intended to address all aspects of an expert witness's duties, but are intended to facilitate the admission of opinion evidence[2], and to assist experts to understand in general terms what the Court expects of them. Additionally, it is hoped that the guidelines will assist individual expert witnesses to avoid the criticism that is sometimes made (whether rightly or wrongly) that expert witnesses lack objectivity, or have coloured their evidence in favour of the party calling them.

<u>Guidelines</u>

1. General Duty to the Court[3]

1.1 An expert witness has an overriding duty to assist the Court on matters relevant to the expert's area of expertise.

1.2 An expert witness is not an advocate for a party even when giving testimony that is necessarily evaluative rather than inferential.

1.3 An expert witness's paramount duty is to the Court and not to the person retaining the expert.

2. The Form of the Expert's Report[4]

2.1 An expert's written report must comply with Rule 23.13 and therefore must

(a) be signed by the expert who prepared the report; and

(b) contain an acknowledgement at the beginning of the report that the expert has read, understood and complied with the Practice Note; and

(c) contain particulars of the training, study or experience by which the expert has acquired specialised knowledge; and

(d) identify the questions that the expert was asked to address; and

(e) set out separately each of the factual findings or assumptions on which the expert's opinion is based; and

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2 As to the distinction between expert opinion evidence and expert assistance see *Evans Deakin Pty Ltd v Sebel Furniture Ltd* [2003] FCA 171 per Allsop J at [676].

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

4 Rule 23.13.

(f) set out separately from the factual findings or assumptions each of the expert's opinions; and

(g) set out the reasons for each of the expert's opinions; and

(ga) contain an acknowledgment that the expert's opinions are based wholly or substantially on the specialised knowledge mentioned in paragraph (c) above[5]; and

(h) comply with the Practice Note.

2.2 At the end of the report the expert should declare that "[the expert] has *made all the inquiries that* [the expert] *believes are desirable and appropriate and that no matters of significance that* [the expert] *regards as relevant have, to* [the expert's] *knowledge, been withheld from the Court*."

2.3 There should be included in or attached to the report the documents and other materials that the expert has been instructed to consider.

2.4 If, after exchange of reports or at any other stage, an expert witness changes the expert's opinion, having read another expert's report or for any other reason, the change should be communicated as soon as practicable (through the party's lawyers) to each party to whom the expert witness's report has been provided and, when appropriate, to the Court[6].

2.5 If an expert's opinion is not fully researched because the expert considers that insufficient data are available, or for any other reason, this must be stated with an indication that the opinion is no more than a provisional one. Where an expert witness who has prepared a report believes that it may be incomplete or inaccurate without some qualification, that qualification must be stated in the report.

2.6 The expert should make it clear if a particular question or issue falls outside the relevant field of expertise.

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

3. Experts' Conference

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

J L B ALLSOP
Chief Justice
4 June 2013

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

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

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

Appendix 2: Curriculum vitae of Professor Stephen Gray

Stephen F. Gray

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

<u>Academic Qualifications</u>

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.

<u>Employment History</u>

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.

<u>Academic Awards</u>

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.

<u>Large Grants (over $100, 000)</u>

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

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

Current Research Interests

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

Publications

Gray, S., I. Harymawan and J. Nowland, (2014), "Political and government connections on corporate boards in Australia: Good for business?" *Australian Journal of Management*, forthcoming.

Brailsford, T., S. Gray and S. Treepongkaruna, (2013), "Explaining the bid-ask spread in the foreign exchange market: A test of alternate models," *Australian Journal of Management*, forthcoming.

Faff, R., S. Gray and M. Poulsen, (2013), "Financial inflexibility and the value premium," *International Review of Finance*, forthcoming.

T. Fitzgerald, S. Gray, J. Hall and R. Jeyaraj, (2013), "Unconstrained estimates of the equity risk premium" *Review of Accounting Studies*, 18, 560-639.

Gray, S. and J. Nowland, (2013), "Is prior director experience valuable?" *Accounting and Finance*, 53, 643-666.

Chen, E. T., S. Gray and J. Nowland, (2012), "Family representatives in family firms" *Corporate Governance: An International Review*, 21(3), 242-263.

Treepongkaruna, S., R. Brooks and S. Gray, (2012), "Do Trading Hours Affect Volatility Links in the Foreign Exchange Market?" *Australian Journal of Management*, 37, 7-27.

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Chan, K-F., R. Brooks, S. Treepongkaruna and S. Gray, (2011), "Asset market linkages: Evidence from financial, commodity and real estate assets," *Journal of Banking and Finance*, 35, 6, 1415-1426.

Parmenter, B, A. Breckenridge, and S. Gray, (2010), 'Economic Analysis of the Government's Recent Mining Tax Proposals', *Economic Papers*: *A Journal of Economics and Policy*, 29(3), September, 279-91.

Gray, S., C. Gaunt and Y. Wu, (2010), "A comparison of alternative bankruptcy prediction models," *Journal of Contemporary Accounting and Economics*, 6, 1, 34-45.

Feuerherdt, C., S. Gray and J. Hall, (2010), "The Value of Imputation Tax Credits on Australian Hybrid Securities," *International Review of Finance*, 10, 3, 365-401.

Gray, S., J. Hall, D. Klease and A. McCrystal, (2009), "Bias, stability and predictive ability in the measurement of systematic risk," *Accounting Research Journal*, 22, 3, 220-236.

Treepongkaruna, S. and S. Gray, (2009), "Information volatility links in the foreign exchange market," *Accounting and Finance*, 49, 2, 385-405.

Costello, D., S. Gray, and A. McCrystal, (2008), "The diversification benefits of Australian equities," *JASSA*, 2008, 4, 31-35.

Gray, S. and J. Hall, (2008), "The Relationship Between Franking Credits and the Market Risk Premium: A Reply," *Accounting and Finance*, 48, 1, 133-142.

Gray, S., A. Mirkovic and V. Ragunathan, (2006), "The Determinants of Credit Ratings: Australian Evidence," *Australian Journal of Management*, 31(2), 333-354.

Choy, E., S. Gray and V. Ragunathan, (2006), "The Effect of Credit Rating Changes on Australian Stock Returns," *Accounting and Finance*, 46(5), 755-769.

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Gray, S. and S. Treepongkaruna, (2006), “Are there non-linearities in short-term interest rates?” *Accounting and Finance*, 46(1), 149-167.

Gray, P., S. Gray and T. Roche, (2005), “A Note on the Efficiency in Football Betting Markets: The Economic Significance of Trading Strategies,” *Accounting and Finance*, 45(2) 269-281.

Duffie, D., S. Gray and P. Hoang, (2004), “Volatility in Energy Prices. In V. Kaminski,” (Ed.), *Managing Energy Price Risk: The New Challenges and Solutions* (3rd ed.). London: Risk Books.

Cannavan, D., F. Finn and S. Gray, (2004), “The Value of Dividend Imputation Tax Credits in Australia,” *Journal of Financial Economics*, 73, 167-197.

Gray, S. and S. Treepongkaruna, (2003), “Valuing Interest Rate Derivatives Using a Monte-Carlo Approach,” *Accounting and Finance*, 43(2), 231-259.

Gray, S., T. Smith and R. Whaley, (2003), “Stock Splits: Implications for Investor Trading Costs,” *Journal of Empirical Finance*, 10, 271-303.

Gray, S. and S. Treepongkaruna, (2003), “On the Robustness of Short-term Interest Rate Models,” *Accounting and Finance*, 43(1), 87-121.

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Gray, P. and S. Gray, (2001), “A Framework for Valuing Derivative Securities,” *Financial Markets Institutions & Instruments*, 10(5), 253-276.

Gray, P. and S. Gray, (2001), “Option Pricing: A Synthesis of Alternate Approaches,” *Accounting Research Journal*, 14(1), 75-83.

Dahlquist, M. and S. Gray, (2000), “Regime-Switching and Interest Rates in the European Monetary System,” *Journal of International Economics*, 50(2), 399-419.

Bollen, N., S. Gray and R. Whaley, (2000), “Regime-Switching in Foreign Exchange Rates: Evidence from Currency Options,” *Journal of Econometrics*, 94, 239-276.

Duffie, D., S. Gray and P. Hoang, (1999), “Volatility in Energy Prices. In R. Jameson,” (Ed.), *Managing Energy Price Risk* (2nd ed.). London: Risk Publications.

Gray, S. and R. Whaley, (1999), “Reset Put Options: Valuation, Risk Characteristics, and an Example,” *Australian Journal of Management*, 24(1), 1-21.

Bekaert, G. and S. Gray, (1998), “Target Zones and Exchange Rates: An Empirical Investigation,” *Journal of International Economics*, 45(1), 1-35.

Gray, S. and R. Whaley, (1997), “Valuing S&P 500 Bear Market Warrants with a Periodic Reset,” *Journal of Derivatives*, 5(1), 99-106.

Gray, S. and P. Gray, (1997), “Testing Market Efficiency: Evidence from the NFL Sports Betting Market,” *The Journal of Finance*, 52(4), 1725-1737.

Gray, S. (1996), “Modeling the Conditional Distribution of Interest Rates as a Regime- Switching Process,” *Journal of Financial Economics*, 42, 27-62.

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Brailsford, T., S. Easton, P.Gray and S. Gray, (1995), “The Efficiency of Australian Football Betting Markets,” *Australian Journal of Management*, 20(2), 167-196.

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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 10 years.
- Corporate Finance Honours: Average 6.9 over 10 years.

2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).
2000 University of Queensland Award for Excellence in Teaching.
1999 Department of Commerce KPMG Teaching Prize, University of Queensland.
1998 Faculty Teaching Prize, Faculty of Business Economics and Law, University of Queensland.
1998 Commendation for Excellence in Teaching, University-wide Teaching Awards, University of Queensland.
1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.

Board Positions

2002 - Present: Director, Financial Management Association of Australia Ltd.
2003 - Present: Director, Moreton Bay Boys College Ltd. (Chairman since 2007).
2002 - 2007: External Risk Advisor to Board of Enertrade (Queensland Power Trading Corporation Ltd.)

Consulting

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

Consulting interests and specialties, with recent examples, include:

- **Corporate finance**
  - ⇒ **Listed multi-business corporation:** Detailed financial modeling of each business unit, analysis of corporate strategy, estimation of effects of alternate strategies, development of capital allocation framework.

- **Capital management and optimal capital structure**
  - ⇒ **State-owned electricity generator:** Built detailed financial model to analyze effects of increased leverage on cost of capital, entity value, credit rating, and stability of dividends. Debt of $500 million issued.

- **Cost of capital**
  - ⇒ **Cost of Capital in the Public Sector:** Provided advice to a government enterprise on how to estimate an appropriate cost of capital and benchmark return for Government-owned enterprises. Appearance as **expert witness** in legal proceedings that followed a regulatory determination.
  - ⇒ **Expert Witness:** Produced a written report and provided court testimony on issues relating to the cost of capital of a cable TV business.
  - ⇒ **Regulatory Cost of Capital:** Extensive work for regulators and regulated entities on all matters relating to estimation of weighted-average cost of capital.

- **Valuation**

- ⇒ **Expert Witness:** Produced a written report and provided court testimony. The issue was whether, during a takeover offer, the shares of the bidding firm were affected by a liquidity premium due to its incorporation in the major stock market index.
- ⇒ **Expert Witness:** Produced a written report and provided court testimony in relation to valuation issues involving an integrated mine and refinery.

- **Capital Raising**
  - ⇒ Produced comprehensive valuation models in the context of capital raisings for a range of businesses in a range of industries including manufacturing, film production, and biotechnology.

- **Asset pricing and empirical finance**
  - ⇒ **Expert Witness:** Produced a written report on whether the client's arbitrage-driven trading strategy caused undue movements in the prices of certain shares.

- **Application of econometric techniques to applied problems in finance**
  - ⇒ **Debt Structure Review:** Provided advice to a large City Council on restructuring their debt portfolio. The issues involved optimisation of a range of performance measures for each business unit in the Council while simultaneously minimizing the volatility of the Council's equity in each business unit.
  - ⇒ **Superannuation Fund Performance Benchmarking:** Conducted an analysis of the techniques used by a large superannuation fund to benchmark its performance against competing funds.

- **Valuation of derivative securities**
  - ⇒ **Stochastic Volatility Models in Interest Rate Futures Markets:** Estimated and implemented a number of models designed to predict volatility in interest rate futures markets.

- **Application of option-pricing techniques to real project evaluation**
  - ⇒ **Real Option Valuation:** Developed a framework for valuing an option on a large office building. Acted as arbitrator between the various parties involved and reached a consensus valuation.
  - ⇒ **Real Option Valuation:** Used real options framework in the valuation of a bio-tech company in the context of an M&A transaction.

Appendix 3: The conceptual interpretation of gamma and theta

223. In this appendix, we consider a standard dividend imputation setting in which a company generates profits in Australia, pays corporate tax, and then distributes franked dividends to its shareholders. We follow the standard notation in defining F to be the proportion of created credits that are distributed to shareholders and θ to be the equilibrium value of distributed credits. We also follow the standard approach of defining gamma to be the product if these two parameters:

$$\gamma = F \times \theta \tag{1}$$

224. In our initial example, we consider a simple case in which the company distributes all of the credits that it creates (in which case $F = 1$) and where 50% of the face value of distributed credits are reflected in the stock price. In this case:

$$\gamma = F \times \theta = 1 \times 0.5 = 0.5.$$

225. We also consider a company with an initial stock price of $S_0 = 100$ and required return on equity of $r_e = 10\%$.

226. Officer (1994) shows that, in this setting, the proportion of the required return on equity that is due to dividends is:[124]

$$G = \frac{1-T}{1-T(1-\gamma)} \tag{2}$$

and that the proportion of the required return on equity that is due to imputation credits is:

$$(1-G) = \frac{\gamma T}{1-T(1-\gamma)} \tag{3}$$

where T is the corporate tax rate, which we set to 30% in this example.

227. In this case, the proportion of the required return from dividends is:

$$\frac{1-T}{1-T(1-\gamma)} = \frac{1-0.3}{1-0.3(1-0.5)} = 82.4\%$$

and the proportion from imputation credits is:

$$\frac{\gamma T}{1-T(1-\gamma)} = \frac{0.5 \times 0.3}{1-0.3(1-0.5)} = 17.6\%.$$

228. Since the total required return on equity is 10% in this case, a return of 8.24% is required from dividends and the remaining 1.76% will come from imputation credits. Note that there are no capital gains in this constant perpetuity setting – post-tax profit is the same every year in perpetuity and all of this profit is paid out in full as a dividend.

[124] We define this term to be G to simplify the following derivations.

229. That is, in equilibrium, every year the \$100 stock generates a dividend of \$8.24 and imputation credits that have a value of \$1.76. The stream of dividends and imputation credits are both level perpetuities in this framework, so their present value can be written as:

$$\frac{8.24}{0.1}+\frac{1.76}{0.1}=82.4+17.6=100.$$

230. In this case, dividends represent 82.4% of the value of equity and the remaining 17.6% is due to imputation credits.

231. To fund the required streams of dividends and imputation credits, the company must generate pre-tax profit (Y_1) of:

$$Y_1=\frac{Gr_eS_0}{1-T}=\frac{0.824\times 0.10\times 100}{1-0.3}=11.77. \qquad (4)$$

232. That is, the company generates pre-tax profit of \$11.77 and pays tax of \$3.53,[125] leaving \$8.24 to be paid out as a dividend. The corporate tax payment generates imputation credits with a face value of \$3.53. These credits are distributed to shareholders who value them at half their face value (because $\theta = 0.5$), which is \$1.76.

233. In this case, the current stock price will be equal to the sum of the present values of the dividend, imputation credits, and end-of-year stock price:

$$S_0=\frac{Div_1+\theta\times Tax_1+S_1}{1+r_e}=\frac{8.24+0.5\times 3.51+100}{1.10}=100. \qquad (5)$$

234. Now consider the case where some fraction of the post-tax profit is retained within the firm. In particular, we consider the case where the firm distributes 70% of its post-tax profit as a dividend to shareholders. This also implies that the firm will distribute 70% of the imputation credits that are created by the payment of corporate tax. In this example, we assume that 70% of the face value of imputation credits are reflected in the stock price, in which case we have:

$$\gamma = F\times\theta = 0.7\times 0.7 = 0.49.$$

235. In this case, we have:

$$G=\frac{1-0.3}{1-0.3(1-0.49)}=0.826. \qquad (6)$$

236. We also assume that the 30% of post-tax profits that are reinvested back into the firm will earn the normal return of 10% p.a.

237. In this case, the required pre-tax profit is:

$$Y_1=\frac{Gr_eS_0}{1-T}=\frac{0.826\times 0.10\times 100}{1-0.3}=11.81$$

and the dividend paid is equal to a fraction of post-tax profit:

[125] 30% of 11.77 is 3.53.

$$Div_1 = Y_1(1-T)F = 11.81(1-0.3)0.7 = 5.79\,. \tag{7}$$

238. Also note that the amount of post-tax profit that is reinvested is $Y_1(1-T)(1-F)$. Since this reinvestment is assumed to earn a normal return, it will have a value equal to the amount invested. Consequently, the end-of-year stock price will be:

$$S_1 = S_0 + Y_1(1-T)(1-F) = 100 + 11.77(1-0.3)(1-0.7) = 102.48\,. \tag{8}$$

239. The amount of imputation credits that are created equals the amount of corporate tax that is paid (30% of 11.81 is 3.54). However, only proportion F of this corporate tax is distributed as imputation credits:

$$IC_1 = Y_1TF = 11.81 \times 0.3 \times 0.7 = 2.48. \tag{9}$$

240. Since $\theta = 0.7$, 70% of the face value of imputation credits is incorporated into the stock price – $0.7 \times 2.48 = 1.74.$

241. The current stock price can be written as the present value of the dividends, imputation credits and end-of-year stock price:

$$\begin{aligned} S_0 &= \frac{Y_1(1-T)F + \theta \times Y_1TF + S_1}{1+r_e} \\ &= \frac{11.81(1-0.3)0.7 + 0.7 \times 11.81 \times 0.3 \times 0.7 + 102.48}{1.10} = 100. \end{aligned} \tag{10}$$

242. Now, substituting the expression for pre-tax profit in Equation (4) into Equation (8) yields:

$$S_1 = S_0 + \frac{Gr_eS_0}{1-T}(1-T)(1-F) = S_0(1 + Gr_e(1-F)). \tag{11}$$

243. That is, the growth rate in the stock price is:

$$g = Gr_e(1-F). \tag{12}$$

244. This same growth rate will also apply to dividends and the amount of imputation credits that are distributed each year. In this case, the growth rate is:

$$g = 0.826 \times 0.10(1-0.7) = 2.48\%\,.$$

245. With this constant growth rate, the present value of dividends can be written as:

$$PV(Divs) = \frac{Div_1}{r_e - g}. \tag{13}$$

246. Substituting the expression for growth in Equation (12) and the expression for Div_1 in Equation (7) into Equation (13) yields:

$$PV(Divs) = \frac{Div_1}{r_e - g} = \frac{Y_1(1-T)F}{r_e - Gr_e(1-F)} = \frac{5.79}{0.10 - 0.248} = 76.92\,. \tag{14}$$

247. Substituting the expression for pre-tax profit in Equation (4) into Equation (14) yields:

$$PV(Divs) = \frac{\frac{Gr_e S_0}{1-T}(1-T)F}{r_e - Gr_e(1-F)} = \frac{GF}{1-G(1-F)} S_0 . \tag{15}$$

248. Now, substituting the expression for G in Equation (2) into Equation (15) yields:

$$PV(Divs) = \frac{GF}{1-G+GF} S_0 = \frac{\frac{1-T}{1-T(1-\gamma)}F}{\frac{\gamma T}{1-T(1-\gamma)} + \frac{1-T}{1-T(1-\gamma)}F} S_0 = \frac{(1-T)F}{\gamma T + (1-T)F} S_0 \tag{16}$$

249. Finally, substituting in the expression for gamma in Equation (1) into Equation (16) yields:

$$PV(Divs) = \frac{(1-T)F}{F\theta T + (1-T)F} S_0 = \frac{1-T}{1-T(1-\theta)} S_0 . \tag{17}$$

250. That is, the proportion of the stock price that is due to dividends is $\frac{1-T}{1-T(1-\theta)}$. In this case we have:

$$PV(Divs) = \frac{1-T}{1-T(1-\theta)} S_0 = \frac{1-0.3}{1-0.3(1-0.7)} 100 = 0.769 \times 100 = 76.9.$$

251. A similar derivation shows that the proportion of the stock price that is due to imputation credits is:

$$1 - \frac{1-T}{1-T(1-\theta)} = \frac{\theta T}{1-T(1-\theta)} .$$

252. In this case we have:

$$PV(IC) = \frac{\theta T}{1-T(1-\theta)} S_0 = \frac{0.7 \times 0.3}{1-0.3(1-0.7)} 100 = 0.231 \times 100 = 23.1.$$

253. Another way to see the results set out above is to note that the total required return on equity is composed of dividends, capital gains and imputation credits:

$$r_e = r_{divs} + r_{cap\,gains} + r_{IC} \tag{18}$$

254. Now, note that for every F dollars of dividends, there are $1-F$ dollars of capital gains. This implies that for every dollar of dividends there are $\frac{1-F}{F}$ dollars of capital gains, in which case:

$$r_{cap\,gains} = \frac{1-F}{F} r_{divs} .$$

255. Also note that there are $\frac{T}{1-T}$ imputation credits attached to every dollar of dividends, each of which has an equilibrium value of θ. This implies that for every dollar of dividends there are imputation credits worth $\frac{\theta T}{1-T}$, in which case:

$$r_{IC} = \frac{\theta T}{1-T} r_{divs}.$$

256. Substituting these results into Equation (18) yields:

$$\begin{aligned} r_e &= r_{divs} + \frac{1-F}{F} r_{divs} + \frac{\theta T}{1-T} r_{divs} \\ &= \left(1 + \frac{1-F}{F} + \frac{\theta T}{1-T}\right) r_{divs} \\ &= \left(\frac{1-T+F\theta T}{F(1-T)}\right) r_{divs} \\ &= \left(\frac{1-T(1-\gamma)}{F(1-T)}\right) r_{divs}. \end{aligned}$$

257. That is, each year the proportion of the return that is due to dividends is:

$$\frac{r_{divs}}{r_e} = \frac{F(1-T)}{1-T(1-\gamma)}.$$

258. It follows that the proportion of the return that is due to capital gains is:

$$\frac{r_{cap\,gains}}{r_e} = \frac{1-F}{F}\left(\frac{F(1-T)}{1-T(1-\gamma)}\right) = \frac{(1-F)(1-T)}{1-T(1-\gamma)},$$

in which case the proportion of the return that is due to dividends and capital gains collectively is:

$$\frac{r_{divs+cap\,gains}}{r_e} = \frac{(1-T)}{1-T(1-\gamma)}.$$

259. Similarly, the proportion of the return that is due to imputation credits is:

$$\frac{r_{IC}}{r_e} = \frac{\theta T}{1-T}\left(\frac{F(1-T)}{1-T(1-\gamma)}\right) = \frac{\gamma T}{1-T(1-\gamma)}.$$

260. Now note that the current stock price can be written as:

$$S_0 = PV(Divs) + PV(IC).$$

261. Since every dollar of dividends is accompanied by imputation credits with an equilibrium value of $\frac{\theta T}{1-T}$, we have:

$$S_0 = PV(Divs) + \frac{\theta T}{1-T} PV(Divs) = \frac{1-T+\theta T}{1-T} PV(Divs)$$

262. This implies that the proportion of the current stock price that is due to the future stream of dividends is:

$$\frac{PV(Divs)}{S_0} = \frac{1-T}{1-T+\theta T}.$$

263. Consequently, the proportion of the current stock price that is due to the future stream of imputation credits is:

$$\frac{PV(IC)}{S_0} = \frac{\theta T}{1-T} \frac{1-T}{1-T+\theta T} = \frac{\theta T}{1-T+\theta T}.$$

264. These expressions for the relative proportions of annual returns and the relative proportions of the current stock price can be reconciled by noting that the capital gains reflect the fact that reinvested funds will result in a future increase in the amount of both dividends and imputation credits. That is, some of the capital gain reflects the increase in future dividends and some reflects the increase in future imputation credits – in the ratio of $1 : \frac{\theta T}{1-T}$. Assigning the annual capital gain in this proportion, reconciles the annual return calculations with the current stock price calculations above.

Appendix 4: The Lally (2013) estimate of the distribution rate

An empirical estimate based on observable data

265. In relation to the distribution rate, Lally (2013a,[126] pp. 53-54) discusses why the 100% value that the AER adopted in its 2009 WACC review, based on advice from Handley (2008), is flawed and unsupportable. This simply confirms the view of the Tribunal and indeed the AER's own submissions to the Tribunal in the *Gamma* Case. Lally concludes that:

> the various theory-based arguments (all for a distribution rate of 1) are not justified, and therefore an empirical estimate is warranted.[127]

266. We agree with the conclusion that an empirical estimate is warranted and note that it is consistent with regulatory practice and with the views of other expert advice to the AER.

267. The advice from Handley (2008), on which the AER relied for its 2009 WACC Review, was that undistributed credits should be treated as though they were distributed on the basis that they may be distributed at some time in the future. Lally (2013a) specifically rejects that argument, concluding that the observed payout rate in the historical data should be used:

> Since there is no reasonable basis for estimating what proportion of these undistributed credits will ever be distributed, and it seems unlikely that most of them will ever be, I recommend that the historical data be used to estimate the distribution rate.

268. We also agree with the conclusion that the distribution rate should be estimated as the observed payout rate in the historical data and we note that there is general agreement on this point.

269. In summary, Lally (2013a) concludes that the distribution rate should be estimated empirically using observable data about the proportion of imputation credits that are actually distributed in practice. We agree with this conclusion and note that it has consistent with regulatory practice and with the views of other expert advice to the AER.

Empirical estimates of the distribution rate

270. Lally (2013a) has regard to two empirical estimates of the distribution rate:

   a) The 70% estimate that is based on Australian Tax Office data and which is generally accepted, as set out above; and

   b) His own analysis of a sample of ten companies, which produces an estimate that "would appear to be over 90%."[128]

271. As set out above, the widely accepted empirical estimate is 0.7. This is based on what NERA (2013) refers to as the "cumulative payout ratio." In fact, the AER's Draft Rate of Return Guideline Explanatory Statement explicitly sets out that approach and notes that its estimate of the distribution rate will be based on that approach. In relation to the implementation of that approach, and the data required for it, the AER concludes that:

[126] Lally, M., 2013, *The Estimation of Gamma*, Report for the AER, 23 November.
[127] Lally (2013a), p. 54.
[128] Lally (2013a), p. 52.

> We consider this is a reasonable approach to estimate the payout ratio. In particular, we consider it is simple, fit for purpose, transparent, replicable and based on reliable and publicly accessible data sets.[129]

272. Lally (2013a) questions the reliability of the data and the resulting estimates. For example, he states that:

> The ATO data suggests a figure of 70% but NERA (2013a) identifies some difficulties in the underlying data.[130]

273. This leads Lally (2013) to seek to produce his own estimate of the distribution rate by extrapolating payout ratios from a sample of ten companies. Nowhere does he explain what “concerns” or “difficulties” he might have with the ATO data that forms the basis of the estimate that is used by everyone else.[131]

274. Moreover, NERA (2013) note that their estimate of the distribution rate may, if anything, be *upwardly* biased. In particular, the data is available in the form of end-of-year franking account balances. Consequently, if the franking account balance is not reported for a particular firm, the credits in that firm’s previous franking account are treated as having been distributed during the year. However, some firms simply neglect to report the franking account balance. In addition, any firm that becomes bankrupt during the year will no report a franking balance, and in those cases the franking credits are generally never distributed.[132]

Lally approach produces unstable estimates, relative to the standard approach

275. In his report for the QCA’s 2004 WACC review, Lally (2004) refers to his estimate of the distribution rate for eight companies and recommends that the distribution rate should be set to 100% on the basis of that analysis.[133] The QCA rejected that recommendation in 2004. In a recent report for the QCA, Lally (2013b)[134] extends the sample of firms from 8 to 10 and the estimate falls from 100% to 85%.

276. Lally (2013a) himself notes that estimates from the accepted approach (by a range of authors) have been 0.69, 0.71, 0.69, and 0.70 and that “the consistency in these estimates encourages confidence in them.”[135] Clearly, they are much more consistent than the estimates produced by his own small sample approach. In our view, the stable estimates from the accepted approach should not be rejected on the basis of unstated “concerns” or “difficulties.”

277. Another relevant consideration is the role of foreign sourced profits. Suppose the average company distributes 70% of its profits as dividends. In general, a company with 30% or more of its profits from overseas operations will be able to distribute all of the imputation credits that it creates. Very large companies (such as the ten that Lally (2013a,b) examines) are unlikely to be representative of the broader market. For example, they more likely to have more overseas profits than the average firm – and certainly more overseas profits than the benchmark regulated firm. Consequently, it is not

[129] AER Draft Rate of Return Guideline, Explanatory Statement, p. 236.
[130] Lally (2013a), p. 51.
[131] Whereas a number of concerns have been raised in relation to the quality of the ATO data on the *redemption* of imputation credits, no material concerns have been raised in relation to the data on the *distribution* of imputation credits.
[132] NERA (2013), p. 5.
[133] Lally (2004), p. 40.
[134] Lally, M., 2013, *Estimating Gamma*, Report for the QCA, 25 November.
[135] Lally (2013a), p. 50.

clear that the Lally approach is capable of producing an appropriate estimate of the distribution rate in any event.

Lally recommendations on the distribution rate

278. In his recent report for the AER, Lally (2013a) recommends:

> an estimate for the distribution rate of at least 70%.[136]

279. In his report for the QCA (dated two days later and based on the same set of evidence) Lally (2013b) recommends that:

> the estimated market-level distribution rate is 85%.[137]

Conclusions and recommendations

280. We conclude that the Lally small sample approach should receive no weight because:

a) It produces highly variable estimates over time, including materially different recommendations two days apart, whereas the accepted approach produces stable estimates;

b) The Lally approach is motivated only by unspecified problems with the ATO data. Whereas there are known to be problems with ATO redemption rate data, no issues have been raised in relation to the distribution rate data; and

c) The small sample of firms used in the Lally approach are not indicative of either the average firm or the benchmark regulated firm.

[136] Lally (2013a), pp. 5, 54.
[137] Lally (2013b), p. 5.

Appendix 5: The conceptual definition of theta

Terminology: "Utilisation rate" and "theta"

281. When discussing the conceptual role of theta, the first issue to address is one of terminology. In its 2009 WACC Review, the AER used the terms "theta" and "utilisation rate" interchangeably. For example, the AER referred to:

> the utilisation rate (commonly referred to as 'theta')[138]

and:

> Recent estimates of the utilisation rate (theta).[139]

282. The rationale for equating the terms "utilisation rate" and "theta" is set out in Lally (2013a). He uses U to represent the utilisation rate and proposes that:

$$\theta = \delta \times U$$

where δ represents the implied value of a dollar of cash dividends. Since the AER fixes $\delta = 1$ throughout its process for determining the allowed return on equity, it follows that the terms "utilisation rate" and "theta" are equivalent under the AER framework. Lally (2013a) suggests that the AER should consider more complex models for determining the allowed return on equity that do not require that the value of cash dividends be fixed at $\delta = 1$. Examples include Lally (1992) and Lally and van Zijl (2003). However, the AER has maintained its approach of fixing $\delta = 1$ throughout its current Guideline

283. As set out in Section 2 above, it is generally accepted that gamma must be estimated as the product of two components: $\gamma = F \times \theta$. The fact that the Rules define gamma to be "the value of imputation credits"[140] would seem to imply that theta must be interpreted as "the value of distributed imputation credits." Moreover, from the discussion above, it does not matter whether the second parameter is called "theta" or "utilisation rate" or "the parameter that must be multiplied by F to obtain gamma." It also does not matter what symbol is used for this parameter – the point is that under the Rules that second parameter must be interpreted as "the value of distributed imputation credits."[141]

284. The only question then is what is meant by "the value of distributed imputation credits." Prior to the current Guideline, the AER interpreted value to mean "worth" or "price" – the value to the market. This remains the interpretation adopted by every other regulator. The Guideline now proposes a materially different interpretation that is examined in detail below.

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138 AER 2009 WACC Review Final Determination, p. 398.

139 AER 2009 WACC Review Final Determination, Table 10.4, p. 399.

140 NER cls. 6.5.3, 6A.6.4 (current since version 53); NGR r. 87A(1) (current since version 14).

141 This interpretation is also consistent with the Revenue and Pricing Principles, which require that "a reference tariff should allow for a return commensurate with the regulatory and commercial risks involved" and that "a service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs." In the regulatory setting, the regulator first determines the required return on equity, then sets the allowed revenues so that the sum of the allowed return on equity and the assumed value of imputation credits equals the required return on equity. If the regulator over- or under-estimates the value of franking credits, investors will be under- or over-compensated. In such a case, the return that equity holders receive is not commensurate with the regulatory and commercial risks involved or with the efficient costs the service provider incurs.

The Guideline's "re-evaluation of the conceptual task"[142]

Overview of the conceptual re-evaluation

285. In its 2009 WACC Review the AER interpreted theta as:

> the per dollar value of a distributed credit.[143]

286. The AER further proposed that redemption rates could be used to estimate that "per dollar value of a distributed credit." However, the Tribunal ruled that redemption rates cannot be used to estimate theta (at least insofar as theta is interpreted as the per dollar value of a distributed credit). Specifically, the Tribunal held that redemption rates do not produce an estimate of value. In particular, the Tribunal held that redemption rates provide no more than an upper bound check on estimates of theta obtained from the analysis of market prices, and that it is wrong to interpret such an estimate as a point estimate rather than as an upper bound:

> The AER accepted that utilisation rates derived from tax statistics provide an upper bound on possible values of theta. Setting aside the manner in which the AER derived a value from the tax statistics study, it correctly considered that information from a tax statistics study was relevant. However, its relevance could only be related to the fact that it was an upper bound. No estimate that exceeded a genuine upper bound could be correct. Thus the appropriate way to use the tax statistics figure was as a check.[144]

287. As part of its recent Guideline process, the AER has conducted a "conceptual re-evaluation" of the task and now interprets theta as the redemption rate (the average proportion of distributed credits that shareholders are able to redeem):

> the extent to which investors can use the imputation credits they receive to reduce their personal tax.[145]

288. By way of analogy, consider the task of determining the greatest ever one-day international (ODI) cricketer. There would be a range of views about what method should be employed to answer this question. One proposal might be that the greatest ever one-day cricketer is estimated as the person who captained his team for the longest period. However, it seems likely that any expert tribunal would reject that approach as an inappropriate estimate because it completely ignores the wealth of relevant empirical data that is available. This problem for the proponent of that method is not solved by the proponent conducting a conceptual re-evaluation and concluding that "best" actually meant "longest captaining" all along (if only you think about it carefully enough) – providing a means of reviving the approach that has already been rejected.[146]

Summary of the conceptual re-evaluation

289. In conducting its conceptual re-evaluation, the AER begins with the definition of the relevant market, concluding that the definition that it adopted for its 2009 WACC Review remains appropriate:

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[142] AER Rate of Return Guideline, Explanatory Statement, p. 160.
[143] AER 2009 WACC Review Final Determination, p. 414.
[144] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 91.
[145] AER Rate of Return Guideline, Explanatory Statement, p. 159.
[146] For completeness, this technique would produce an "estimate" of Stephen Fleming, who captained New Zealand between 1997 and 2007, averaging 32.4 at a strike rate of 71.5.

	AER 2009 WACC Review	AER 2013 Guideline
Market definition	"the AER has adopted a conceptual framework that defines 'the market' as the domestic Australian capital market with foreign investors recognised to the extent they invest in that market."[147]	"we propose that the defined market is an Australian domestic market that recognises the presence of foreign investors to the extent they invest in the Australian market."[148]

290. The AER also concludes that its specification of a representative investor as being a weighted-average across all investors remains appropriate:

	AER 2009 WACC Review	AER 2013 Guideline
Representative investor	"a weighted average of all investors in the market (i.e. the 'representative investor')."[149] "the task is to determine the valuation of the 'representative investor', which is the weighted average valuation of all investors in the market."[150]	"the representative investor [i]s the weighted average of investors within the defined market, where the weightings reflect market participation (equity ownership value) and risk aversion."[151]

291. In its 2009 WACC Review, the AER concluded that the relevant regulatory task was to take a weighted-average of the value that each investor applied to distributed credits. In its recent Guideline, the AER has removed any reference of value to investors:

	AER 2009 WACC Review	AER 2013 Guideline
Regulatory task	"the value of imputation credits is best considered a weighted average valuation of all investors (both domestic and foreign investors) in the defined market."[152]	"The value of imputation credits is calculated as a weighted average across investors in the defined market."[153]

292. In its 2009 WACC Review, the AER defined theta in the standard way to be the value of a distributed credit. In its recent Guideline, the AER has defined theta to be the average redemption rate – the amount of distributed credits that end up being redeemed:

	AER 2009 WACC Review	AER 2013 Guideline
Definition of theta	"θ (theta) is the per dollar value of a distributed credit."[154]	"The utilisation rate is the before-personal-tax reduction in company tax per one dollar of imputation credits that the representative investor receives." [155] "…the utilisation rate, which is the extent to which investors can use the imputation credits they receive to reduce their personal tax."[156]

147 AER 2009 WACC Review Final Determination, pp. 425-426.
148 AER Rate of Return Guideline, Explanatory Statement, p. 161.
149 AER 2009 WACC Review Final Determination, p. 423.
150 AER 2009 WACC Review Final Determination, p. 425.
151 AER Rate of Return Guideline, Explanatory Statement, p. 142.
152 AER 2009 WACC Review Final Determination, pp. 425-426.
153 AER Rate of Return Guideline, Explanatory Statement, p. 161.
154 AER 2009 WACC Review Final Determination, p. 414.
155 AER Rate of Return Guideline, Explanatory Statement, p. 165.
156 AER Rate of Return Guideline, Explanatory Statement, p. 159.

Reasons for the Guideline's re-definition of theta

293. The Guideline materials provide several reasons why it has changed its interpretation of theta from "the per dollar value of a distributed credit"[157] to "the extent to which investors can use the imputation credits they receive."[158] In this section, we evaluate each of the reasons that have been put forward in the Guideline materials.

Interpretation of the recent AEMC Rule change

294. The Guideline materials note that prior to the latest change the Rules stated that:

> γ is the assumed utilisation of imputation credits.[159]

295. At the time of the latest Rule change, all regulators (including the AER) had always interpreted this provision to require an estimate of the *value* of imputation credits, where "value" was interpreted as "value to the market". In this context, the AEMC amended the Rules to state that:

> γ is the value of imputation credits.[160]

296. In our view, the clear intention of the AEMC was to clarify that the prevailing regulatory practice (and the practice that is still adopted by all regulators other than the AER) should be continued. That practice is to estimate the *value* (as in "worth") of imputation credits. It seems highly unlikely that the AEMC could have had any other intention given that the wording in the new Rule accords precisely with the standard practice of all regulators at the time the Rule change was made.

297. Moreover, there are two reasons why it would seem to be quite fanciful to suggest that the intention of the AEMC was to *change* the interpretation of gamma *away* from the standard practice of all regulators at the time:

    a) The AEMC inserted the word "value," the ordinary meaning of which corresponds precisely to the practice of all regulators at the time of the change; and

    b) The AEMC did not provide a detailed explanation about why such as change was necessary in its Final Determination. This is consistent with a mere tidying up of a Rule to properly reflect the existing practice, but inconsistent with an intention to fundamentally change the Rules away from the adopted practice.

298. By contrast, the Guideline materials now conclude that the Rule which states that "gamma is the value of imputation credits" should not be interpreted as affirming the existing regulatory practice. In particular, the Guideline materials now contend that the term "value" in the Rules should not be interpreted as taking its common meaning of "worth" or "price," but rather as "the number used"[161] where the "number used" is determined on the basis of utilisation/redemption rates.

299. In our view, this is clearly inconsistent with the apparent intention of the AEMC given the context of the Rule change set out above. Moreover, if the AEMC had really intended "value" to mean "the

[157] AER 2009 WACC Review Final Determination, p. 414.
[158] AER Rate of Return Guideline, Explanatory Statement, p. 159.
[159] NER cls. 6.5.3, 6A.6.4 (as at version 52).
[160] NER cls. 6.5.3, 6A.6.4 (current since version 53); NGR r. 87A(1) (current since version 14).
[161] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 150.

number used" it would surely have stated that γ is the value *for* imputation credits rather than the value *of* imputation credits.[162]

300. In summary, our view is that the AEMC Rule change does not support the new conceptual definition that is set out in the Guideline. Rather the change appears to be a mere tidying up of a Rule to properly reflect the longstanding regulatory practice.

McKenzie and Partington (2011)

301. The Guideline materials also refer to advice from McKenzie and Partington (2011) as supporting the new interpretation of theta. In its Guideline materials, the AER states that the McKenzie and Partington report that it commissioned during the *Gamma* case "raised fundamental questions over the framework."[163]

302. In that report, McKenzie and Partington (2011) state that there are two possible interpretations of theta:

> the market value of franking credits distributed[164]

and:

> the franking credits redeemed as a percentage of franking credits distributed…known as the utilisation ratio.[165]

303. That is, McKenzie and Partington (2011) are clear about the fact that one must choose between a *value* interpretation and a *utilisation* interpretation. In our view, it is this exact distinction that the AEMC sought to clarify in its Rule change. The standard regulatory practice has always been to estimate the *value* of imputation credits and this remains the practice of all regulators other than the AER. The Rule change clarifies that the *value* interpretation that has always been used is the correct one.

304. McKenzie and Partington (2011) are also clear about the fact that:

   a) Empirical studies such as dividend drop-off analysis provide an estimate of the *value* of imputation credits; whereas

   b) Redemption rates provide an estimate of the *utilisation* of credits.[166]

305. Nowhere in their report do McKenzie and Partington (2011) state their view about which of the value or utilisation interpretations is the appropriate one in the regulatory/valuation setting, although they do note that the general consensus is that the value interpretation should be used:

> The literature subsequent to Officer has tended to view both gamma and theta as market values.[167]

[162] NER cls. 6.5.3, 6A.6.4 (current since version 53); NGR r. 87A(1) (current since version 14).
[163] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 149.
[164] McKenzie and Partington (2011), p. 2.
[165] McKenzie and Partington (2011), p. 2.
[166] McKenzie and Partington (2011), p. 2.
[167] McKenzie and Partington (2011), p. 3.

306. In a more recent report, McKenzie and Partington (2013) clarify their view as follows:

> Theta (θ) is the value to the investor of the imputation credits distributed, expressed as a fraction of face value,[168]

and:

> The standard practice has been to measure the market value of theta.[169]

307. McKenzie and Partington (2013) then state that:

> The question then is how to measure the market value of the imputation credits[170]

and the balance of their report considers various empirical estimates of the value of imputation credits, without any further discussion of utilisation/redemption rates.

308. In summary, the advice from McKenzie and Partington does not recommend that the utilisation/redemption interpretation of theta should be adopted. Rather, McKenzie and Partington simply state that if such an interpretation *is* to be adopted, redemption rates provide an estimate of the *utilisation* of credits. Certainly McKenzie and Partington never suggest that when estimating theta redemption rates should be used to the exclusion of market value estimates, or even in preference to market value estimates.

309. In our view, the advice from McKenzie and Partington (2011, 2013) does not support the Guideline's reliance on redemption rates to estimate theta.

Handley (2008)

310. During its 2009 WACC Review, Handley (2008) provided the same advice in a report commissioned by the AER. One issue that was addressed in the Handley report was the appropriate interpretation of the utilisation/redemption rate estimates reported by Handley and Maheswaran (2006). Handley (2008) advised the AER that the Handley and Maheswaran study estimated utilisation/redemption rates, rather than the value of distributed credits. Handley further advised that it would be inappropriate to use a utilisation/redemption rate interpretation of theta for the purposes of estimating gamma. He advised the AER that a utilisation/redemption rate estimate of theta will not produce an appropriate estimate of gamma – at best, it will produce an upper bound for gamma.

311. In particular, Handley (2008) advised the AER that an estimate of gamma based on the utilisation/redemption rate interpretation:

> may be interpreted as a reasonable upper bound on the value of gamma.[171]

312. At the Roundtable convened by the AER in October 2008, Handley further addressed the concept of an estimate of gamma that was based on a utilisation/redemption rate (rather than on a market value

[168] McKenzie and Partington (2013), p. 31.
[169] McKenzie and Partington (2013), p. 32.
[170] McKenzie and Partington (2013), p. 33.
[171] Handley (2008), p.8.

estimate of theta). He again stated clearly that the utilisation/redemption rate interpretation does not provide an appropriate estimate of gamma:

> Well, that's not our estimate of gamma therefore we haven't said that's our estimate of gamma. In some ways, what you could do is you could certainly say that is perhaps an upper bound for what gamma is.[172]

313. In summary, the author of the main utilisation/redemption rate study that the AER relied upon at its last WACC Review has advised the AER that the study estimates the utilisation/redemption rate and not theta, and that utilisation/redemption rates cannot be used to provide an appropriate estimate of gamma. Handley's point is that his redemption rate study provides a reasonable estimate of the utilisation of imputation credits, but that the utilisation of credits cannot be used to produce an appropriate estimate of gamma.

314. In our view, the advice from Handley (2008) does not support the Guideline's primary reliance on redemption rates to estimate theta.

Officer (1994)

315. In its Guideline materials, the AER points out that Officer (1994) defines gamma to be both:

   a) The value of a dollar of tax credit to the shareholder; and

   b) The proportion of company tax that is rebated against personal tax.[173]

316. In their report for the AER, McKenzie and Partington (2011) also note this apparent inconsistency, describing it as "a potential source of confusion" [174] and "ambiguity."[175]

317. Logically, there are two paths through the confusion and ambiguity caused by the drafting of the text in Officer (1994):

   a) Conclude that Officer means gamma to have a *value* interpretation and that words suggesting a *utilisation* interpretation were poorly drafted (i.e., the reference to utilisation should be read as simply identifying the source of value); or

   b) Conclude that Officer means gamma to have a *utilisation* interpretation and that words suggesting a *value* interpretation were poorly drafted.

318. In our view, the first interpretation is plausible and the second is not. To see this, first consider the following passage from Officer (1994):

> Where there is a market for tax credits one could use the market price to estimate the value of γ for the marginal shareholder, i.e. the shareholder who implicitly sets the price of the shares and the price of γ and the company's cost of capital at the margin, but where there is only a covert market, estimates can only be made through dividend drop-off rates.[176]

[172] AER Roundtable transcript, 10 October 2008, p. 18.
[173] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 138.
[174] McKenzie and Partington (2011), p.2.
[175] McKenzie and Partington (2011), p.3.
[176] Officer (1994), p. 5.

319. In our view, it is inconceivable that anyone who so clearly refers to the "market price" and "value" and who specifically references dividend drop-off analysis could possibly be of the view that the value interpretation was the one that was incorrect. Such explicit statements are unlikely to have been made by accident. It is far more likely that the references to "the proportion of tax collected from the company which gives rise to the tax credit associated"[177] have simply been poorly drafted.

320. Second, one can bypass the ambiguous language in Officer (1994) altogether and go directly to the mathematical equations and numerical examples to see precisely how gamma *is* interpreted in his paper. For example, consider the calculations in Officer's worked example. In particular, consider the calculations relating to the vanilla definition of WACC labelled "III" on p. 17 of Officer (1994). That example adopts the parameters set out in Table 1 below.

Table 1
Parameters for Officer (1994) worked example

Parameter	Symbol	Estimate
Corporate tax rate	T	39%
Gamma	γ	0.5
Cost of equity	r_e	17.70%
Cost of debt	r_d	14.32%

Source: Officer (1994)

321. The cash flows and imputation credits from that example are summarised in Table 2 below.

Table 2
Cash flows and imputation credits for Officer (1994) worked example

	Symbol	$ (millions)
Pre-tax profit	X_O	39.96
Interest	X_D	5.14
Taxable income	X_O-X_D	34.82
Corporate tax	TAX	13.58
Face value of imputation credits	IC	13.58

Source: Officer (1994)

322. In general, the annual cash flow to equity is:

$$\begin{matrix} Cash\ Flow \\ to\ Equity \end{matrix} = \begin{matrix} Pre-tax \\ Profit \end{matrix} - Interest - \begin{matrix} Corporate \\ Tax \end{matrix} + \begin{matrix} Value\ of \\ Imputation\ Credits \end{matrix}$$

which can be expressed as:

$$CF(Equity) = X_O - X_D - TAX + \gamma \times IC.$$

323. Consequently, the annual cash flow to equity in this case is:[178]

177 Officer (1994), p. 5.

178 Since, in this example, all of the profits after interest and tax are paid as a dividend to the shareholders, we can also write $CF(Equity) = Dividend + \gamma \times IC = 21.24 + 0.5 \times 13.58 = 28.03$.

$$\begin{aligned} CF(Equity) &= X_O - X_D - TAX + \gamma \times IC \\ &= 39.96 - 5.14 - 13.58 + 0.5 \times 13.58 \\ &= 28.03. \end{aligned}$$

324. Since, in this example, all cash flows are perpetuities the value of equity is given by: [179]

$$E = \frac{X_O - X_D - TAX + \gamma \times IC}{r_e} = \frac{39.96 - 5.14 - 13.58 + 0.5 \times 13.5}{0.177} = 158.362\,.$$

325. This expression unambiguously shows that gamma represents the extent to which imputation credits are capitalised into the stock price. Gamma shows the effect that imputation credits have on the *value* of the shares. In the absence of imputation credits, the value of the firm's equity would be:

$$E_{ex-IC} = \frac{X_O - X_D - TAX}{r_e}.$$

326. Gamma then represents the increase in the *value* of equity due to imputation credits, expressed as a proportion of the face value of imputation credits:

$$\gamma = \frac{E_{with-IC} - E_{ex-IC}}{IC}.$$

327. This shows, unambiguously, that gamma has a *value* interpretation.

328. Finally, we note that McKenzie and Partington (2011) have advised the AER that:

> The literature subsequent to Officer has tended to view both gamma and theta as market values.[180]

329. We suggest that the foregoing discussion explains why it is that the standard practice is to view gamma and theta as market values. We also suggest that the literature subsequent to Officer has *uniformly* viewed gamma and theta as market values. Even the authors of utilisation/redemption rate studies view gamma and theta as market values, such that redemption rates can only provide an upper bound.

330. In our view, Officer (1994), properly and holistically interpreted, does not support the Guideline's reliance on redemption rates to estimate theta.

Hathaway and Officer (2004)

331. The Guideline materials present a quote from Hathaway and Officer (2004) that is claimed to be "supporting the cash flow interpretation of the value of imputation credits."[181] However, the Guideline materials have misconstrued the point that Hathaway and Officer are making. The point

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[179] Similarly the value of debt is given by $D = \frac{5.14}{0.14316} = 35.903$ in which case the value of the firm is $V = E + D = 194.265$ as set out in Officer (1994, p. 17).
[180] McKenzie and Partington (2011), p. 3.
[181] AER, Rate of Return Guideline, Explanatory Statement, Appendix H, p. 143, emphasis added.

being made is simply that estimates of the value of distributed credits are not estimates of gamma, but of theta. They need to be multiplied by the distribution rate (F) to obtain an estimate of gamma.

332. Indeed the Guideline materials quote only the first half of the relevant paragraph. In the second half of that same paragraph, Hathaway and Officer (2004) state that:

> Gamma is not the *value* of distributed credits alone. It is the compounding of two factors – the fraction of tax distributed as credits multiplied by the *value* of distributed credits. In this sense it is the *value* of all possible credits, that is, the *value* of all tax payments giving rise to the creation of credits.[182]

333. Moreover, the primary purpose of the Hathaway and Officer (2004) study was to present the results of a dividend drop-off analysis, which is clearly relevant only to the standard *value* interpretation of theta. Hathaway and Officer also present some statistics relating to redemption rates, but that analysis has been retracted by Hathaway who has since stated that it should not be relied upon.[183]

334. In our view, Hathaway and Officer (2004) does not support the Guideline's reliance on redemption rates to estimate theta.

Lally (2013a)

335. In his report for the AER, Lally (2013a) considers a theoretical framework in which, under certain assumptions, the weighted-average utilisation rate will equal the equilibrium value of distributed imputation credits. Under this set of assumptions, theta can be estimated either by estimating the weighted-average utilisation rate or by using market value studies to estimate the effect that imputation credits have on stock prices – because the market value must be equal to the weighted-average utilisation rate under those special assumptions.

336. Lally (2013a) recommends to the AER that they adopt a set of assumptions whereby all Australian equities are owned by resident investors who fully redeem all imputation credits that are distributed to them and who value a redeemed imputation credit equal to a dollar of cash dividends. Under these special assumptions, theta will be equal to the weighted-average utilisation rate, which is 100%. Thus, Lally recommends that the AER should set theta equal to 1.

337. The AER has rejected that advice on the basis that the special assumptions that are required to support it are clearly violated in practice.[184] In particular, Australian equities are not owned entirely by resident investors. Indeed, the estimates of all other WACC parameters reflect the effect of foreign investors, so the estimate of theta should also reflect the effect of foreign investors.

338. This leads the AER to depart from the set of assumptions under which theta will be equal to the weighted-average utilisation rate. That is, the Guideline adopts a framework in which the pre-conditions for that result do not hold. Yet the Guideline continues to estimate theta as the weighted-average utilisation rate even though it departs from the assumptions that are required for that result to hold.

339. This position is supported by quoting various passages from Lally (2013a). However, those passages from Lally (2013a) indicate that theta will be equal to the weighted-average utilisation rate *only under certain assumptions*, which are departed from in the Guideline framework. Indeed, Lally is critical of the

182 Hathaway and Officer (2004), p. 7.
183 Hathaway (2013), Paragraph 12.
184 AER Rate of Return Guideline, Explanatory Statement, p. 178.

AER for continuing to estimate theta as the weighted-average utilisation rate even though it departs from the assumptions that are required for that result to hold.

340. The Lally (2013a) advice to the AER on this issue is identical to the submission from the ENA (2013). However, the AER's Guideline materials do not reference the ENA submission on this issue and they interpret Lally (2013a) as actually endorsing the approach that is proposed in the Guideline. Consequently we devote a separate appendix of this report to an explanation of this important issue, below.

Summary and conclusions

341. On the issue of the conceptual definition of theta, we conclude that:

a) The Guideline is alone in its conceptual interpretation of theta:

i) Prior to the current Guideline, the practice of all regulators was to interpret theta[185] as the value (to the market) of distributed imputation credits;

ii) This remains the practice of all other regulators;

iii) The Guideline now proposes to refer to theta as "the utilisation rate" and to conceptualise it as "the extent to which investors can use the imputation credits they receive to reduce their personal tax"[186];

b) None of the proposed reasons for the conceptual redefinition of theta that are set out in the Guideline materials are valid, or supported by advice or evidence:

i) The AEMC Rule change (which now specifically defines gamma to be "the value of imputation credits") does not support the new conceptual definition. It seems clear that the intention of the AEMC was simply to tidy up the Rule to properly reflect the longstanding regulatory practice of adopting a market value interpretation of theta and gamma. The Rule change is quite inconsistent with the notion that the longstanding *value* interpretation should be replaced by a different interpretation;

ii) McKenzie and Partington (2011) identify two possible interpretations for theta – the standard value interpretation and the Guideline's utilisation interpretation. They express no opinion about which interpretation is correct or which should be preferred. However they do note that the "standard practice has been to measure the market value of theta"[187] and in a subsequent report they have stated that "theta is the value to the investor of the imputation credits distributed;"[188]

iii) Handley (2008) has advised the AER that his redemption rate study provides a reasonable estimate of the utilisation of imputation credits, but that the utilisation of credits cannot be used to produce an appropriate estimate of gamma. Handley advises that since theta represents the value (to the market) of imputation credits, and since redemption rates provide only an upper bound for that value, they can only be used to produce an upper bound and not a point estimate;

[185] Or whatever term is used for "the parameter that must be multiplied by F to obtain gamma."
[186] AER Rate of Return Guideline, Explanatory Statement, p. 159.
[187] McKenzie and Partington (2013), p. 32.
[188] McKenzie and Partington (2013), p. 31.

iv) Officer (1994) refers to theta in terms of both value to shareholders and utilisation. However, the formulas and numerical calculations show, unambiguously, that gamma has a *value* interpretation whereby gamma represents the increase in the *value* of equity due to imputation credits, expressed as a proportion of the face value of imputation credits;

v) The Guideline materials cite part of a paragraph of Hathaway and Officer (2004) as supporting its proposed interpretation of theta. However, the Guideline materials misconstrue point that was being made, which is simply that gamma is the product of the distribution rate and theta. The remainder of the same paragraph endorses the standard value interpretation of theta: "Gamma is not the value of distributed credits alone. It is the compounding of two factors – the fraction of tax distributed as credits multiplied by the *value of distributed credits*."[189]; and

c) Lally (2013a) advises the AER that theta can be estimated as the weighted-average utilisation rate *only under certain assumptions*, which do not hold in the Guideline's framework. Lally is critical of the AER for continuing to estimate theta as the weighted-average utilisation rate even though it departs from the assumptions that are required for that result to hold.

189 Hathaway and Officer (2004), p. 7.

Appendix 6: The advice from Lally (2013a)

Theoretical framework

342. Lally (2013a) considers a class of models that includes Monkhouse (1993) and Lally and van Zijl (2003). These models all consider a setting in which there is a single market in which the *m* investors jointly own all of the *n* assets. In these models there is a closed system – there are no assets outside the market that are available to the *m* investors inside the market and there are no investors outside the market who can buy any of the *n* assets inside the market. That is, these models only apply in a closed system where the *m* investors collectively own all of the *n* assets and nothing else.

343. The models then derive an equilibrium by solving a market clearing condition. This involves noting that:

    a) All of the *m* investors must invest all of their wealth across the *n* assets and nothing else; and

    b) All of the *n* assets must be owned entirely by the *m* investors and no one else.

344. Each of the *m* investors will hold a different amount of each of the *n* assets according to their wealth, their risk aversion and their tax status. Other things equal, wealthy investors will hold more of each asset than poor investors, highly risk averse investors will tend to hold safer portfolios, and investors who are eligible to redeem imputation credits will hold relatively more of the stocks that distribute larger amounts of those credits.

345. Because there is a closed system in which the *m* investors collectively own all of the *n* assets and nothing else, it is possible to derive the relative amount of each asset that each investor will want to hold. This will be a function of the investor's relative wealth, risk aversion and tax status. The relative demand for each asset will determine its equilibrium price and the equilibrium return that investors will require for holding it. Again, it is very important to emphasise that none of these equilibrium calculations can be performed unless the system is closed such that the *m* investors collectively own all of the *n* assets and nothing else.

346. A by-product of these equilibrium calculations is an estimate of the equilibrium value of the imputation credits that are distributed by each firm. This is a derived figure for the extent to which imputation credits will be capitalised into the equilibrium stock price. In these models, the equilibrium value of imputation credits (capitalised into the stock price) turns out to be a weighted-average of the extent to which each investor is able to redeem imputation credits, weighted by wealth and risk aversion. That is, under the assumptions of these models (including the assumption that a dollar of redeemed credit is equal in value to a dollar of cash dividends) the market value of imputation credits (i.e., the extent to which the credits are capitalised into stock prices) will be equal to the weighted-average redemption rate. Under the assumptions of these models, the market value of imputation credits can be estimated as the weighted-average of the utilisation rates of the *m* investors.

347. That is, in an economy where the prerequisite conditions hold (i.e, there is a closed system in which the *m* investors collectively own all of the *n* assets and nothing else) and where all of the assumptions of the model hold (including the assumption that redeemed credits and cash dividends are equally valued), it must be the case that the market value of imputation credits is equal to the weighted-average utilisation rate. In this case, there is equality between:

    a) The extent to which imputation credits are capitalised into stock prices; and

    b) The weighted-average redemption rate.

That is, there are two equivalent ways of determining the value of imputation credits, but only if the pre-requisite conditions and assumptions of the model hold.

Specific cases of a closed system

348. Lally (2013a) considers an extreme case where:

    a) There are *m* investors who collectively own all of the *n* assets and nothing else;

    b) All of the *m* investors value a dollar of redeemed credits equal to a dollar of cash dividends, and

    c) All of the *m* investors can redeem 100% of the imputation credits that are distributed to them (i.e., there are no foreign investors).

349. He notes that (a) and (b) above establish the pre-conditions that are required for theta to be equal to the weighted-average utilisation rate. He also notes that from (c) above the weighted-average utilisation rate will be 100%. In this special case, 100% of the face value of the distributed credits will be capitalised into the stock price and theta will be equal to 1. Lally (2013a) recommends that the AER should adopt the assumptions set out above and set theta to 1.

350. Of course, if theta is to be estimated not as it actually *is* in the market for equity funds, but as it *would be* in a world with no foreign investors, consistency requires that all WACC parameters must be estimated on the same basis. Lally (2013a) presents some calculations to show how one might go about estimating beta and MRP as they *would be* in such a world.

351. Lally (2013a) also considers the case of perfectly integrated capital markets where:

    a) The *m* investors consist of all global investors; and

    b) The *n* assets consist of all global equities.

352. This is also a closed system in which the *m* investors collectively own all of the *n* assets and nothing else. Consequently, an equilibrium exists in which the value of imputation credits capitalised into the stock price is equal to the weighted-average of the utilisation rates over the *m* investors. In this case, only a small proportion of the *m* investors are eligible to redeem imputation credits (commensurate with the small proportion of Australian investors in the global market), in which case theta will be negligibly small.

353. By contrast, the Guideline proposes a setting in which:

    a) The *m* investors consist of all Australian investors and those foreign investors who own some Australian shares; and

    b) The *n* assets consist of all Australian equities.

354. This is not a closed system because it is not the case that the *m* investors collectively own all of the *n* assets and nothing else. Consequently, no market clearing equilibrium can be derived and it will not be the case that an equilibrium exists in which the value of imputation credits capitalised into the stock price is equal to the weighted-average of the utilisation rates over the *m* investors.

355. In the context of these equilibrium models, if foreign investors are included, foreign assets must also be included. Alternatively, if foreign assets are not included, then foreign investors must be assumed away. If neither of these assumptions is made, no equilibrium model will apply and the weighted-average utilisation rate cannot be used as an estimate of theta.

356. By way of analogy, consider two children's birthday parties being held side by side in a park. The objective is to determine whether the food has been fairly distributed among the children (having regard to their different ages and taste preferences etc.). If each child is only allowed to take food from their party's table, fairness can be assessed by observing what each child takes relative to the total food available from that table. That is, each table is a closed system. If, however, children are allowed to take food from either table, fairness can only be assessed by observing the total amount of food taken by each child relative to the total amount of food available from both tables. That is, there is a single closed system consisting of all of the food and all of the children.

357. Note that, in the latter case, it is impossible to determine anything by observing only the food that each child takes from one of the tables because there is no information about whether that child has taken a little or a lot from the other table. In this case, a single table is not a closed system, so we can infer nothing from observing just that table. The only setting in which one can infer anything from observing a single table is in the former case where there are no "foreign investors" at all.

358. In the case where the prerequisite conditions for the model do not hold, the weighted-average redemption rate will not tell us anything about the equilibrium value of imputation credits (in the same way that observing how much food each child takes from one table will tell us nothing about whether or not each child has a fair proportion of the food overall). In this case, the weighted-average redemption rate cannot be used to estimate the value of imputation credits, leaving empirical estimation from observed stock prices as the only available method.

Lally's advice to the AER on the application of equilibrium models

359. Lally (2013a) has advised the AER that the weighted-average utilisation rate that comes out of equilibrium models such as Lally and van Zijl (2003) only applies in a closed system where the m investors collectively own all of the n assets and nothing else. That is, the model is only relevant if certain pre-conditions hold. If those pre-conditions do not hold, the model will not apply, and any attempt to apply the model will be likely to mislead.

360. However, the equity ownership approach used in the Guideline involves the attempted implementation of an equilibrium model where the pre-conditions for such a model clearly do not apply. The Guideline approach uses a result that applies only in closed systems in a system that is clearly not closed. This approach remains in the Guideline even after Lally (2013a) has advised that it is incorrect. In fact, as set out below, Lally is critical of the AER's claims that a result that applies only in a closed system can still be used in a setting where there is no closed system.

Lally's "endorsement" of the AER approach

361. The AER engaged Lally (2013a) to undertake a critical review of the imputation credit related sections of the draft Guideline and concludes that the Lally review supports its theta estimate of 0.7:

> The expert advice from Associate Professor Lally suggests that our determination of a utilisation rate of 0.7 is reasonable, based on the evidence currently available.[190]

[190] AER Rate of Return Guideline, Explanatory Statement, p. 170.

362. However, what Lally (2013a) actually concludes is that theta should be set to 1 by "ignoring foreigners."[191] That is, Lally recommends that we should *assume* that all Australian equities are owned entirely by Australian residents who can fully utilise imputation credits, despite clear evidence to the contrary.

363. Associate Professor Lally has recommended this approach to Australian regulators for at least 10 years[192] and none of them have ever adopted it.

364. Lally (2013a) goes on to consider other approaches for estimating theta. He ranks each of the other approaches in terms of how close they are to his favoured "ignoring foreigners" estimate of 1. The Guideline's estimate of 0.7 ranks second because it is closest to Lally's favoured estimate of 1.

365. Indeed Lally concludes that the Guideline's approach produces estimates that are implausible,[193] as do all approaches other than his "ignoring foreigners" approach.

366. Lally (2013a) goes on to state that the only redeeming feature of the Guideline's equity ownership approach is that, even though it is an estimate of the wrong thing, it is at least a statistically precise one,[194] but even that is disputed in Section 0 of this report.

367. In the remainder of this appendix, we review each of the criticisms of the Guideline approach that are set out by Lally (2013a).

Inconsistency of Guideline approach

368. As set out above, Lally's main criticism of the Guideline's proposed approach is that it applies the result of a model (theta is equal to the weighted-average utilisation rate) where the pre-conditions for that result (a closed system) do not apply.[195] He clearly advises that the theoretical result (theta is equal to the weighted-average utilisation rate) will only apply where the pre-conditions for the model are satisfied, namely either:

    a) A perfectly segmented market in which all Australian equities are owned by Australian investors, who own nothing else; or

    b) A perfectly integrated market that includes all global equities and all global investors.

369. The Guideline's proposed framework is neither of these cases, so the theoretical result (theta is equal to the weighted-average utilisation rate) does not apply. The Guideline considers a more realistic case in which Australian investors own some foreign assets and foreign investors own some Australian assets, as that would be commensurate with the market for equity funds. But Lally notes that equilibrium results can only be obtained if we assume that markets are perfectly segmented, in which case:

> foreign investors, who by definition can hold both Australian and foreign risky assets, have no place in such a model[196]

or if we assume that markets are perfectly integrated, in which case:

[191] Lally (2013a), p. 3.
[192] See, for example, Lally (2004).
[193] Lally (2013a), p. 4.
[194] Lally (2013a), pp. 3-4.
[195] Lally (2013a), p. 14.
[196] Lally (2013a), p. 14.

> if Australian investors have access to foreign assets, the appropriate CAPM will reflect that fact and the equilibrium prices of Australian assets will differ. [197]

370. Lally (2013a) also notes that:

> The ENA (2013, section 7.4.6) makes the same point

and we include the relevant section of that submission as Appendix 7 to this report.

371. Lally (2013a) comments further on the inconsistency of using a theoretical result in a setting where the pre-conditions for that theoretical result are not satisfied. He says that:

> By contrast, Handley (2008, section 2.2) appears to believe that there is no inconsistency and believes that all CAPMs start by defining the "market", from which the "relevant" set of investors follows. Thus, if the market is Australian equities, then the relevant set of investors includes foreigners to the extent they invest in Australian equities. I do not agree. CAPMs do not start with a definition of the "market" but a set of assumptions about investor behaviour and institutional features, and the particular assumptions imply which market portfolio and set of investors are relevant. Some versions of the CAPM assume complete segmentation of equity markets, in which case the relevant investors are Australian residents and the relevant market portfolio is all Australian risky assets (assets that can be purchased by Australian residents in a world in which there is complete segmentation of risky asset markets). Other versions of the CAPM assume complete integration, in which case the relevant investors are those throughout the world and the relevant market portfolio would be all risky assets throughout the world.[198]

372. Copeland (2014) also makes the same point:

> Equilibrium under the CAPM requires that all investors in the market collectively own all of the assets in the market. This is a direct consequence of two-fund separation and the fact that aggregate borrowing equals aggregate lending, as I have indicated above. Having an investor from outside the market owning some of the assets inside the market would mean that a CAPM equilibrium could not be obtained.[199]

Circularity of Guideline approach

373. Lally (2013a) also concludes that the "equity ownership" approach has no proper basis:

> The AER (2013, page 237) also defines the utilisation rate as the proportion of distributed credits that investors redeem. This is not correct; the redemption rate is merely an estimation method.[200]

374. Here, Lally is referring to the AER's Draft Explanatory Statement, which simply defines that theta is equal to the redemption rate:

[197] Lally (2013a), p. 14.
[198] Lally (2013a), pp. 14-15.
[199] Copeland (2014), p. 5.
[200] Lally (2013a), p. 13.

> The utilisation rate is the proportion of distributed credits that investors redeem to reduce their tax liabilities.[201]

375. Lally's point here can be summarised as follows:

a) A number of different methods have been proposed for estimating theta;

b) One of the methods that has been proposed is the imputation credit redemption rate, which can be estimated either:

   i) By using ATO redemption data; or

   ii) By estimating the proportion of Australian equities that are owned by residents, and assuming that residents will redeem all credits that are distributed to them;

c) The Guideline defines that theta is equal to the redemption rate; and

d) The Guideline then gives primary weight to its redemption rate estimates of theta on the basis that they "accord with the AER's interpretation" of theta.[202]

376. That is, Lally's point is one of basic logic – the Guideline's approach is entirely circular in the way that it defines theta in terms of one of the estimation methods and then concludes that estimation method must receive most weight because it best accords with the Guideline's definition.

377. We agree with Lally's criticism of the circularity of this approach and with his conclusion that the Guideline approach is "not correct" in the way that it defines theta (or the "utilisation rate.")

378. This criticism of the proposed approach is not addressed anywhere in the Guideline. Rather, the Guideline materials conclude that Lally actually supports the proposed approach:

> In his review, Lally considers that this estimation technique aligns with our conceptual framework.[203]

379. Of course the AER's favoured estimation technique aligns with their conceptual framework. Lally's whole point is that the AER's conceptual framework is simply to define theta in terms of the favoured estimation technique. The fact that that estimation technique then aligns with the conceptual framework is entirely circular.

380. Lally (2013a) is very clear about this point when he points out that the equity ownership approach for estimating theta:

> follows directly from the AER's definition of *U*.[204]

Guideline approach has "perverse" effects

381. Lally (2013a) also notes that the Guideline's equity ownership approach:

[201] AER Draft Rate of Return Guideline, Explanatory Statement, p. 237.
[202] AER Rate of Return Guideline, p. 24.
[203] AER Rate of Return Guideline, Explanatory Statement, p. 172.
[204] Lally (2013a), p. 16.

> has a potentially perverse effect upon the estimated cost of equity. In particular, as national equity markets become increasingly integrated, foreign ownership of Australian equities will rise, and any estimate of U that is consistent with its definition will fall. If this has the effect of raising the estimated cost of equity capital using the Officer model and the true cost of equity actually falls as markets become more integrated (because investors will be holding more well diversified portfolios) then the effect of defining U to include foreign investors will be entirely perverse.[205]

382. That is, as barriers to foreign investment fall, the supply of foreign equity capital will tend to rise, having the effect of reducing the cost of equity for Australian firms (a simple supply/demand effect). This will also result in a fall in the equity ownership estimate of theta, and a consequential increase in the regulatory estimate of the allowed return on equity, which Lally correctly describes as "entirely perverse."

383. Indeed the equity ownership approach implies that Qantas (and all Australian firms) should be arguing for a *tightening* of foreign ownership restrictions as this would increase the proportion of resident ownership and consequently reduce the required return on equity, which is also entirely perverse.

Summary of advice from Lally (2013a)

384. The key points to be drawn from the Lally (2013a) discussion of the conceptual framework for theta are as follows:

   a) Lally has advised that under certain special conditions and assumptions, theta will equal the weighted-average utilisation rate. And when those conditions and assumptions do not hold, theta will not equal the weighted-average utilisation rate;

   b) The Guideline proposes to estimate theta as the weighted-average utilisation rate in a setting where those special conditions and assumptions do not hold – the real-world Australian equity market, which has been "contaminated" by foreign investment. Lally advises that it is wrong to apply a theoretical result in a setting where the pre-conditions for that theoretical result are not satisfied;

   c) Lally advises that the Guideline's approach is circular and "not correct" in the way that it defines theta in terms of one of the estimation methods and then concludes that estimation method must receive most weight because it best accords with its own definition;

   d) Lally advises that the application of the Guideline approach produces results that are "entirely perverse." As barriers to foreign investment fall, the supply of foreign equity capital will tend to rise, having the effect of *reducing* the cost of equity for Australian firms. This will also result in a fall in the equity ownership estimate of theta, and a consequential *increase* in the allowed return on equity.

[205] Lally (2013a), pp. 15-16.

Appendix 7: ENA submission cited by Lally (2013a)

385. The Explanatory Statement cites a number of studies that derive representative investor models in the context of a dividend imputation tax system. Those studies include Lally (1992), Lally and van Zijl (2003), and Monkhouse (1993). Those papers are all based on the basic CAPM framework and/or the after-tax CAPM framework that was originally developed by Brennan (1970).[206]

386. In the 2009 WACC Review, the discussion of representative investor models converged on a setting in which there is a single market consisting of n risky assets held collectively by m investors. The AER stated that:

> …the starting point for the Sharpe CAPM (and all subsequent versions of the CAPM) is to assume a given set of assets (n risky assets and a risk-free asset) and a given set of investors (m) who collectively determine the prices of those assets.[207]

387. In his advice to the AER on this issue, Handley (2009) also set out part of the derivation of the CAPM where there is a single market consisting of n risky assets held collectively by m investors.[208]

388. A crucial aspect of these models is that:

a) The m investors must, between them, hold 100% of the n assets; and

b) The m investors own nothing other than the n assets.

389. That is:

a) None of the m investors can hold any assets outside the model; and

b) There can be no investors outside of the model who can possibly buy any of the n assets inside the model.

390. In other words, the derivation of the CAPM and subsequent models that are based on it, require a closed system. A model in which investors who are inside the system are able to invest in assets outside the system, or where investors outside the system are able to invest in assets inside the system is very different from the CAPM or any subsequent model based on it. None of the CAPM derivations hold in such a case and the CAPM pricing equation (which is used to estimate the required return on equity) does not hold.

391. To see this, consider the derivation presented by Brennan (2008)[209] as cited by Handley (2009).[210] Here every investor maximises their end-of-period utility:

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[206] Brennan, M.J., (1970), Taxes, Market Valuation and Corporate Financial Policy, National Tax Journal, 23, 417–427.
[207] AER 2009 WACC Review Final Decision, p. 424.
[208] Handley (2009), "Further comments on the valuation of imputation credits," pp. 13-14.
[209] Brennan, M.J., "Capital asset pricing model," in "The New Palgrave Dictionary of Economics," Eds. Steven N. Durlauf and Lawrence E. Blume, Palgrave Macmillan, 2008, The New Palgrave Dictionary of Economics Online, Palgrave Macmillan. 23 September 2013, DOI:10.1057/9780230226203.0190.
[210] Handley (2009), *Further comments on the value of imputation credits*, April, www.aer.gov.au. We adopt the full notation, as set out in Brennan (1992).

$$\underset{z_{ij}}{Max} V_i\left(\overline{W}_i, S_i^2\right)$$
$$\text{subject to:}$$
$$\overline{W}_i = \sum_{j=1}^{n} z_{ij} \overline{P}_{j1} - R\sum_{j=1}^{n}\left(z_{ij} - \overline{z}_{ij}\right)\overline{P}_{j0}$$
$$S_i^2 = \sum_{j=1}^{n} \sum_{k=1}^{n} z_{ij} z_{ik} \omega_{jk}$$

392. The first of these equations says that all investors maximise their end-of-period expected utility over their total portfolio. Utility is increasing in wealth (and hence expected returns), $\overline{W}_i$, and decreasing in variance, S_i^2. z_{ij} represents the weight that investor *i* invests in each of the *n* assets. The second equation says that investor *i* must invest all of his wealth among the assets within the market. Expected end-of-period wealth is the expected payoff on each of the *n* risky assets inside the system plus the return on the amount invested in the risk-free asset. The last equation is the expression for the variance of the returns of the investor's portfolio, all of which has been invested among the *n* assets inside the market.

393. Brennan (2008) goes on to note that market clearing requires that $\sum_{i=1}^{m} \mathbf{z_i} = \mathbf{1}$. This market clearing condition requires that, for each asset *j*, the sum of the demands of all investors must equal the supply of the asset.

394. The budget constraint above requires that every investor has invested 100% of their initial wealth allocation among the *n* risky assets (and the risk-free asset) in the market.

395. In summary, the derivation of the equilibrium requires that:

a) The *m* investors must, between them, hold 100% of the *n* assets in the market; and

b) The *m* investors own nothing other than the *n* assets (and a residual position in the risk-free asset).

396. That is:

a) None of the *m* investors can hold any assets outside the market; and

b) There can be no investors outside of the market who can possibly buy any of the *n* assets inside the market.

397. If these requirements for market clearing are not met, no equilibrium can be derived, no representative investor can be determined, and the CAPM pricing relation cannot be obtained.

398. Now consider the case where each of the *m* investors inside the system is able to invest in n_1 assets inside the system and n_2 assets outside the system, this optimisation becomes:

$$\underset{z_{ij}}{Max} V_i\left(\overline{W}_i, S_i^2\right)$$

subject to:

$$\overline{W}_i = \sum_{j=1}^{n_1+n_2} z_{ij}\overline{P}_{j1} - R\sum_{j=1}^{n_1+n_2}\left(z_{ij} - \overline{z}_{ij}\right)\overline{P}_{j0}$$

$$S_i^2 = \sum_{j=1}^{n_1+n_2}\sum_{k=1}^{n_1+n_2} z_{ij} z_{ik}\omega_{jk}.$$

399. That is, the end-of-period utility of each investor depends on the value of his investments inside the system plus the value of his investments outside the system and the relationship (covariance) between those two holdings. This optimisation has the obvious implication that investors in CAPM-type models maximise the utility of their total portfolios. When considering the return that they require from a particular investment, investors consider the returns that are available from alternative investments and the relationship between the particular investment and the rest of the investor's portfolio.

400. The ENA submits that (a) if the standard requirements for market clearing are not met, no equilibrium can be derived, no representative investor can be determined, and the CAPM pricing relation cannot be obtained, and (b) the standard market clearing conditions are not met in the "representative investor" framework set out in the Explanatory Statement.

Appendix 8: Implementation issues for alternative definitions of theta

Overview

401. This appendix examines implementation issues in relation to the equity ownership, tax statistic and conceptual goalposts approaches. The focus is on the quality of the available data and the reliability of the estimate. The issue of whether these approaches provide an estimate that is consistent with the appropriate definition of theta is addressed in the body of the report.

Reliability of equity ownership data

402. Implementation of the equity ownership approach is fraught with difficulty. This is best demonstrated by the facts that:

a) Lally (2012) concludes that "the proportion of Australian equities held by Australians" is 54%[211] whereas Lally (2013a) puts the figure at 70%[212] based on a data source that pre-dates the earlier estimate by four years; and

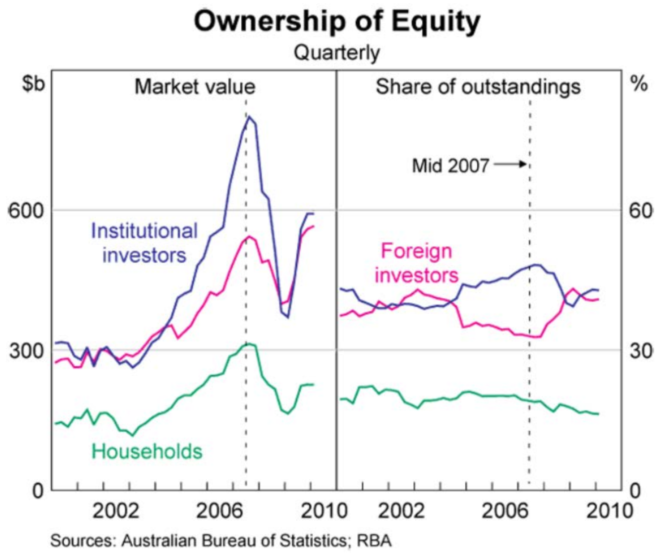
b) The Australian Bureau of Statistics has posted a data quality warning in relation to the data that has been relied upon by Lally (2103a) and the AER.[213]

Updated estimates of equity ownership

403. The AER and Lally (2013a) both refer to an estimate of "the proportion of Australian shares that are held by Australians" of 70%.[214] The original source of this figure is the AER Draft Guideline Explanatory Statement, which in turn refers to a 2007 estimate from the Australian Bureau of Statistics (**ABS**).[215] A more recent RBA paper shows that the 2007 ABS estimate of the proportion of foreign equity ownership is materially lower than previous and subsequent estimates. That is, the 2007 estimate happens to produce the lowest estimate of foreign equity ownership (and consequently the highest estimate of theta) of any point in the last 10 years – as illustrated in Figure 8 below.

211 Lally (2012), p. 6.
212 Lally (2013a), p. 16.
213 See the ABS feature article that first explains the foreign ownership calculations at http://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/5306.0Feature%20Article150Jun%201992?opendocument&tabname=Summary&prodno=5306.0&issue=Jun%201992&num=&view=.
214 See Lally (2013a), p. 16.
215 AER Draft Guideline Explanatory Statement, Footnote 367, p. 130 cites the source of the 70% figure as being Australian Bureau of Statistics, *Feature article: Foreign ownership of equity*, Available at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/5302.0Feature%20Article10Sep%202007?opendocument&tabname=Summary&prodno=5302.0&issue=Sep%202007&num=&view.

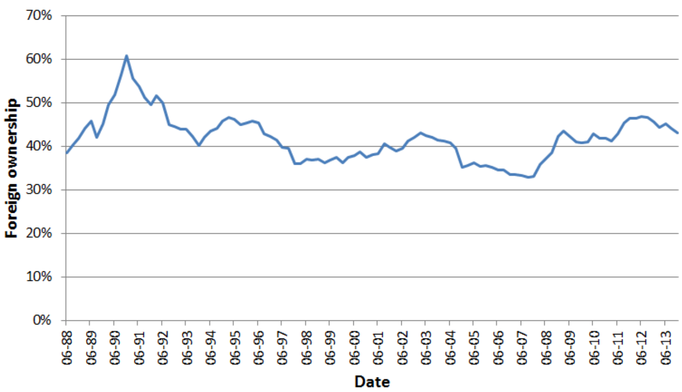
Figure 8
RBA estimates of the ownership of Australian equity



Source: Black and Kirkwood (2010), RBA.

404. If the ABS aggregate equity ownership estimate is to be used, the 2007 estimate should not be preferred to the updated estimates – which show materially higher levels of foreign investment. Figure 9 below shows the time series of foreign ownership percentages using the ABS data that was the source of the 30% estimate adopted in the Guideline and of Black and Kirkwood (2010). This figure shows that more recent estimates of foreign ownership are in the order of 45%.[216]

Figure 9
Updated ABS estimates of the ownership of Australian equity



Source: ABS Series 5232.0 Australian National Accounts: Financial Accounts, Table 32.

Consistency with ASX estimates

405. The updated estimates set out above are consistent with those reported by the Australian Securities Exchange (ASX). The ASX presents foreign ownership estimates for privately-owned equity only. Lally (2012) refers to the ASX (2011) estimate of 46% foreign ownership and concludes that "the

216 These figures are computed as ABS Series A3425417X divided by the sum of ABS Series A3366544F, A3364525L, A3364528V, A3545235F, A3372154L, A3367456X, A3545239R, A3358849V, A3359968C, A3361015J, A3545244J, A3545245K, and A3369589R.

proportion of Australian equities held by Australians" is 54%.[217] ASX (2013) provide the most recent estimate of the proportion of privately-owned equity that is owned by foreign investors, concluding that the best estimate remains at 46%.[218]

Lally (2012, 2013a, 2013b) estimates of redemption rates

406. In his recent reports for the QCA and AER, Lally provides a number of estimates of "the proportion of Australian equities owned by Australians." In his November (2012) report to the QCA, Lally (2012) states that:

> the proportion of Australian equities held by Australians is 54%.[219]

407. The source of this estimate is ASX (2012), which is based on data through to the end of 2011.

408. In his November 2013 report to the QCA, Lally (2013b) cites two estimates. Both of these pre-date the estimate he used in his earlier report and both of them are higher than the estimate he used in his earlier report. He provides no indication of why these superseded estimates should now be preferred to the more recent estimate used in his 2012 report. He simply refers to the task of estimating the proportion of Australian equities owned by Australians and states that:

> In respect of listed equity, this is currently about 60% (Black and Kirkwood, 2010, page 2). If unlisted equity were included, with valuations based upon accounting values, the result is (unsurprisingly) higher at about 70% (Australian Bureau of Statistics, 2007).[220]

409. Throughout the remainder of the latter report, Lally (2013b) states that the proportion of Australian equities held by Australians is "about 0.70"[221] without providing any indication of why that estimate should be preferred among the two (superseded) estimates that are cited.

410. In his November 2013 report to the AER, Lally (2013a) confirms that he has adopted the AER estimate that is based on the 2007 ABS data, without any reference to any other estimates:

> Drawing upon data from the Australian Bureau of Statistics (2007), the estimate is 70%.[222]

411. In summary, between his 2012 and 2013 reports, Lally has increased his equity ownership estimate materially by relying on data that is four years older and which includes approximations in relation to unlisted equity that is the subject of data quality warnings from the ABS – without any explanation or even any reference to his earlier estimate that was based on more current data.

Use of unlisted equity

412. The 45% foreign ownership figure in Figure 9 above is based on listed equity. In our view, this is the appropriate calculation given that all other WACC parameters are estimated with reference to exchange-listed businesses because they are more reflective of the efficient benchmark entity.

[217] Lally (2012), p. 6.
[218] ASX (2013), p. 2. The ASX figures are based on ABS series 5232.0, Table 32 for the September quarter 2012.
[219] Lally (2012), p. 6.
[220] Lally (2013b), p. 13.
[221] Lally (2013b), pp. 3, 38, 53.
[222] Lally (2013a), p. 16.

Consequently, the reference to calculations including unlisted equity above (Paragraph 408 above) is not relevant.

413. Moreover, the ABS warns that its estimates in relation to unlisted equity are unreliable. In particular, the ABS warns that:

> The estimated market value of equity issued by some sectors is considered to be of poor quality. In particular, estimates of the market value of the amount issued by private corporate trading enterprises are considered poor because they are largely built up from counterpart and other information obtained from ABS Surveys of Foreign Investment and Balance Sheet Information. This sector covers equity issued by both listed and unlisted private corporate trading enterprises, of which there are over half a million.
>
> In terms of the analysis undertaken here, errors in the estimated market value of equity on issue will impact on the accuracy of estimates of the proportion of that equity owned by non-residents.
>
> A further concern relates to valuation. While both financial accounts and international investment statistics (from which the rest of the world data are sourced) are on a market value basis in principle, collection and estimation methods differ between the two sets of statistics…Because of the differences in the methodologies used, it is possible that there could be more variability in the market value estimates of equity held by the rest of the world than in the estimated market value of the equity on issue, thus causing some variation in the foreign ownership series derived from these data.[223]

Reliability of ATO redemption rate data

414. The ATO maintains two separate databases that relate to imputation credits:

a) The ATO franking account balance (FAB) data; and

b) The ATO dividend flow data.

415. The FAB data is used when estimating the distribution rate, *F*. Companies record any undistributed credits in their franking account balance. Consequently, the estimation of the distribution rate over any particular period is a relatively straightforward calculation since:

a) The total amount of credits created is equal to the total amount of corporate tax collected; and

b) The total amount of credits that are not distributed is equal to the increase in the aggregate FAB over the period.

416. Consequently, the distribution rate can be estimated as:

$$1 - \frac{Increase\ in\ FAB}{Total\ corporate\ tax\ paid}.$$

223 See the ABS feature article that first explains the foreign ownership calculations at http://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/5306.0Feature%20Article150Jun%201992?opendocument&tabname=Summary&prodno=5306.0&issue=Jun%201992&num=&view=.

417. This method of estimating the distribution rate consistently produces estimates close to 70%. See, for example, NERA (2013, p. 5).

418. Estimation of the redemption rate requires the use of the ATO dividend flow data. The redemption rate can be estimated as the ratio of redeemed credits to distributed credits. The ATO dividend flow data includes information about both of these components. However, a series of calculations are required to determine the amount of distributed credits because some credits are distributed to other companies, and will be added to the recipient company FAB to be distributed to shareholders at a later point.

419. Hathaway (2013) shows that the ATO dividend flow data indicates that between 2004 and 2011 $204.7 billion of credits were distributed and $127.6 billion were redeemed. This suggests that 62.3% of the distributed credits were redeemed.

420. However, the ATO dividend flow data does not reconcile with the ATO FAB data. Whereas the former suggests that $204.7 billion of credits were distributed, the latter suggests that $292.2 billion were distributed. The discrepancy is obviously material and leads Hathaway (2013) to conclude that:

> I would caution anyone…against relying on those parts of my earlier reports which focused on ATO statistics.[224]

421. If the redeemed credits of $127.6 billion are expressed as a percentage of the $292.2 billion of credits that were distributed according to the FAB data, the resulting estimate of the redemption rate is only 44%. In summary, the Hathaway (2013) calculations indicate that the ATO supports an estimate of the redemption rate in the range of 44% to 62%.[225]

422. The Guideline concludes that the ATO data supports a redemption rate in the range of 0.4 to 0.8, where the upper bound is based on an estimate reported by Handley and Maheswaran (2006) for data over the 2000-2004 period. Hathaway (2013) strongly criticises several aspects of the methodology used by Handley and Maheswaran (2006).[226] Even setting aside these methodological criticisms, the Handley-Maheswaran data is now 10 years out of date and pre-dates the Hathaway (2013) sample period entirely. Moreover, Hathaway (2013) explains that he restricts his analysis to the post-2004 period because the pre-2004 data is unreliable:

> The ATO has had a lot of trouble deciding on the appropriate data for the period 2001-2003. The past data has been revised numerous times, both up and down in the years since then. In these circumstances, I have confined my analysis to the changes in levels from 2004 onwards.[227]

423. In our view, there is no reasonable basis for any continued reliance on estimates from Handley and Maheswaran (2006). Rather, the best estimate that can be obtained from the ATO data is the range of 44% to 62% from Hathaway (2013).[228]

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224 Hathaway (2013), Paragraph 12.
225 See Hathaway (2013), Paragraphs 23-25 and AER Rate of Return Guideline, Explanatory Statement, Appendix H, Table H.3, p. 153.
226 See Hathaway (2013), pp. 42-43.
227 Hathaway(2013), Paragraphs 17-18, p. 7.
228 See Hathaway (2013), Paragraphs 23-25 and AER Rate of Return Guideline, Explanatory Statement, Appendix H, Table H.3, p. 153.

424. Lally (2013) notes the concerns that Hathaway (2010, 2013) expresses in relation to the reliability of the tax statistics data and concludes that:

> the best that can be said of all this is that the redemption rate is uncertain[229]

425. Moreover, Lally (2013) also suggests that, even if the redemption rate could be reliably estimated, it is likely to "overestimate the utilisation rate" due to the possibility of foreign investors being able to effectively transfer some credits to domestic investors.[230]

426. Also, in a report for the AER, McKenzie and Partington (2011)[231] question whether redemption rates are even fit to be used as an upper bound for theta (even assuming they could be reliably estimated). Consequently, redemption rates (whether estimated directly from ATO aggregate tax statistics or indirectly by estimating the aggregate proportion of domestic ownership and assuming that domestic shareholders will redeem) can, at most, be used as an upper bound for theta.

427. Another potential problem with this data stems from the fact that it does not discriminate between public and private companies. Many micro businesses are structured as private companies that routinely distribute all imputation credits to their owners who redeem them all. Thus, the redemption rate for these businesses will be higher than for the average exchange-listed business. In this regard, we note that all other WACC parameters are estimated with reference to exchange-listed businesses (and not private micro and small businesses) because exchange-listed businesses are more reflective of the efficient benchmark entity.

428. Finally, we note that if theta is defined (wrongly, in our view) to be the redemption rate, the ATO data could be used to estimate gamma directly, without the need to separately estimate the distribution rate and theta, as follows:

$$\begin{aligned}\gamma &= F \times \theta \\ &= \frac{\textit{Credits distributed}}{\textit{Total corporate tax paid}} \times \frac{\textit{Credits redeemed}}{\textit{Credits distributed}} \\ &= \frac{\textit{Credits redeemed}}{\textit{Total corporate tax paid}}.\end{aligned}$$

429. That is, the discrepancy in the amount of credits distributed can be circumvented entirely by simply taking the ratio of credits redeemed to total corporate tax paid – which is 30% (127.6/421.5).[232] In our view, this is not a valid point estimate of gamma because theta is properly interpreted as the value of distributed credits not the redemption rate. However, this figure might be used as an upper bound check on the final estimate of gamma.

Conclusions and recommendations in relation to the use of redemption rates

430. Our conclusions in relation to redemption rate estimates of theta are as follows:

a) The redemption rate is the ratio of redeemed credits to distributed credits and can be estimated in two ways:

[229] Lally (2013), p. 15.
[230] Lally (2013), p. 15.
[231] McKenzie and Partington, (2011), p. 6.
[232] See Hathaway (2013), Figure 1, p. 8.

i) Using aggregate tax statistics published by the ATO relating to the distribution and redemption of imputation credits; and

ii) By estimating the proportion of Australian shares that are held by resident investors, and assuming that those resident investors will redeem any imputation credit they receive;

b) If theta is interpreted as the value of a distributed credit, redemption rates cannot be used to estimate theta. Consistent with this view, the Tribunal has ruled that redemption rates cannot be used to estimate the value of a distributed credit;

c) ATO tax statistic estimates of the redemption rate are so unreliable that no sound conclusion can be drawn from them. However, the best estimate of the redemption rate that can be obtained from ATO data is the range of 44% to 62% from Hathaway (2013);

d) Equity ownership estimates of the redemption rates are also highly unreliable. In particular, the AER's 70% (domestic ownership) estimate should not be relied upon because it is:

i) Based on data from 2007 that has been superseded;

ii) Includes equity in GOCs, general government and the Reserve Bank;

iii) Includes equity in unlisted entities;

iv) Is inconsistent with the ASX estimate of domestic ownership of Australian equities; and

v) Is subject to a warning from the ABS about data problems and inaccuracies.

The best available updated estimate of domestic equity ownership is 55%.

The "conceptual goalposts test"

The rationale for the "conceptual goalposts" test

431. The Guideline materials define "the market" to reflect the impact of foreign investors to the extent that they have chosen to invest in Australian shares:

> Consistent with the 2009 WACC review, we propose to define the market as an Australian domestic market that recognises the presence of foreign investors to the extent they invest in the Australian market. This definition reflects the realities of capital markets, and sits in between the purely theoretical definitions of a 'full segregated' market and a 'fully integrated' market. This definition has critical implications for the value of imputation credits.[233]

432. In this context, Lally (2013a) notes that the weighted-average utilisation rate can only be used to estimate theta in settings where the required pre-conditions apply. In particular, those conditions only apply if Australia is assumed to be a perfectly segmented market, or a perfectly integrated market. Those conditions do not apply in the hybrid case adopted in the Guideline.

433. Lally (2013a) goes on to argue that the reasonableness of any estimate of theta can be tested by determining whether the allowed return on equity based on that estimate of theta lies between:

[233] AER (2013), Draft Rate of Return Guideline, Explanatory Statement, p. 120.

a) The allowed return on equity in a perfect segmentation world; and

b) The allowed return on equity in a perfect integration world.

434. As set out in Section 2 above, the allowed return on equity is computed as the total required return on equity less an adjustment for the value of imputation credits.

Implementation of the "conceptual goalposts" test

435. The test of whether a particular estimate of theta produces an allowed return on equity that is between the allowed return in a theoretical full segregation scenario and a theoretical full integration scenario requires estimates of what each WACC parameter would be in each of those theoretical scenarios.[234]

436. Lally (2013a) undertakes the estimation task by starting with estimates of WACC parameters from the real world and making adjustments to determine what those parameter values would be if markets were perfectly segmented and what they would be if markets were perfectly integrated. In our view, this is an impossible task. Estimating beta and MRP in the real world (reflecting the actual observable impact that foreign investors have on observable asset prices) is extremely difficult and a matter of great controversy, thousands of pages of expert submissions, and almost continual litigation. The task of estimating what beta and MRP *would be* if no foreign investment was allowed, and what they *would be* if markets were perfectly integrated is impossible.[235]

437. Even if it was possible to derive point estimates of beta and MRP as they would be in these theoretical scenarios, the reasonable ranges (or confidence intervals) around the point estimates would be very wide indeed – reflecting not just statistical estimation error, but also the extent to which the theoretical adjustments to convert estimates from their real world values to their theoretical world values might not be perfectly accurate. Indeed properly constituted ranges would likely be so wide as to render the resulting estimates of no use whatsoever.

438. However, Lally (2013a) produces point estimates of the required return on equity in these theoretical worlds to three decimal places and uses these point estimates to rule out all estimates of theta other than his own theoretically reasoned value of 1. He does not consider the possibility of *any* estimation error or of *any* model error in converting real-world estimates to their theoretical world values.[236]

439. In addition to this, all of Lally's calculations are based on a mechanistic implementation of the Sharpe-Lintner CAPM where MRP is estimated solely from the historical arithmetic mean of excess stock returns, which is inconsistent with the Guideline's approach of having regard to other relevant evidence.

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234 See Lally (2013a), Section 3.9.

235 For example, to properly estimate what the market risk premium would be in a world where foreign investment was banned would require the implementation of the Guideline procedure under the assumption that no foreign investment was allowed. This would require an estimate of what historical stock returns would have been had no foreign investment been allowed. It would also require a parameterisation of the DGM under the assumption that no foreign investment is allowed. This, in turn, would require an estimate of what the market dividend yield would be in the absence of foreign investment and an estimate of what growth forecasts analysts would be using if no foreign investment was allowed, and an estimate of what long-run GDP growth would be if no foreign investment was allowed. In our view, this is an impossible task.

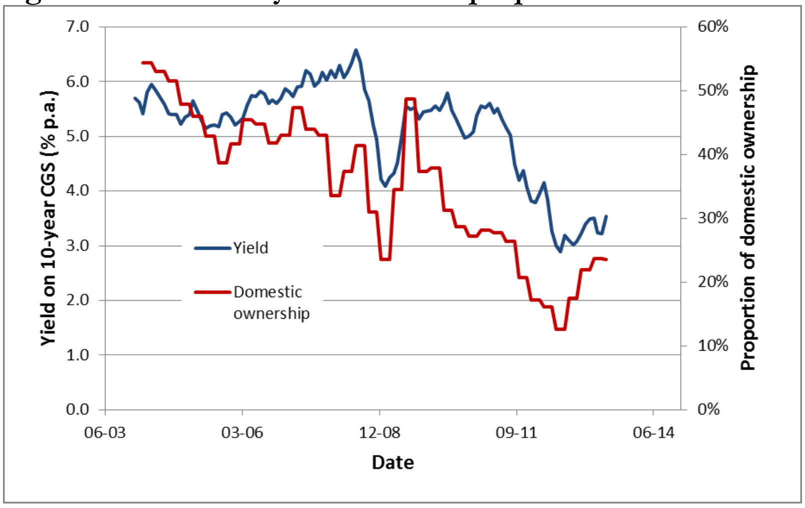
236 Lally (2012, 2013) does consider different values for certain parameters that are used to convert from the real world to the theoretical worlds, but he assumes that his approach for converting between worlds is perfectly accurate.

The key assumption of the "conceptual goalposts" test

440. One of the most important aspects of the Lally "test" is the assumption that the risk-free rate would not change in a segmented market. In our view, this assumption is untenable. The Reserve Bank reports that more than 80% of all Australian government bonds are currently owned by foreign investors. If that demand were removed from the market entirely, the price of government bonds would surely be lower and the yield would surely be higher.[237] Yet the Lally test is based on the risk-free rate being the same in a perfect segmentation world as in a perfect integration world. Lally (2013a) uses this assumption to rule out all of the empirical evidence on theta in favour of his theoretically reasoned value of 1.

441. Given that at any point in time there is a fixed supply of Commonwealth government bonds, basic supply/demand dynamics indicate that the material reduction in demand caused by the withdrawal of all foreign ownership would result in a reduction in the price of government bonds and a consequential increase in yields. The relationship between foreign ownership and government bond yields is illustrated in Figure 10 and Figure 11 below.

Figure 10
Australian government bond yields and the proportion of domestic ownership



Source: RBA Statistical Tables E3 and F2.

442. Figure 10 shows that, over the last ten years, movements in government bond yields have closely mirrored movements in the proportion of domestic ownership. When the proportion of foreign investment increases (causing a reduction in domestic ownership) yields tend to fall. Conversely, when foreign investment falls, yields tend to rise. This is consistent with increases in foreign investment bidding up the price of government bonds and lowering yields.

443. Figure 11 shows the relationship between changes in government bond yields and changes in the proportion of foreign ownership over the last ten years. Increases in foreign investment are associated with decreases in government bond yields and the relationship is statistically and economically significant.[238]

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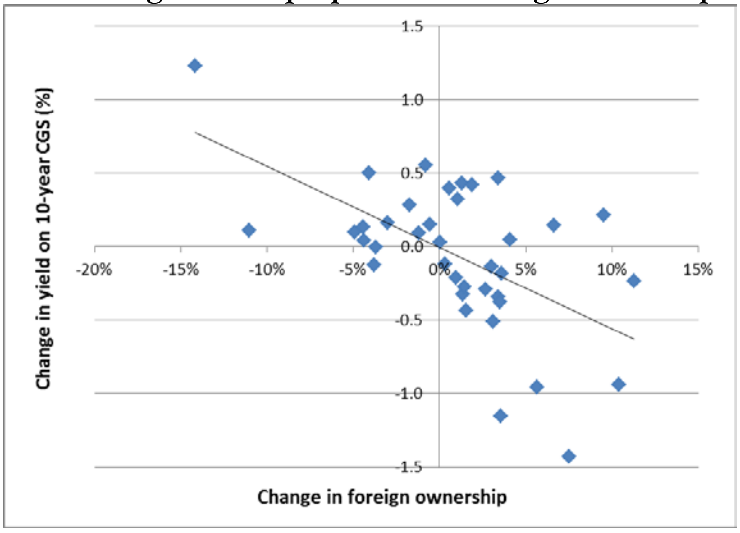
[237] Given that the foreign ownership of Australian government bonds is greater than Australian ownership of foreign government bonds.

[238] *T*-statistic is -3.97, *p*-value is less than 1%, *R*-squared value is 33%.

Figure 11
The relationship between changes in Australian government bond yields and changes in the proportion of foreign ownership



Source: RBA Statistical Tables E3 and F2

444. Of course CGS yields vary for many reasons in addition to changes in the demand from foreign investors and correlation does not imply causation. However, the data from the last ten years is consistent with the basic economic principle that (other things being equal) a reduction in demand leads to a reduction in price. By contrast, the notion that the government bond yield would be unchanged if all foreign investment were withdrawn is inconsistent with basic economic principles and with the empirical data.

445. Lally (2013a) explains that his "test" is based on the assumption that government bond yields would remain the same even if all foreign investment were withdrawn on the basis that:

> CAPMs treat the risk free rate as exogenously determined, and therefore the same empirically observed rate applies to both the Officer and Solnik models.[239]

446. This simply means that the CAPM is silent on how the risk-free rate is determined. The risk-free rate is determined by the demand/supply dynamics of government bonds. The CAPM then takes the resulting risk-free rate as an exogenously determined input. However, this does not imply that the same risk-free rate should be used independent of the demand for government bonds. In a setting where there is high demand, the exogenously determined risk-free rate would be low and a low figure would be employed in the CAPM. In a setting where there is low demand, the exogenously determined risk-free rate would be high and a high figure would be employed in the CAPM. Logically, it does not follow that because the risk-free rate is exogenously determined the same value should be used in materially different settings.

447. By analogy, suppose we have a model for estimating the winning time in a marathon race. The weather conditions would be an obvious exogenous input variable – analogous to the risk-free rate in the CAPM.[240] But this does not imply that we should assume the same weather conditions for the Boston and Brisbane marathons. That is, "exogenous" means "determined by factors outside the model" – it does not mean "equal in all circumstances."

[239] Lally (2013a) Footnote 20, p. 40.
[240] Like the risk-free rate, weather conditions are relevant and they are exogenous in the sense that they are independently determined. For example, the number or quality of runners in the race does not affect what sort of weather might eventuate.

448. Moreover, if the perfect segmentation risk-free rate is increased by just 1% above the perfect integration risk-free rate, the empirical estimates based on market data pass the Lally test. In particular, Lally (2013a) concludes that the plausible range for the cost of equity is 6.8% to 7.7%.[241] The upper bound is based on calculations for the "complete segmentation" world. If the risk-free rate for the complete segmentation world was set to 1% above the risk-free rate for the complete integration world, the upper bound would be 8.7%.[242] In this case, the estimate of the cost of equity, based on theta being set to 0.35, would be squarely within the "conceptual goalposts" at 8.4%.

449. That is, even setting aside all of the problems with such a test, none of the market-based empirical estimates are ruled out unless one assumes that government bond yields would be identical whether or not foreign investors are admitted.

The results of the "conceptual goalposts" test

450. As set out above, there are two key features of the "conceptual goalposts" test that are difficult to accept:

a) It requires accurate estimates of what the required return on equity would be if Australia was a perfectly segmented market and what it would be if Australia was part of a perfectly integrated world market; and

b) It requires that the government bond yield would remain unchanged whether or not foreign investors (who currently own 80% of those bonds) are excluded from the market.

451. In our view, these features render the conceptual goalposts test useless and it should be given no weight whatsoever. If, however, one accepts these features, the next step would be to consider the result of the test. The result is that the proposed estimate of theta in the Guideline fails the test.[243] Indeed every estimate of theta generally fails the test – other than Lally's theoretically reasoned estimate of 1.

452. Moreover, the Guideline's 0.7 estimate of theta fails the conceptual goalposts test. According to Lally (2013), every estimate of theta fails the test other than his own theoretically reasoned estimate of 1. The Guideline materials cite Lally (2013, pp. 46-47) as supporting the conclusion that estimates "in the range 0.8 to 1.0 meet this test."[244] However, Lally (2013) makes no such conclusion. He never even considers an estimate of 0.8. Rather, his conclusion is that estimates "that are significantly less than 1 fail this test in virtually every case examined, and are therefore deficient"[245] and that "the only sensible estimate…is at or close to 1."[246]

453. The Guideline materials conclude that the conceptual goalposts test supports the proposed estimate of theta (0.7) on the basis that this estimate fails the test less severely than some standard empirical estimates. In our view, there are three difficulties with this conclusion:

a) The fact that the Guideline estimate fails the test would generally mean that the test does *not* support the Guideline estimate; and

241 Lally (2013a), p. 43.
242 Lally (2013a), p. 43.
243 Specifically, Lally (2013a), p. 45 concludes that the QCA theta estimate of 0.625 fails the test.
244 AER Rate of Return Guideline, Explanatory Statement, Footnote 533, p. 160.
245 Lally (2013), pp. 46-47.
246 Lally (2013), pp. 46-47.

b) Using the conceptual goalposts test to rule out the standard empirical estimates requires one to believe that:

   i) It is not possible to reliably estimate the extent to which investors value imputation credits in the real world; but

   ii) It is possible to reliably estimate (to three decimal places) the total return on equity that investors would require from the benchmark firm in a world where Australia was perfectly segmented from global capital markets, and in a world where Australia was perfectly integrated into global capital markets; and

c) The test requires that the government bond yield would remain unchanged whether or not foreign investors (who currently own 80% of those bonds) are excluded from the market.

Summary and recommendation on the conceptual goalposts test

454. In our view, the AER should not use the "conceptual goalposts" test as the basis for setting aside all of the empirical evidence based on market data in favour of a theoretically assumed theta. That test requires estimates of point estimates of what CAPM parameters would be in theoretical perfect segmentation and perfect integration worlds, it ignores estimation error, and it invokes the assumption that government bond yields would be the same in these two worlds. Such a test is not fit for any purpose, let alone the purpose of effectively excluding all available empirical evidence in favour of a theoretically assumed value. Moreover, the Guideline estimate of theta fails that test in any event.

Appendix 9: Additional dividend drop-off stability analysis

Stability and the effect of influential observations

455. The Guideline materials note that, whereas the SFG estimates have been shown to be stable and robust to the removal of influential observations, Vo et al (2013) report that:

> the estimate of theta is highly sensitive to the choice of the underlying sample of dividend events. Removing just 30 observations from a sample of 3309 can result in a dramatically different estimate of theta.[247]

456. Vo et al (2013) claim that the sensitivity of their results to the removal of influential observations is due to multicollinearity,[248] and variously refers to multicollinearity as being "strong," [249] "extreme" [250] and "severe."[251] However, no test for multicollinearity is ever performed.[252] The conclusions about multicollinearity are apparently drawn from informal observations about the correlation between dividends and imputation credits which is a necessary but insufficient condition for the estimates to have been affected by multicollinearity. Moreover, in Model Specification 2, there is only one independent variable, in which case multicollinearity is clearly impossible.

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

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

459. For example, the SFG (2011) study contained an extensive section on stability analysis[253] whereby observations are removed in pairs consisting of the observations that have the most influential upward and downward effects on the estimate of theta, respectively. As pairs of observations are removed, theta is re-estimated to determine the sensitivity of the theta estimate to influential observations. The result is a figure such as that replicated below for Model Specification 4.[254]

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

> The stability analysis for Model 4, in Figure 8 above, shows that the estimates of the value of cash dividends, the value of theta, and the value of the combined package are very stable and robust to the removal of pairs of influential data points…In summary, the stability analyses demonstrate that the estimates of theta are either maintained or lowered when pairs of influential observations are removed from the data set.[255]

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

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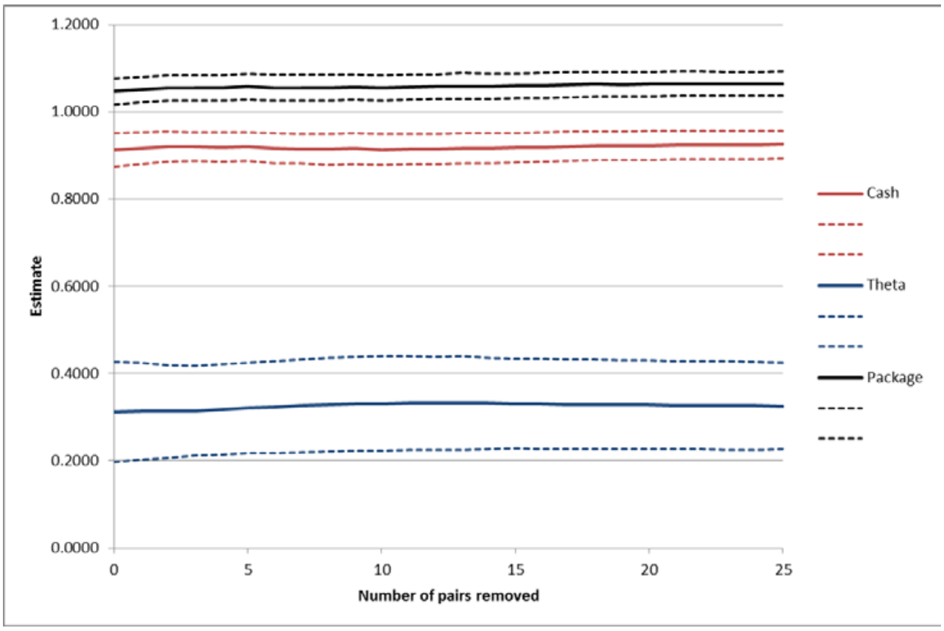
[247] Vo et al (2013), p. 30.
[248] Vo et al (2013), p. 13.
[249] Vo et al (2013), p. 32.
[250] Vo et al (2013), p. 32.
[251] Vo et al (2013), p. 19.
[252] Vo et al (2013), p. 26.
[253] SFG (2011), pp. 28-32.
[254] This appeared as Figure 8, p. 31 in SFG (2011).
[255] SFG (2011), p. 31.

Figure 12. SFG stability analysis



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

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

a) Influential observations are removed one at a time, rather than in pairs; and

b) The stability analysis is only applied in relation to the non-standard approach whereby prices are not corrected for market movements over the ex-dividend day.

463. The results based on the ERA's non-standard approach are likely to be more variable and less reliable than standard estimates and this may be manifest in the stability analysis. Also recall that the Guideline materials state that "the most relevant results from the Vo et al study relate to regressions with the market adjustment."[256]

464. Given that:

a) The stability of theta estimates is clearly a key issue for Vo et al (2013) and for the AER's Guideline; and

b) The only stability analysis performed by Vo et al (2013) is in relation to the non-standard approach of making no correction for market movements over the ex-dividend day,

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

Additional SFG stability analysis

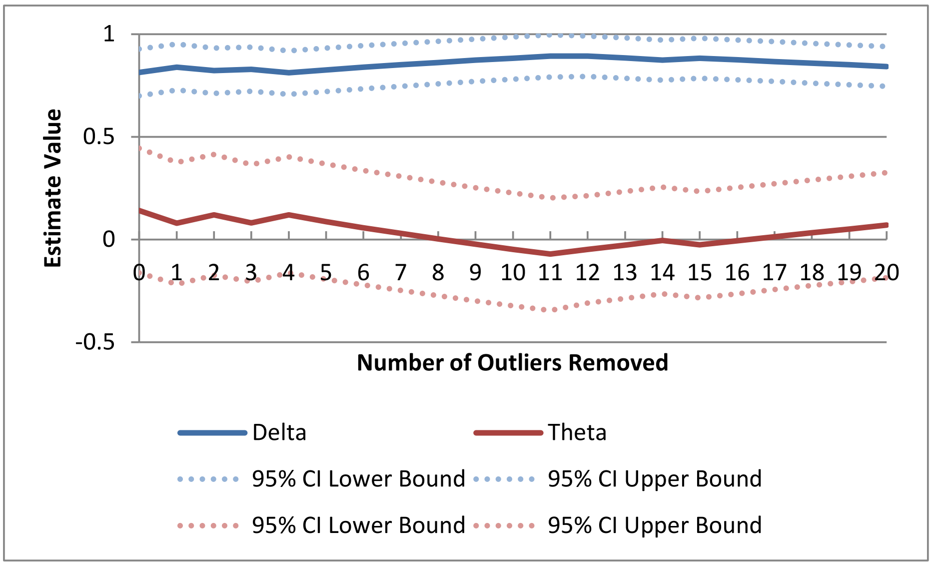
465. First, we apply the one-at-a-time influential observation (DFBETAS) approach that Vo et al (2013) employed, but using the standard ex-day market correction and our updated data set.

[256] AER Rate of Return Guideline, Explanatory Statement, Appendix H, p. 174.

466. In general, we conclude that the estimates of theta are robust to the removal of influential observations – particularly in relation to Model Specification 4, which we consider to produce the most reliable estimates.

467. Figure 13 below shows that the estimates of delta (the market value of cash dividends) and theta from Model 1 (basic model estimated via OLS) are relatively insensitive to the removal of influential observations. Even with the removal of the twenty most influential observations the estimates do not deviate markedly from their original values.

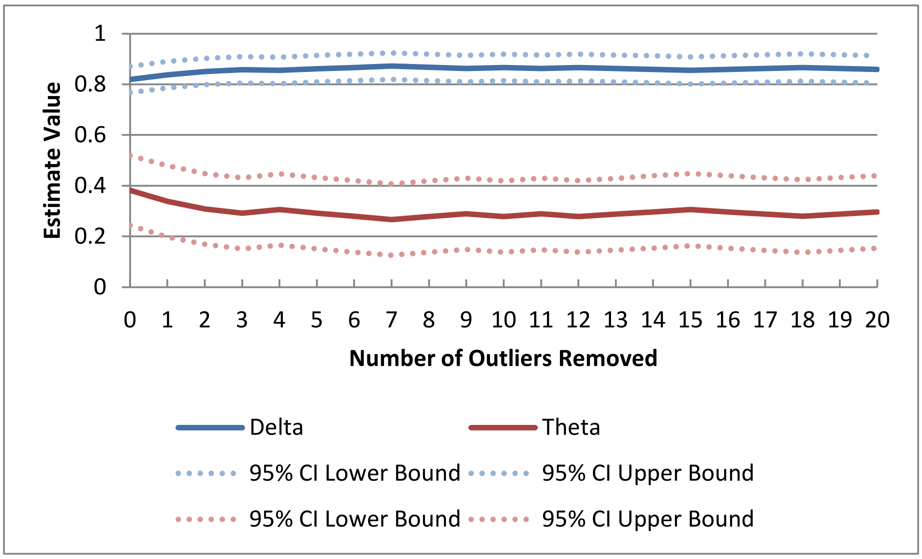
Figure 13. Sensitivity of Model 1 Delta and Theta estimates to the removal of influential observations



Source: SFG Consulting.

468. Next we examine the sensitivity of Model 2 (basic model estimated with GLS with dividend yield as the weighting variable) to the removal of the most influential observations. Again, we remove the most influential observation one at a time. Figure 14 below shows that the estimate of theta does not alter materially, although it does decline slightly.

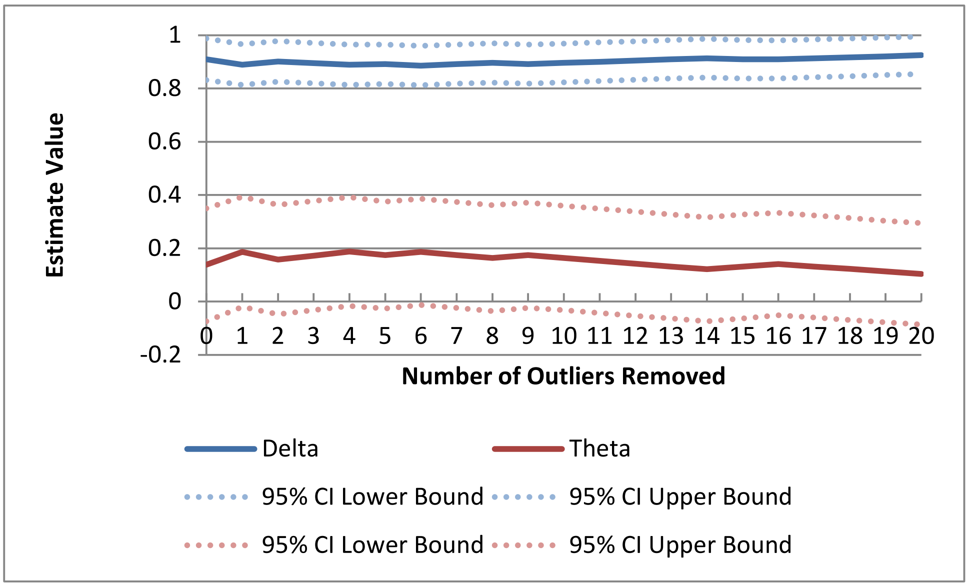
Figure 14. Sensitivity of Model 2 Delta and Theta estimates to the removal of influential observations



Source: SFG Consulting.

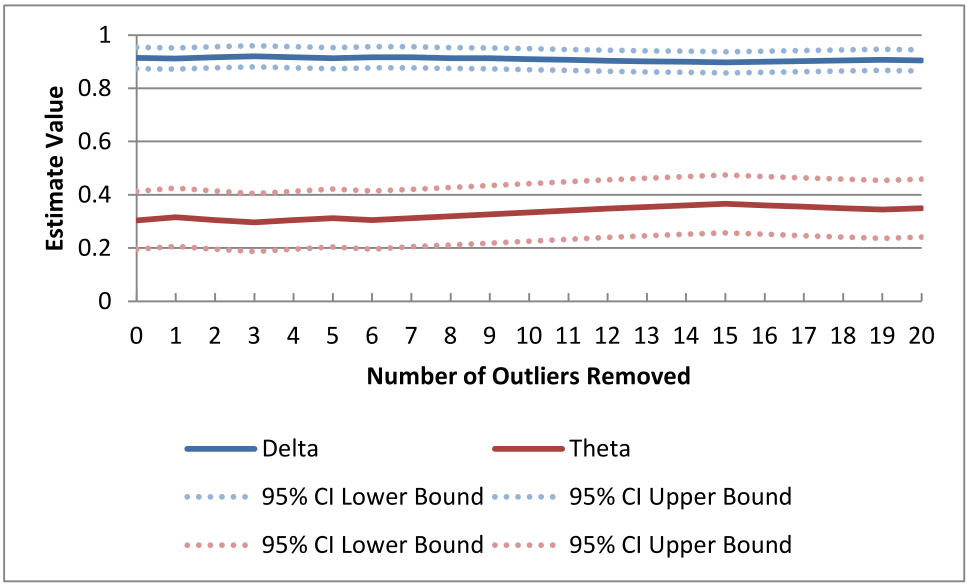
469. Next we examine the sensitivity of Model 3 (the basic model estimated with GLS with inverse stock return volatility used as the weighting variable) estimates to the removal of influential observations using the same procedure as before. Figure 15 shows, consistent with the findings for the other models, that the estimates of theta remain relatively stable.

Figure 15. Sensitivity of Model 3 Delta and Theta estimates to the removal of influential observations



470. Finally, we examine the sensitivity of Model 4 (the basic model estimated with GLS with dividend yield and inverse stock return volatility used as the weighting variables) to the removal of the influential observations. Again, we find that the estimates are not materially affected by the removal of the influential observations, as illustrated in Figure 16.

Figure 16. Sensitivity of Model 4 Delta and Theta estimates to the removal of influential observations



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

Bootstrap removal of 5% of data set

472. To further test the stability of the SFG (2013) theta estimates, we conduct a randomised bootstrapping analysis. To do this, we randomly eliminate five per cent of the sample and re-estimate each of the models using the remaining data. We then repeat this procedure (on the original full sample) another 999 times, yielding 1,000 estimates of theta – each computed after a different 5% of the sample has been removed. This analysis is designed to show how sensitive the estimate of theta might be to removal of 5% of the sample observations.

473. The results from this procedure also lead us to conclude that the SFG estimates of theta are stable and robust to the removal of even 5% of the sample observations. In all cases, the 90% confidence interval is relatively narrow and close to, or below, the SFG point estimate of 0.35. Again, this is particularly the case for model specification 4, which we consider to be the most reliable.

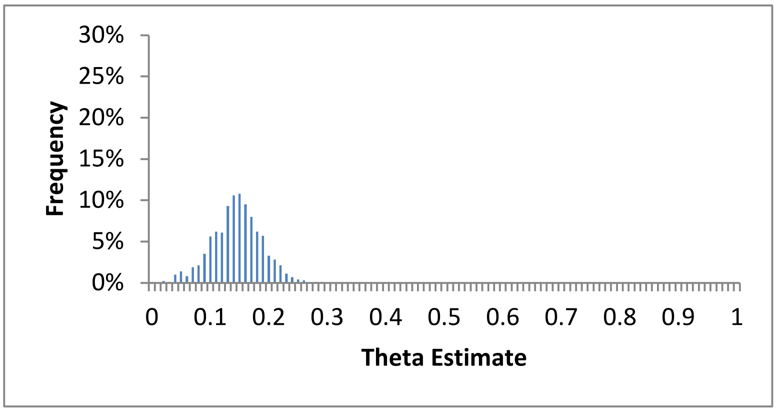
474. The results of this bootstrap test for Model 1 (basic model estimated via OLS) are set out in Table 3 below. The average theta estimate of 0.14 is consistent with the estimate when model specification 1 is applied to the full sample. The 90% confidence interval is from 0.7 to 0.21.

Table 3. Bootstrap re-sampling summary statistics for Model 1

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

Source: SFG calculations

Figure 17. Histogram of theta estimates from simulation of Model 1



Source: SFG calculations

475. Figure 17 above shows that even under the relative extreme procedure of removing 5% of the sample there tends to be relatively little deviation from the mean theta estimate of 0.14.

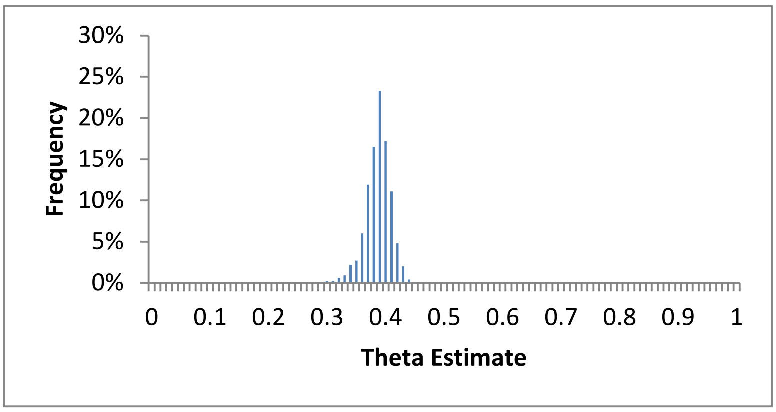
476. The results from running the bootstrap analysis for Model 2 (basic model estimated with GLS with dividend yield as the weighting variable) are set out in Table 4 below. The mean estimate is 0.38 within a narrow 90% confidence interval of 0.35 to 0.41.

Table 4. Bootstrap re-sampling summary statistics for Model 2

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

Source: SFG calculations

Figure 18. Histogram of theta estimates from simulation of Model 2



Source: SFG calculations

477. Figure 18 above shows the narrow distribution of theta estimates for Model Specification 2.

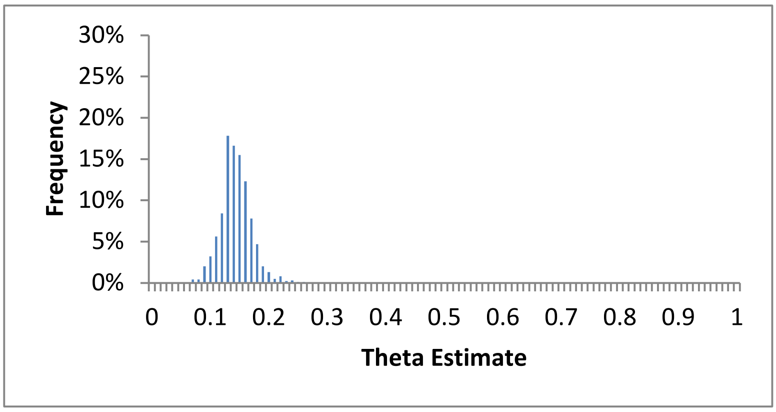
478. The results of the bootstrap re-sampling procedure for Model 3 (the basic model estimated with GLS with inverse stock return volatility used as the weighting variable) are set out in Table 5 below. The mean estimate of 0.14 is from a 90% confidence interval of 0.10 to 0.18.

Table 5. Bootstrap re-sampling summary statistics for Model 3

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

Source: SFG calculations

Figure 19. Histogram of theta estimates from simulation of Model 3



Source: SFG calculations

479. Figure 19 above shows that the range of estimates is similar to that for Model Specification 1, which is similar in its specification to Model 3.

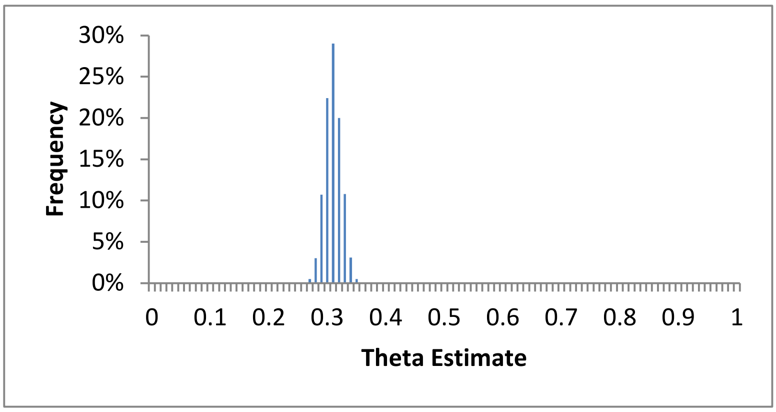
480. The results of the bootstrap re-sampling procedure for Model 4 (the basic model estimated with GLS with dividend yield and inverse stock return volatility used as the weighting variables) are set out in Table 6 below. The mean estimate of 0.31 is from a 90% confidence interval of 0.28 to 0.33.

Table 6. Bootstrap re-sampling summary statistics for Model 4

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

Source: SFG calculations

Figure 20. Histogram of theta estimates from simulation of Model 4



Source: SFG calculations

481. Figure 20 above shows a tightly clustered group of theta estimates centred on 0.30. The simulations provide evidence that the theta estimate from Model Specification 4 is insensitive to the removal of even 5% of the data sample.

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

Conclusions in relation to SFG stability analysis

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

An updated dividend drop-off estimate of theta

REPORT PREPARED FOR AGN, MULTINET GAS, AUSNET TRANSMISSION, AUSNET GAS DISTRIBUTION AND TRANSGRID

September 2016

An updated dividend drop-off estimate of theta

Executive Summary

1.1 Context

1 In the Australian regulatory setting, the regulator requires an estimate of a parameter that reflects the implied market value of dividend imputation tax credits at the time those credits are *created* by the payment of corporate tax. This parameter is known as 'gamma.' Gamma, in turn, is a function of two other parameters. One of these is the implied market value of imputation credits at the time they are *distributed* to shareholders – a parameter known as 'theta.'

2 One method of estimating theta is known as 'dividend drop-off analysis.' This is an econometric (statistical) technique that estimates the value of distributed imputation credits (theta) by observing the change in stock prices around ex-dividend events (days when the dividend and imputation credit separate from the share).

3 Specifically, share prices are expected to drop, on average, by the value of the cash dividend and the attached imputation credit on the ex-dividend date when the dividend and credit separate from the share. By comparing 'with-dividend' share prices against 'ex-dividend' share prices, it is possible to infer the value that the market has placed on dividends and imputation credits.

4 The Australian Competition Tribunal (Tribunal) has twice endorsed the use of dividend drop-off analysis for the purpose of estimating theta. In the *Energex Gamma Case*,[1] the Tribunal rejected methods that were based on counting the proportion of distributed credits that might be redeemed, and instead directed that a 'state of the art' dividend drop-off study should be performed to assist with its deliberations. The resulting study, the SFG (2011) study, concluded that the best estimate of theta was 0.35. The Tribunal endorsed and adopted that estimate.

5 For a number of years, the AER adopted a theta of 0.35. However, in its December 2013 Rate of Return Guideline, the AER proposed to increase its estimate of theta, again on the basis of methods that involve counting the proportion of credits that might be redeemed. In the *PIAC-Ausgrid Case*,[2] the Tribunal again rejected that approach and set theta to 0.35 on the basis of an updated dividend drop-off estimate – the SFG (2013) study.[3]

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[1] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011).

[2] Applications by Public Interest Advocacy Centre and Ausgrid [2016] ACompT1.

[3] The AER has sought a judicial review of the Tribunal's decision, but that review application has not yet been heard.

1.2 The current report

6 This report summarises the results of updating the 2011 and 2013 SFG reports using the most recently available data. As set out below, this report has been prepared by Stephen Gray, Professor of Finance at the UQ Business School at the University of Queensland and Director of Frontier Economics. Professor Gray is also the author of the 2011 and 2013 SFG studies.[4]

7 All of the procedures for compiling the data set and performing the statistical analysis that are set out in this report follow the approach adopted in the 2011 and 2013 SFG reports. This report simply summarises the results that are obtained from applying the same methods to an updated data set through to June 2016.

8 We conclude that the updated data set supports an unchanged estimate of theta of 0.35.

1.3 Author of report

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

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

11 I was assisted in the preparation of this report by Dr Damien Cannavan of the UQ Business School at the University of Queensland. Dr. Cannavan and I have co-authored a number of papers relating to the valuation of dividend imputation tax credits. He assisted in the compilation of the data sets and with the econometric analysis of the data.

[4] Professor Gray and Dr Damien Cannavan, also from UQ Business School, are in the process of preparing an updated dividend drop-off analysis for publication in an academic journal. This report summarises the relevant results from that work.

2 Background and context

2.1 The role of gamma in the regulatory process

12 In the Australian regulatory setting, the regulator estimates the return that investors would require to provide equity capital to the firm and then allows the firm to charge prices so that it is able to pay that return to the investors. In the absence of imputation, this process is straightforward.

13 Consider, for example, a firm with $1,000 of equity in its RAB and a required return on equity of 7%. In this case, the equity investors require a return of $70.[5] The regulator will allow the firm to earn a pre-tax profit of $100, from which it will pay $30 corporate tax,[6] leaving $70 to return to shareholders, as required.

14 Now consider the same example with imputation, and where the regulator has determined that gamma should be set to 0.4, as the AER has done in its recent decisions. In this case, the regulator will allow the firm to earn a pre-tax profit of $85.37, from which it will pay $25.61 corporate tax (30%), leaving $59.76 to distribute to shareholders. The $25.61 of corporate tax will create $25.61 of imputation credits that are assumed to have a value of 0.4 × 25.61 = $10.24. Thus, the shareholders receive $59.76 from the firm plus imputation credits that are assumed to have a value of $10.24, providing the total return of $70.00 that is required.

15 In summary, the return that shareholders would otherwise receive from the firm ($70.00) is reduced by the regulator's estimate of the value of imputation credits ($10.24).

16 To illustrate the key point of contention in relation to gamma, suppose that the regulator estimates that 40% of all credits that are created will be redeemed and sets gamma on that basis, whereas imputation credits are only valued (in aggregate by the equity market) at 25% of the face amount. In this case, the regulator will reduce the return that the shareholders would otherwise receive by $10.24, but the credits received by those shareholders would only have a value to them of 0.25 × 25.61 = $6.40. This would result in shareholders being under-compensated as their return is reduced by $10.24 in relation to credits that are only worth $6.40 to them.

2.2 Points of agreement

17 There are a number of points on which there is broad agreement between consultants, regulators and regulated businesses, as set out below.

---

[5] 7% × $1,000 = $70.

[6] Assuming a 30% corporate tax rate.

Two parameters to be estimated

18 There is broad agreement that gamma should be estimated as the product of two parameters: $\gamma = F \times \theta$. The first parameter is the distribution rate – the proportion of created imputation credits that are attached to dividends and distributed to shareholders. The second parameter is variously defined as "theta" or "the value of distributed imputation credits" or "the utilisation rate." While there is dispute about how each component of gamma should be interpreted and estimated, there is broad agreement that gamma is to be estimated as the product of these two components.[7] For example, if firms distribute 70% of the imputation credits they create and if those credits are each valued at 35% of face value, then gamma would be:

$$\gamma = F \times \theta = 0.7 \times 0.35 = 0.25 .$$

Agreement in relation to theta

19 There is broad agreement that two different interpretations of the second parameter, theta, have been proposed:

a. a *market value* interpretation; and

b. a *redemption proportion* interpretation.[8]

20 There is also broad agreement that:

a. If the *market value* interpretation is adopted, we should use estimation methods that are designed to estimate the market value from the market prices of traded securities; and

b. If the *redemption proportion* interpretation is adopted, we should use estimation methods that are designed to estimate the proportion of credits that are (or are likely to be) redeemed.[9]

2.3 Key point of disagreement: The estimation of theta

21 Over the last six years, the key point of dispute between regulated businesses and the AER has been whether theta, the value of distributed imputation credits, should be estimated with reference to the market prices of traded securities, or whether theta should be estimated as the proportion of credits that might be

---

[7] AusNet Draft Decision, Attachment 4, p. 11. Throughout this report we use references to the AusNet Draft Decision as an example of the AER's current approach to gamma. The AusNet decision is among the batch of the AER's most recent final decisions. The AER's approach to, and estimate of, gamma has remained the same for more than two years.

[8] AER Rate of Return Guideline, Explanatory Statement, p. 158. The AER defines gamma in terms of the expected proportion of the credits that are created by the payment of corporate tax that investors are able to redeem or utilise.

[9] AusNet Draft Decision, Attachment 4, p. 35 and following.

available for redemption. We begin this section by providing some background on this issue.

2.3.1 The 2011 Energex Gamma Case

22 Prior to the AER's 2009 WACC Review, the long-standing regulatory precedent was to set gamma to 0.5. However, in its Statement of Regulatory Intent in May 2009, the AER set gamma to 0.65. That estimate was based on:

a. Setting F to 100%. The AER's consultant on this issue proposed that the distribution rate should be set on the basis of theoretical assumption rather than market evidence; and

b. Setting θ to 0.65 as the mid-point of two estimates:

   i. A dividend drop-off estimate of 0.57 whereby one compares the prices of shares immediately before the ex-dividend date with the prices of the same shares immediately after, as a means of inferring the implied value of dividends and the tax credits that are attached to them ; and

   ii. An estimate based on ATO tax statistics about the proportion of imputation credits that are redeemed.

23 The first three businesses to be regulated under the AER's SoRI estimate of 0.65 were ENERGEX, Ergon Energy and ETSA Utilities,[10] all of whom sought a review by the Australian Competition Tribunal (the Tribunal). This review took place under the National Electricity (Distribution) Rules and has become known as the *Energex Gamma Case.*[11]

Issues and Tribunal findings

24 Two techniques for estimating theta were considered by the Tribunal:

a. Tax statistics about the proportion of distributed imputation tax credits that had been redeemed by shareholders, obtained from the Australian Taxation Office (ATO); and

b. Dividend drop-off analysis, whereby the implied value of imputation tax credits is inferred from the price change that occurs over ex-dividend days.

25 The Tribunal held that the ATO tax statistic approach did not produce an estimate of market value and that the AER was wrong to have interpreted tax statistic estimates in that way. In particular, the Tribunal held that the ATO tax statistic approach provides no more than an upper bound check on estimates of theta obtained from the analysis of market prices, and that the AER was wrong

[10] Now called SA Power Networks.

[11] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011).

to have interpreted such an estimate as a point estimate rather than as an upper bound:

> The AER accepted that utilisation rates derived from tax statistics provide an upper bound on possible values of theta. Setting aside the manner in which the AER derived a value from the tax statistics study, it correctly considered that information from a tax statistics study was relevant. However, its relevance could only be related to the fact that it was an upper bound. No estimate that exceeded a genuine upper bound could be correct. Thus the appropriate way to use the tax statistics figure was as a check.[12]

26 This left the Tribunal with dividend drop-off analysis. On this point, the AER had sought to rely entirely on a single study by Beggs and Skeels (2006). The Tribunal held that the AER was wrong to rely on an out-dated and methodologically unsound dividend drop-off study. The Tribunal then directed that a 'state-of-the-art' dividend drop-off study should be conducted to assist the Tribunal. The Tribunal also directed that the dividend drop-off study, to be performed by SFG, "should employ the approach that is agreed upon by SFG and the AER as best in the circumstances."

27 In summary, the Tribunal ruled that:

a. The AER had erred in using tax statistics estimates for any purpose other than as an upper bound;

b. The AER had erred in its reliance on the Beggs and Skeels (2006) dividend drop-off estimate of theta; and

c. SFG should be retained to prepare a "state-of-the-art" dividend drop-off analysis with terms of reference to be agreed with the AER.

The SFG "state-of-the-art" dividend drop-off study

28 After agreement could not be reached between the parties on the terms of reference for the state-of-the-art drop-off study, the Tribunal held another hearing and ruled that:

a. The four variations of the econometric specification of dividend drop-off analysis drawn by SFG from the literature should be used; and

b. The results from the full updated data set compiled by SFG should be used rather than reporting results for various sub-periods.

29 SFG then conducted the dividend drop-off study and circulated a draft report to all parties. The AER and the regulated businesses that were parties to the *Energex Gamma Case* provided detailed comments on the draft report and these were taken into account in a revised report that was provided to all parties and to the Tribunal.

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[12] Application by Energex Limited (No 2) [2010] ACompT 7 (13 October 2010), Paragraph 91.

30 Although the AER submitted that the SFG study had departed from the terms of reference, the Tribunal disagreed and accepted the estimates from the SFG dividend drop-off study:

> The Tribunal is satisfied that the procedures used to select and filter the data were appropriate and do not give rise to any significant bias in the results obtained from the analysis. Nor was that suggested by the AER.
>
> In respect of the model specification and estimation procedure, the Tribunal is persuaded by SFG's reasoning in reaching its conclusions. Indeed, the careful scrutiny to which SFG's report has been subjected, and SFG's comprehensive response, gives the Tribunal confidence in those conclusions.[13]

31 The Tribunal went on to conclude that:

> The Tribunal is satisfied that SFG's March 2011 report is the best dividend drop-off study currently available for the purpose of estimating gamma in terms of the Rules.[14]

and:

> The Tribunal finds itself in a position where it has one estimate of theta before it (the SFG's March 2011 report value of 0.35) in which it has confidence, given the dividend drop-off methodology. No other dividend drop-off study estimate has any claims to be given weight vis-à-vis the SFG report value.[15]

Final estimate of Gamma

32 Having determined that the appropriate distribution rate is 70% and that the best dividend drop-off estimate of theta is 0.35, the Tribunal multiplied these two estimates together to obtain a gamma estimate of 0.25:

> Taking the values of the distribution ratio and of theta that the Tribunal has concluded should be used, viz 0.7 and 0.35, respectively, the Tribunal determines that the value of gamma is 0.25.[16] [17]

2.3.2 The 2013 SFG update

33 In June 2013, SFG provided an update of its dividend drop-off estimate of theta in a report commissioned by the Energy Networks Association (ENA). This involved applying the same econometric methodologies and applying the same statistical, diagnostic and robustness tests as in the 2011 study performed for the Tribunal. In that study, the data set was updated from September 2010 to October 2012.

34 The 2013 study notes that the conclusions from the earlier 2011 study were that:

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

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

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

[16] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 42.

[17] As set out in Section 2.3.3 below, the AER has subsequently conducted a conceptual re-evaluation of the estimation of theta and concluded that the Tribunal erred in adopting a market value perspective.

> For the reasons set out in detail in this report, we conclude that the appropriate estimate of theta from the dividend drop-off analysis that we have performed is 0.35 and that this estimate is paired with an estimate of the value of cash dividends in the range of 0.85 to 0.90.[18]

35 The 2013 went on to conclude that:

> …the conclusions from the earlier study remain valid when tested against the updated data set.[19]

2.3.3 The 2016 PIAC-Ausgrid Case[20]

36 In its December 2013 Rate of Return Guideline, the AER announced that it had conducted a "conceptual re-evaluation"[21] of gamma and that it intended to redefine gamma in terms of the proportion of imputation tax credits that might be redeemed. This led the AER to propose an increased gamma of 0.5 in its Rate of Return Guideline.

37 In the first set of regulatory determinations after the Guideline, the AER maintained its approach of relying primarily on the redemption rate evidence, but reduced its proposed gamma to 0.4 after a reconsideration of the relevant redemption rate evidence.

38 The AER's re-evaluation runs counter to the *Energex Gamma* decision, where the Tribunal held that the proportion of redeemed credits cannot be used to estimate theta, but can only serve as an upper bound for theta.

39 This led a number of businesses to seek a merits review of the AER's decision in relation to gamma (and several other issues) – proceedings that have become known as the *PIAC-Ausgrid Case*.

40 In the *PIAC-Ausgrid* case,[22] the Australian Competition Tribunal rejected the AER's "conceptual re-evaluation" and held that gamma must be interpreted as the value of credits to investors and not as the proportion that can be redeemed:

> We consider that, by placing most reliance on the equity ownership approach and effectively defining the utilisation rate as the proportion of distributed imputation credits available for redemption, the AER has adopted a conceptual approach to gamma that redefines it as the value of imputation credits that are available for redemption. This is inconsistent with the concept of gamma in the Officer Framework for the WACC.[23]

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18 SFG (2013), Paragraph 85.

19 SFG (2013), Paragraph 86.

20 Applications by Public Interest Advocacy Centre and Ausgrid [2016] ACompT1.

21 AER, 2013, Rate of Return Guideline, Explanatory Statement, p. 160.

22 Applications by Public Interest Advocacy Service Ltd and Ausgrid Distribution [2016] ACompT 1 (26 February 2016).

23 PIAC-Ausgrid, Paragraph 1100.

> …the Tribunal does not accept the AER's approach that imputation credits are valued at their claimable amount or face value (as it said in the Final Decisions: the measure is what can be claimed). The value is not what can be claimed or utilised.[24]

41 Thus, the Tribunal decided that the AER had estimated the wrong thing – a redemption proportion instead of a value – and directed the AER to re-make its decision with a gamma of 0.25 instead of the 0.4 figure that the AER had proposed. The 0.25 estimate is a value estimate based on market prices, and is the estimate that had been used prior to the AER's "re-evaluation."

42 In its decisions since the *PIAC-Ausgrid* judgment, the AER has continued to estimate theta as the proportion of credits that are available to be redeemed. In doing this, the AER relies primarily on the "equity ownership" approach to estimate the proportion of credits that might be redeemed. This involves simply estimating the proportion of Australian equity that is owned by resident investors. The Tribunal in *PIAC-Ausgrid* found that approach to be in error:

> The AER's equity ownership and tax statistics approaches consequently make no attempt to assess the value of imputation credits to shareholders…The Tribunal considers these approaches to be inconsistent with a proper interpretation of the Officer Framework.[25]
>
> The Tribunal considers that the equity ownership approach overstates the redemption rate. We agree with the Network Applicants' submission that "even on the AER's own definition of theta (focussing on potential utilisation by eligible investors), equity ownership rates are above the true maximum possible figure for theta".[26]

43 The Tribunal also noted that the AER's approach to estimating theta was inconsistent with the approach to estimating all other WACC parameters. All other parameters are estimated as market values using the prices of traded securities:

> Moreover, the AER's reasoning ignores the fact that other parameters in the WACC calculations are market values.[27]
>
> …the Tribunal considers the use of market studies to estimate the value of imputation credits is consistent with the methods used to calculate other parameters of the costs of debt and equity from market data.[28]
>
> Consequently, placing significant weight on market value studies is, in the Tribunal's view, consistent with evidence relied on by the AER to calculate the rate of return on capital.[29]

44 The Tribunal's conclusion is very clear on this point:

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24 PIAC-Ausgrid, Paragraph 1081.

25 PIAC-Ausgrid, Paragraph 1095.

26 PIAC-Ausgrid, Paragraph 1093.

27 PIAC-Ausgrid, Paragraph 1073.

28 PIAC-Ausgrid, Paragraph 1097.

29 PIAC-Ausgrid, Paragraph 1098.

> …the AER has adopted a conceptual approach to gamma that redefines it as the value of imputation credits that are available for redemption. This is inconsistent with the concept of gamma in the Officer Framework for the WACC.[30]

45 The Tribunal is also very clear about the fact that it is not enough to simply look at the *number* of credits that might be redeemed – it is also necessary to determine the *value* to investors of any credits that they redeem:

> …it is necessary to consider both the eligibility of investors to redeem imputation credits and the extent to which investors determine the worth of imputation credits to them.[31]

46 The Tribunal also concluded that the approaches that seek to estimate the proportion of credits that are redeemed produce nothing more than an upper bound, and that it is only market value studies such as dividend drop-off analysis, that produce a point estimate:

> Given that two of the three approaches adopted by the AER are considered no better than upper bounds, it follows that the assessment of theta must rely on market studies. The Tribunal considers that, of the various methodologies for estimating gamma employed by the AER, market value studies are best placed to capture the considerations that investors make in determining the worth of imputation credits to them.[32]

47 Having decided that theta (and consequently gamma) must be estimated as market values from the prices of traded securities, the Tribunal adopted the updated 2013 SFG dividend drop-off estimate of 0.35 in its decision.[33] Accordingly, the Tribunal directed the AER to remake its decision with a gamma of 0.25 – being the product of a 70% distribution rate and a theta of 0.35.[34]

2.4 The 2016 dividend drop-off update

48 The results set out below are based on the following approach:

a. Start with the data set used in the 2013 SFG update;

b. Update the data to June 2016, using the same procedures as used in the 2013 SFG update; and

c. Apply the same econometric methods as used in the 2013 SFG update.

49 The updated data and analysis supports the same conclusion of the 2011 and 2013 SFG studies – that the most appropriate estimate of theta remains at 0.35.

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30 PIAC-Ausgrid, Paragraph 1100.

31 PIAC-Ausgrid, Paragraph 1061.

32 PIAC-Ausgrid, Paragraph 1096.

33 PIAC-Ausgrid reasons, Paragraph 1103.

34 The AER has sought a judicial review of the Tribunal's decision, but that review application has not yet been heard.

50 The remainder of this report documents all of the steps and sets out all of the analysis involved in the 2016 updated dividend drop-off analysis.

3 Compilation of data

3.1 Initial data set

51 The current update begins with the same set of ex-dividend events that was used in the 2013 SFG study. That sample consists of 3,642 observations from July 2001 to October 2012. The construction of that sample is explained in detail in Section 3 of the 2013 SFG report.[35]

3.2 Extended sample of ex-dividend events

52 The SFG (2013) data set has now been extended through to June 2016, again following the updating procedures set out in Section 3 of the 2013 SFG report.

Compilation of the updated set of ex-dividend events

53 The first step in updating the set of ex-dividend events involves identifying all ex-dividend events in each of two independent data bases – DatAnalysis and Thompson Reuters Tick History (TRTH). DatAnalysis is operated by Aspect Huntley, which is a wholly-owned subsidiary of Morningstar Inc. It is commonly used as the basis for papers published in the academic and practitioner literature relating to empirical finance. The TRTH database is compiled by Reuters and made available by the Securities Industry Research Centre of Asia-Pacific (SIRCA). This data is also commonly used as the basis for papers published in the academic and practitioner literature relating to empirical finance.

54 The records of all ex-dividend events for all firms listed on the Australian Securities Exchange (ASX) are obtained from each data base. Information obtained includes the following fields:

a. Company name;

b. ASX ticker symbol (three digit code used by the ASX);

c. Dividend amount;

d. Currency in which the dividend was paid;

e. Franking percentage (the proportion of the dividend that was franked);

f. Ex-dividend date; and

g. Type of dividend:

   i. Ordinary (interim, final, quarterly, or monthly);

   ii. Special-cash;

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[35] As set out above, Professor Gray and Dr Damien Cannavan are in the process of preparing an updated dividend drop-off analysis for publication in an academic journal. The remainder of this section summarises the approach taken in that work.

iii. Special-scrip; or

iv. Return of capital.

Application of preliminary screens and conversions

55 The next step in the analysis is to apply a number of preliminary screens, as follows:

a. Eliminate observations where the dividend amount is missing (or set to zero) or where the ex-date is missing;

b. Eliminate observations for which the ticker symbol has more than three letters, as this indicates that the security is not an ordinary share;

c. Eliminate dividends that are defined to be a capital return or a special scrip dividend;

d. Eliminate dividends with a currency defined to be "PCT." This indicates "per cent" rather than a currency and is used for in specie distributions rather than cash dividends;

e. Eliminate all duplicate records. The TRTH database in particular contains a number of duplicated observations; and

f. Eliminate all observations for which there was a corporate event/capitalisation change (such as a rights or bonus issue or other issuance or cancellation of shares) within five days of the ex-dividend event identified in the DatAnalysis Corporate Events file.

56 All foreign currency dividends are then converted into Australian dollars using exchange rates provided by the Reserve Bank of Australia.[36] A record of the dividend currency is retained so that the drop-off analysis can be applied to samples that include, and exclude, foreign currency dividends.

57 In cases where a database indicates that the same company paid two different dividends with the same ex-date, those dividends are added to obtain a single record for each ex-date for each company. For example, if a company paid a 15 cent fully franked dividend and a 5 cent unfranked special dividend with the same ex-date, a single record is retained with:

a. Dividend amount set to 20 cents; and

b. Franking percentage set to $\frac{15}{20}\times 100+\frac{5}{20}\times 0=75$.

58 A record of observations that have been summed in this manner is maintained so that the drop-off analysis can be applied to samples that include, and exclude, these summed observations.

[36] http://www.rba.gov.au/statistics/hist-exchange-rates/index.html?accessed=2013-06-07-12-31-03.

Matching of ex-dividend events across databases

59 The next step is to match ex-dividend events from the two data bases on the following four fields:

a. ASX ticker symbol/company identifier;

b. Ex-dividend date;

c. Australian dollar dividend amount; and

d. Franking percentage.

60 A number of observations match on ASX ticker symbol, ex-dividend date and dividend amount, but not franking percentage. In most of these cases, the franking percentage is missing in one of the databases. In these cases, the ASX web site and company annual reports are checked for franking percentage information. In cases where two independent sources agree on the franking percentage, the observation is treated as a match.

61 Those observations that matched across databases are then allocated to the "Matched" sample. Other observations are allocated to the "Unmatched DatAnalysis" or the "Unmatched TRTH" samples, but only if data is available on the following fields:

a. ASX ticker symbol/company identifier;

b. Ex-dividend date;

c. Australian dollar dividend amount; and

d. Franking percentage,

otherwise they are eliminated from the sample.

Addition of ASX share price data

62 All observations in all three subsamples[37] are then supplemented with additional data sourced from Datastream, which is commonly used as the basis for papers published in the academic and practitioner literature relating to empirical finance. The following data items are added to each observation:

a. The closing cum-dividend day stock price;

b. The closing cum-dividend day trading volume;

c. The closing ex-dividend day stock price;

d. The closing ex-dividend day trading volume;

e. The total return on the All Ordinaries Accumulation Index over the ex-dividend day;

f. The market capitalisation for the firm on the ex-dividend day;

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[37] That is, the "Matched," "Unmatched DatAnalysis," and "Unmatched TRTH" samples.

g. The total market capitalisation for the All Ordinaries index on the ex-dividend day;

h. The mean of the daily excess returns (total stock return less All Ordinaries Accumulation Index return) computed over the year ending six trading days before the ex-dividend day; and

i. The standard deviation of the daily excess returns (total stock return less All Ordinaries Accumulation Index return) computed over the year ending six trading days before the ex-dividend day.

63 The mean and standard deviation of daily excess returns are calculated in the same way as in the 2011 and 2013 SFG reports:

a. **Mean excess return**: This is computed over a period of one year, ending six days prior to the ex-dividend date, so that the historical period does not overlap with the ±5 day window around the ex-dividend date. The mean excess stock return is measured over the trading days beginning one year and six days prior to the ex-dividend day and ending six days prior to the ex-dividend day. The excess stock return for each day is defined as the stock return for a particular company *i* less the return on the market index. Formally, the mean excess stock return for company *i* at time *t* is defined as:

$$\overline{er}_{i,t} = \frac{1}{N}\sum_{j=1}^{N} er_{i,t-5-j}$$

where:

$$er_{i,t} = r_{i,t} - r_{m,t},$$

and N represents the number of trading days over the relevant year-long period.

b. **Standard deviation of excess returns**: The volatility of excess stock returns is computed as the standard deviation of the excess stock return, measured over the same period. Formally, the volatility of excess stock returns for company *i* at time *t* is defined as:

$$\sigma_{i,t} = \sqrt{\frac{1}{N}\sum_{j=1}^{N}\left(er_{i,t-5-j} - \overline{er}_{i,t}\right)^2}.$$

Addition of other data fields

64 The final step is to augment each observation with the following fields:

a. An indicator of whether the dividend was an ordinary or special dividend. In cases where a company paid an ordinary and special dividend with the same ex-date, the dividend is classified as special;

b. An indicator of whether the company made any announcement to the ASX on the cum-dividend day or the ex-dividend day that was classified as price sensitive. We obtain information about announcements and the classification of price sensitivity from the SIRCA company announcement file, which is a direct feed from the ASX;

c. A field that indicates whether the ASX classifies the security as:

    i. ordinary shares of company;

    ii. a listed fund;

    iii. a real estate investment trust (REIT); or

    iv. a stapled security; and

d. A field that indicates whether there was any capitalisation change for the firm within five days of the ex-dividend date, sourced from the SIRCA "dilutions" (capitalisation change) file.

Summary

65 In summary, the processes that have been used to update the data through to June 2016, and which underpin the results that are set out below, are identical to those that were applied in the SFG 2013 update.

4 Econometric methods

4.1 Primary data set

66 The primary data set is compiled as follows:

a. Begin with the matched sample – the set of ex-dividend events for which all relevant items are consistent across the two independent data bases;

b. Eliminate observations where the stock did not trade on the cum-dividend day or the ex-dividend day;

c. Eliminate observations where there was a capitalisation change within five days of the ex-dividend date;

d. Eliminate observations where the company made an announcement that was classified as price sensitive on the cum-dividend day or the ex-dividend day;

e. Eliminate observations where the company in question had a market capitalisation that was less than 0.03% of the market capitalisation of the All Ordinaries index at the time of the ex-dividend date; and

f. Eliminate observations where the security in question falls into any one of the following categories: stapled securities; shares whose primary listing is overseas; CHESS depositary interests; CHESS units of foreign securities; or exchange-traded funds.

67 The compilation of the primary data set follows the procedures adopted in the 2011 and 2013 SFG studies. The rationale for compiling the primary data set in this manner is to ensure that the required data exists and is timely and reliable and uncontaminated by material events that are unrelated to the payment of the dividend. The objective of this process is to produce a final estimate of theta that is as statistically reliable and precise as possible.

4.2 Econometric Models

68 As in the 2011 and 2013 SFG studies (and in accordance with Paragraph 12 of the 2011 Terms of Reference) the objective is to estimate the parameters of the following model:

$$\frac{P_{i,t-1} - P^*_{i,t}}{D_i} = \delta + \theta \frac{FC_i}{D_i} + \varepsilon_i \tag{1}$$

where $P_{i,t-1}$ is the cum-dividend stock price for observation i; $P^*_{i,t} = \dfrac{P_{i,t}}{1+r_{m,t}}$ is the market-adjusted ex-dividend stock price (where $r_{m,t}$ is the return on the All

Ordinaries index on day *t*); D_i is the amount of the dividend for observation i; and FC_i is the amount of franking credits associated with observation *i*.

69 The two parameters to be estimated are δ and θ where:

a. δ represents the estimated market value of cash dividends as a proportion of their face value; and

b. θ represents the estimated market value of distributed franking credits as a proportion of their face value.

70 The econometric model in Equation (1) is estimated using regression analysis applied to the final sample (and subsequently to a number of samples used for the purposes of robustness checks and sensitivity analysis). It is estimated using ordinary least squares, generalised least squares and robust regression methods, as in the 2011 and 2013 SFG studies.

71 Generalised least squares estimation involves multiplying all terms in the original econometric model by the same variable. This would be done if the researcher was concerned about a potential relationship between the variance of the residuals (ε_i) and a particular variable. Suppose, for example, that there is a potential relationship between the variance of the residuals in Equation (1) and dividend yield, $\frac{D_i}{P_{i,t-1}}$, such that the variance of residuals is inversely related to dividend yield. This would be the case if the model in Equation (1) provided a closer fit to the data and generally smaller residuals for observations with a higher dividend yield. If this were actually the case, the coefficient estimates in Equation (1) would be consistent and unbiased, but the usual procedures for conducting statistical inference (e.g., *t*-statistics) may be inaccurate.

72 Generalised least squares estimation is designed to eliminate any relationship between the variance of residuals and the variable in question. This is done by scaling every term in the original model by the variable in question. If, for example, all terms in Equation (1) are multiplied by dividend yield, $\frac{D_i}{P_{i,t-1}}$, then Equation (1) becomes:

$$\frac{P_{i,t-1}-P_{i,t}^{*}}{D_i}\times\frac{D_i}{P_{i,t-1}}=\delta\times\frac{D_i}{P_{i,t-1}}+\theta\frac{FC_i}{D_i}\times\frac{D_i}{P_{i,t-1}}+\varepsilon_i\times\frac{D_i}{P_{i,t-1}}$$

which is equivalent to:

$$\frac{P_{i,t-1}-P_{i,t}^{*}}{P_{i,t-1}}=\delta'\frac{D_i}{P_{i,t-1}}+\theta'\frac{FC_i}{P_{i,t-1}}+\varepsilon_i'. \tag{2}$$

73 The idea behind generalised least squares estimation in this example is that if the variance of the original residuals (ε_i) is inversely related to dividend yield, the scaled residuals (ε_i') are not related to the dividend yield, and standard statistical inference can be performed (i.e., the *t*-statistics will be correct).

74 Consequently, Equation (2) can be thought of (equivalently) as GLS estimation of Equation (1), where the scaling variable is dividend yield, or as OLS estimation of a model in which the percentage stock return is regressed on dividend yield and franking credit yield.

75 The prior literature (e.g., Michaely, 1991; Bellamy and Gray, 2004) identifies dividend yield and stock return volatility as variables that might be related to the variance of the residuals in Equation (1) and we are not aware of any dividend drop-off analysis that uses GLS scaling variables other than dividend yield and stock return volatility. Other things equal, the magnitude of the residuals may be greater for high-volatility stocks because stock price changes tend to be greater for these stocks. In this case, the relevant GLS adjustment would be to scale by the inverse of the volatility of stock returns for the company in question. This adjustment produces the following econometric specification:

$$\frac{P_{i,t-1}-P^{*}_{i,t}}{D_i\sigma_i} = \delta''\frac{1}{\sigma_i} + \theta''\frac{FC_i}{D_i\sigma_i} + \varepsilon''_i \, . \tag{3}$$

76 If both GLS adjustments are applied, the econometric specification is:

$$\frac{P_{i,t-1}-P^{*}_{i,t}}{P_{i,t-1}\sigma_i} = \delta'''\frac{D_i}{P_{i,t-1}\sigma_i} + \theta'''\frac{FC_i}{P_{i,t-1}\sigma_i} + \varepsilon'''_i \, . \tag{4}$$

77 In accordance with the Terms of Reference for the 2011 SFG study (Paragraphs 12 and 14), and consistent with the 2013 SFG study, the four model specifications set out in Equations (1) to (4) above are estimated using OLS regression analysis, noting that the models in Equations (2) to (4) can be thought of as GLS estimates (with different scaling adjustments) of the basic model in Equation (1). Table 1 summarises the four econometric models that are estimated. Even though the four specifications are referred to as "Models" 1 to 4 for convenience, they are actually just different econometric specifications of the one model in which cash dividends and franking credits are posited as the only systematic factors in driving the ex-dividend day change in stock prices.

Table 1: Econometric models to be estimated

Model	Specification	Interpretation
Model 1	$\frac{P_{i,t-1} - P^*_{i,t}}{D_i} = \delta + \theta \frac{FC_i}{D_i} + \varepsilon_i$	Basic model.
Model 2	$\frac{P_{i,t-1} - P^*_{i,t}}{P_{i,t-1}} = \delta' \frac{D_i}{P_{i,t-1}} + \theta' \frac{FC_i}{P_{i,t-1}} + \varepsilon'_i$	GLS estimation of (1) with weighting variable dividend yield, $\frac{D_i}{P_{i,t-1}}$.
Model 3	$\frac{P_{i,t-1} - P^*_{i,t}}{D_i \sigma_i} = \delta'' \frac{1}{\sigma_i} + \theta'' \frac{FC_i}{D_i \sigma_i} + \varepsilon''_i$	GLS estimation of (1) with weighting variable inverse stock return volatility, $\frac{1}{\sigma_i}$.
Model 4	$\frac{P_{i,t-1} - P^*_{i,t}}{P_{i,t-1} \sigma_i} = \delta''' \frac{D_i}{P_{i,t-1} \sigma_i} + \theta''' \frac{FC_i}{P_{i,t-1} \sigma_i} + \varepsilon'''_i$	GLS estimation of (1) with weighting variables dividend yield, and inverse stock return volatility.

4.3 Estimation results

78 The results of the estimation of the four econometric models are set out in Table 2 below. The key results are:

a. The point estimate of the value of a dollar of cash dividends ranges from 81 cents to 91 cents;

b. The point estimate of the value of a dollar of imputation credits ranges from 14 cents to 38 cents; and

c. The point estimate of the value of the package of a one dollar cash dividend and the associated 43 cent franking credit ranges from 87 cents to 104 cents.

79 Following the 2011 and 2013 SFG studies, two methods are used to estimate standard errors:

a. The White method for computing heteroscedasticity-consistent standard errors (which allows for unspecified heteroscedasticity in the residuals); and

b. A method that allows for clustering at the firm level (i.e., allows for the variance of residuals to differ by firms).[38]

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[38] As noted in the 2013 SFG study, we have reason to believe that standard errors vary systematically with firm characteristics, namely higher standard errors for volatile stocks with low dividend yields. We observe a number of firms appearing multiple times in our examination of outliers. Hence, this is our preferred technique for estimating standard errors but we present White's (1984) adjusted

80 The two methods produce standard error estimates that are similar in magnitude and generally indicate that the estimates of the value of cash dividends are significantly less than one and franking credits are significantly greater than zero. The standard errors for the estimated value of a fully-franked dividend (i.e., the package of cash dividend and the associated franking credit) are considerably lower than the standard errors for the estimated values of cash or franking credits separately, meaning there is reliable evidence that the value of one dollar of a fully-franked dividend is approximately one dollar.

81 The R^2 statistics measure how much of the variation in the dependent variable is explained by variation in the independent variables. For Models (2) and (4), the R^2 statistics are substantial – 61% and 73% (respectively) of the variation in the ex-day percentage price change can be explained by variation in the cash dividend and franking credit.39

82 For Models (1) and (3), however, the explanatory power of the cash dividend is moved from the right-hand side of the regression to the left-hand side – the cash dividend appears only on the left-hand side as part of the dependent variable. For these models, the R^2 statistic must be interpreted as a measure of the extent to which the franking percentage (not the amount of credits) is able to explain the ex-day price change – beyond that which can be explained by the cash dividend.

83 That is, for Models (2) and (4) the R^2 statistic measures the combined explanatory power of the cash dividend and the franking credit. For Models (1) and (3) it measures only the incremental explanatory power of the franking credits – the cash dividend is effectively given full opportunity to explain whatever it can of the ex-day price change and the R^2 statistic measures only what the franking credit can explain beyond this. Consequently, it would be wrong to compare R^2 statistics across models or to use them as a basis for selecting a preferred model.

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standard errors for completeness. For a review of estimation techniques for standard errors refer to Petersen (2009).

[39] We refer to the *R*-squared statistic throughout, rather than the adjusted *R*-squared statistic, because the robust regression analysis considered later only generates an *R*-squared statistic and we seek to present explanatory power on a consistent basis throughout.

Table 2: Estimation results: OLS/GLS estimation

Model	Estimate	Standard error (White)	Standard error (Firm clustering)
Model 1			
Cash	0.8412	0.0565	0.0546
Franking credits	0.1729	0.1503	0.1468
Package	0.9153	0.0266	0.0255
R-squared	0.0004		
N	4,690		
Model 2			
Cash	0.8335	0.0301	0.0282
Franking credits	0.3952	0.0787	0.0776
Package	1.0029	0.0140	0.0167
R-squared	0.6079		
N	4,690		
Model 3			
Cash	0.9085	0.0362	0.0365
Franking credits	0.2391	0.0958	0.0979
Package	1.0110	0.0172	0.0184
R-squared	0.0014		
N	4,690		
Model 4			
Cash	0.9138	0.0188	0.0187
Franking credits	0.3610	0.0535	0.0559
Package	1.0685	0.0120	0.0145
R-squared	0.7320		
N	4,690		

Cash represents the estimated value of a one dollar cash dividend; Franking credits represents the estimated value of a one dollar franking credit; Package represents the estimated combined value of a one dollar cash dividend plus the associated 43 cent franking credit. The package value is estimated as the sum of the cash coefficient and 0.43 times the franking credits coefficient. The standard error for the package estimate is computed as a function of the standard errors of the cash and franking credits coefficients, and the correlation between them.

4.4 Robust regression estimates

84 In accordance with the Terms of Reference (Paragraphs 12 and 14) for the 2011 SFG study, and with the approach adopted in the 2013 SFG study, the four models set out in Equations (1) to (4) above are also estimated using robust regression analysis. Robust regression analysis uses automated statistical adjustments to down-weight the influence of extreme data points or outliers. The SAS[40] procedure ROBUSTREG to implement the MM robust regression method. The MM method was developed by Yohai (1987) and accounts for imprecision in the dependent and independent variables. Of the four alternative techniques available in the ROBUSTREG procedure it provides the most

[40] SAS is a statistical programming language.

comprehensive analysis of outliers. The application of these methods in the SAS package is explained in detail in Chen (2002).

85 When implementing the MM robust regression method in SAS, the user is able to over-ride default values and impose values for certain parameters. For example, the INEST option allows the user to impose a prior expectation for the values of the regression coefficients, rather than using values from a first stage estimation procedure. The results set out below are based on the default (neutral) values for all options.

86 The results of the estimation using the ROBUSTREG-MM procedure are summarised in Table 3 below. The estimates of theta for Models 2 and 4 are similar to those reported in Table 2 above. The robust regression estimates of theta for Models 1 and 3 are higher than the estimates in Table 2, and more consistent with the estimates from Models 2 and 4.

87 The ROBUSTREG procedure available in SAS does not permit the calculation of White heteroscedastic-consistent standard errors or standard errors based on firm clustering. The procedure only allows for estimates of the standard covariance matrix of parameters. The result is that the "regular" standard errors in Table 3 are lower than the heteroscedastic-consistent and firm clustering standard errors reported in Table 2. This should not be seen as an improvement in the precision of estimates, but rather that a different definition of standard error is being reported.

Table 3: Estimation results: Robust regression

Model	Estimate	Standard error
Model 1		
Cash	0.8999	0.0268
Franking credits	0.2863	0.0717
Package	1.0312	0.0140
R-squared	0.0021	
N	4,690	
Model 2		
Cash	0.9066	0.0208
Franking credits	0.3571	0.0561
Package	1.0599	0.0113
R-squared	0.5333	
N	4,690	
Model 3		
Cash	0.9200	0.0196
Franking credits	0.3034	0.0523
Package	1.0131	0.0102
R-squared	0.0035	
N	4,690	
Model 4		
Cash	0.9340	0.0144
Franking credits	0.3952	0.0386
Package	1.1036	0.0077
R-squared	0.6712	
N	4,690	

Cash represents the estimated value of a one dollar cash dividend; Franking credits represents the estimated value of a one dollar franking credit; Package represents the estimated value of a one dollar cash dividend plus the associated 43 cent franking credit.

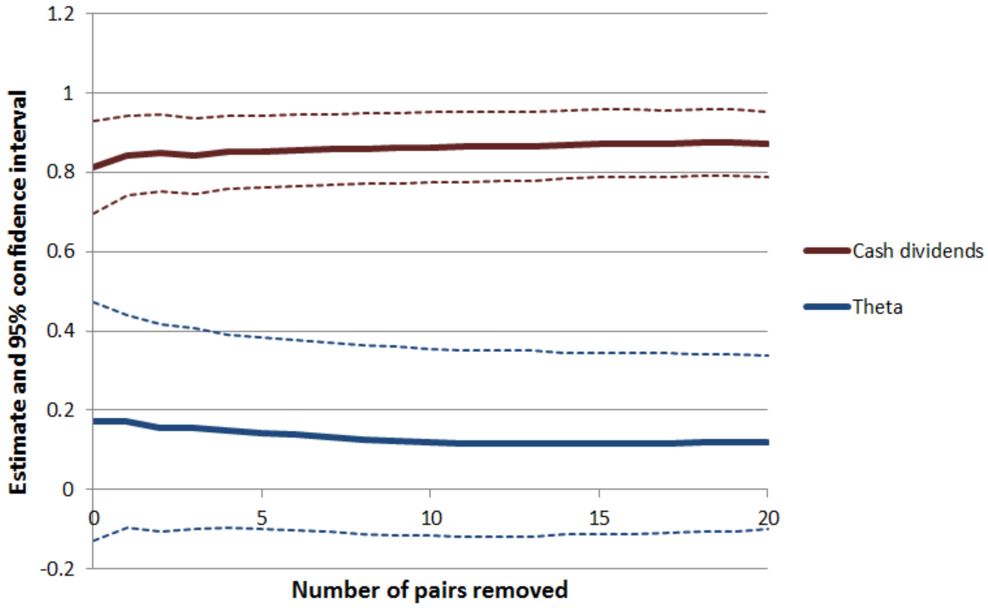
4.5 Stability analysis: Robustness to influential observations

88 The data compilation methods set out above (e.g., eliminating from the sample very small firms or firms that do not trade on the cum-dividend and ex-dividend dates) are designed to eliminate outlier data points that may be erroneous in some respect and which are likely to have a disproportionate influence on the estimate of theta. Even after having performed this screening and checking process, it is inevitable that some of the remaining data points will be more influential than others. Consequently, the 2011 and 2013 SFG studies conduct a stability analysis to quantify the sensitivity of the estimates of theta to influential observations. This is done by first determining which single observation, if removed, would result in the greatest increase in the estimate of theta. The next step is to determine which single observation, if removed, would result in the greatest decrease in the estimate of theta. Then both observations are removed and theta is re-estimated. This process is then repeated by removing another pair

of observations and the process continues until 20 pairs of observations have been removed.[41]

89 The results of applying this stability analysis to Model 1 are summarised in Figure 1. The solid lines represent the estimates of the value of cash dividends and theta, as indicated. In each case, the corresponding dashed lines represent the 95% confidence intervals around the point estimates.

Figure 1: Sensitivity to removal of influential observations: Model 1



90 Figure 1 shows that the original point estimate of theta from Model 1 was 0.17. When the first pair of observations (i.e., one observation that would maximally increase the estimate of theta and one that would maximally decrease the estimate of theta) is removed, there is a negligible change in the point estimate of theta. As further pairs of observations are removed, the point estimate of theta falls marginally before levelling off at approximately 0.12.

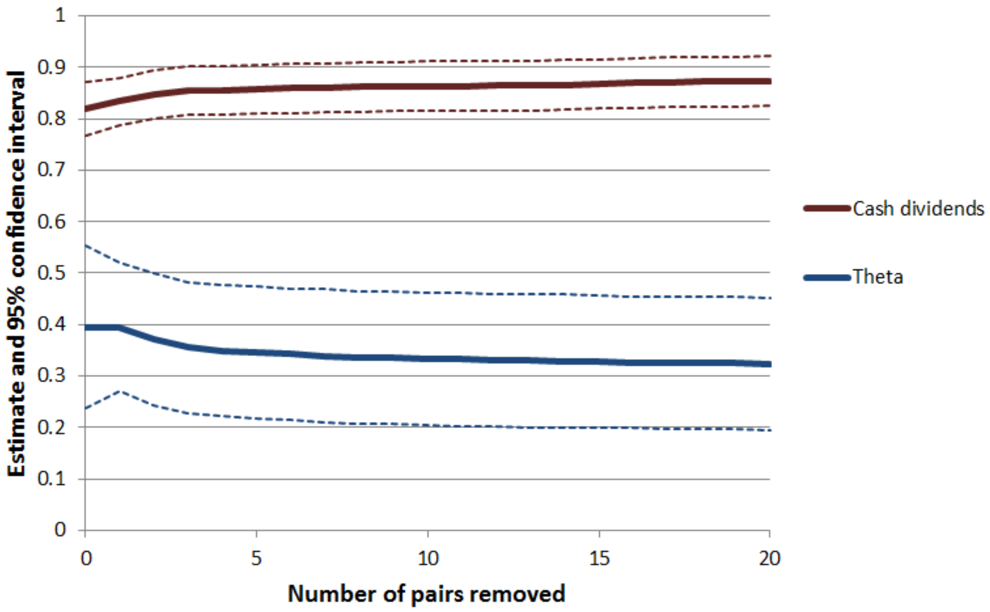
91 The point estimates of the value of cash dividends move in the opposite direction. As pairs of influential observations are removed, the estimate increases slightly before settling at approximately 0.87.

92 The combined value of dividend plus franking credit is stable throughout, taking a constant value (between 0.907 and 0.927) whether the influential observations are included or excluded.

93 The result of applying the same process of removing pairs of influential observations to Model 2 is summarised in Figure 2 below. These results are similar to those for Model 1 above. The point estimate of theta falls slightly as the first pairs of influential observations are removed before stabilising at a constant level – approximately 0.31 in this case.

41 We remove the observations in pairs to aid in the interpretation of the figures below. If the observations were removed one at a time, the estimate of theta would rise or fall with each data point that is excluded producing a jagged graph making it more difficult to interpret.

Figure 2: Sensitivity to removal of influential observations: Model 2



94 The stability analysis for Models 3 and 4 are set out in Figure 3 and Figure 4 respectively.

Figure 3: Sensitivity to removal of influential observations: Model 3

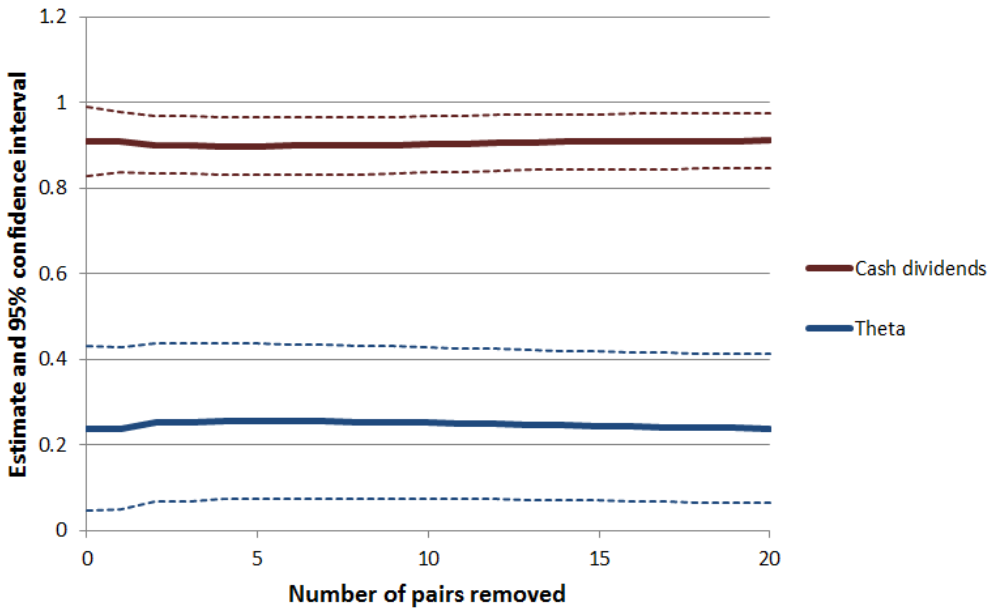
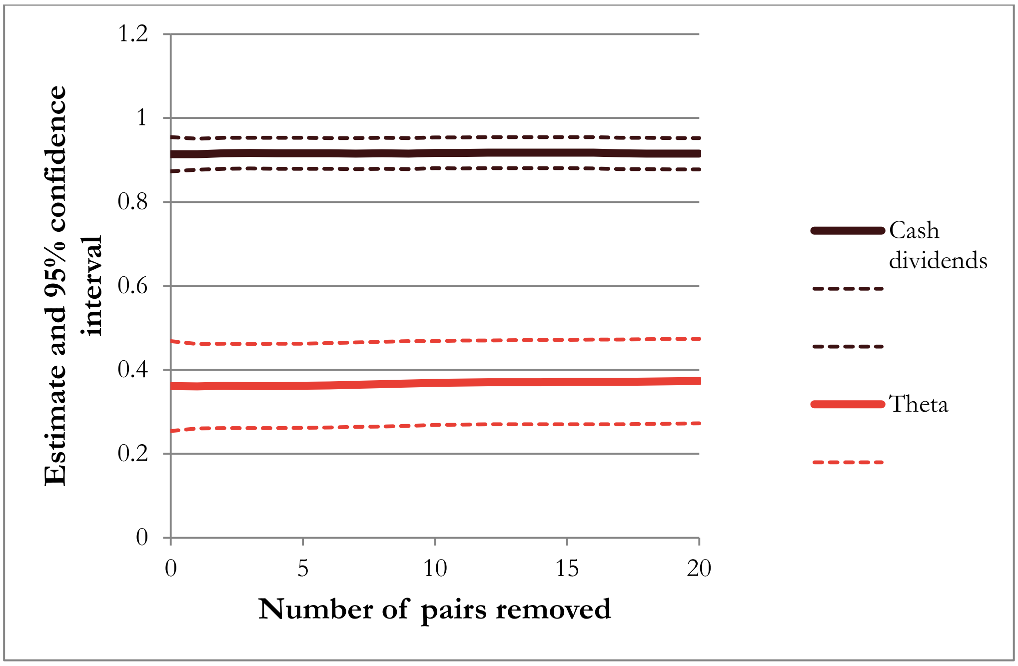


Figure 4: Sensitivity to removal of influential observations: Model 4



95 The stability analysis for Model 4, in Figure 4 above, shows that the estimates of the value of cash dividends, the value of theta, and the value of the combined package are very stable and robust to the removal of pairs of influential data points. That is, the estimates from Model Specification 4 are less sensitive to the effects of influential observations.

96 In summary, the stability analyses demonstrate that the estimates of theta are either maintained or slightly lowered when pairs of influential observations are removed from the data set.

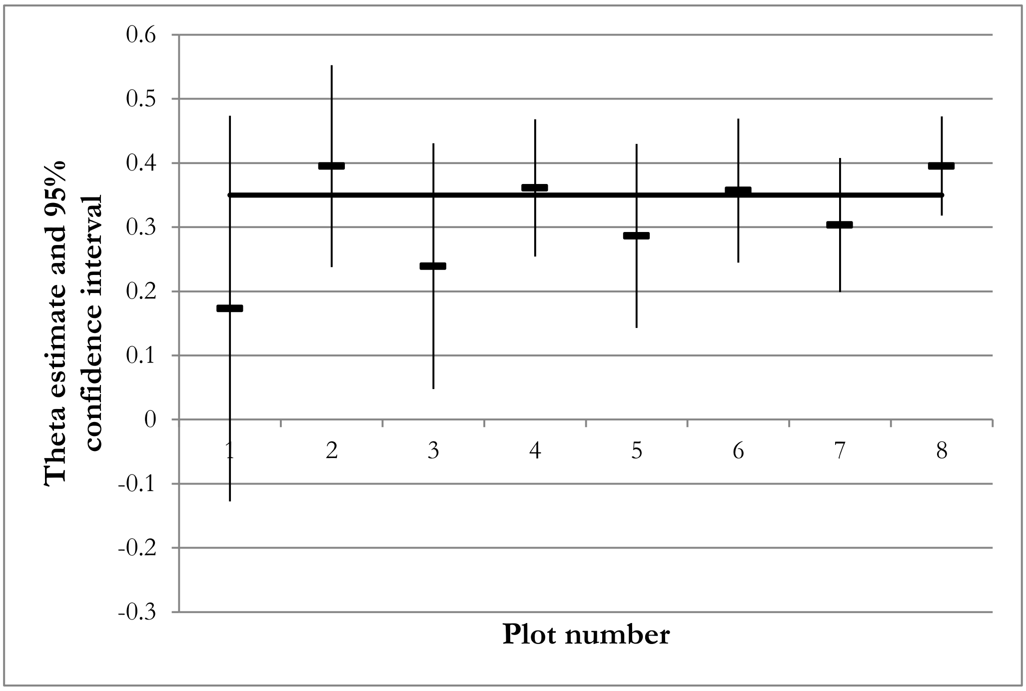
4.6 Sensitivity analysis

97 In this section, the sensitivity of the results to variations in the model specifications and estimation methods is examined. In each case, our preferred estimate of 0.35 from the current study is compared with the point estimates and confidence intervals from the various econometric specifications.

0.35 is consistent with results from different model specifications and estimation techniques

98 We begin by noting that our preferred final estimate of 0.35 lies within the standard statistical 95% confidence interval for all of the specifications. The range of overlap in the confidence intervals is from 0.26 to 0.41, which has a mid-point of 0.34. This is illustrated in Figure 5 below, which plots estimates for Model Specifications 1-4 estimated by OLS/GLS (Plots 1-4 in the figure) and then the corresponding robust regression estimates (Plots 5-8 in the figure). For none of these estimations can the proposed estimate of 0.35 be statistically rejected.

Figure 5: Summary of point estimates and confidence intervals for theta by model specification and estimation technique



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

Plot 1: Model specification 1, OLS estimation; *Plot 2: Model specification 2, OLS estimation;*

Plot 3: Model specification 3, OLS estimation; *Plot 4: Model specification 4, OLS estimation;*

Plot 5: Model specification 1, RR estimation; *Plot 6: Model specification 2, RR estimation;*

Plot 7: Model specification 3, RR estimation; *Plot 8: Model specification 4, RR estimation.*

5 Conclusions

99 This report summarises the results of updating the 2011 and 2013 SFG reports using the most recently available data. All of the procedures for compiling the data set and performing the statistical analysis that are set out in this report follow the approach adopted in the 2011 and 2013 SFG reports. This report simply summarises the results that are obtained from applying the same methods to an updated data set through to June 2016.

100 In our view, the analyses set out above support a point estimate for theta of 0.35. For none of these estimations can the proposed estimate of 0.35 be statistically rejected. Although the estimates from some of the econometric specifications have point estimates well below 0.35, we place more (but not exclusive) weight on the Model 4 specifications that are uniformly very close to 0.35.

6 Declaration

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

Professor Stephen Gray

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Issues in the estimation of gamma

REPORT PREPARED FOR AGN, MULTINET GAS, AUSNET TRANSMISSION AND AUSNET GAS

September 2016

Issues in the estimation of gamma

1 Executive summary

1 Frontier Economics has been engaged by AGN, Multinet Gas, AusNet Transmission and AusNet Gas to provide expert advice on certain issues relating to the estimation of the value of dividend imputation tax credits, gamma. The issues we have been asked to address are:

a. Whether we consider the approach of Lally (2016) provides an appropriate estimate of the imputation credit distribution rate. This approach involves estimating the distribution rate from 20 very large multinational corporations;

b. Whether we consider that the AER's estimates that are based on Australian Tax Office (ATO) tax statistics are reliable in light of the questions that have been raised about the ATO estimates of 'Credits Distributed';

c. Whether we consider the issues that the AER has raised in relation to dividend drop-off analysis to be so material as to affect the weight that might reasonably be applied to that evidence; and

d. Whether we consider that the dividend drop-off estimate of theta should be adjusted to convert it into a pre-personal cost and pre-personal tax estimate.

2 Our primary conclusions are set out below.

Distribution rate

3 Our view is that, of the available estimates of the distribution rate, the traditional all-equity estimate provides the best match to the BEE. This is because the BEE is defined to be an Australian firm that need not be a listed company and which has no foreign operations. The alternative estimates considered by the AER (i.e., the Lally 2016 estimates) are based on large multinationals that have substantial access to foreign profits to assist in the distribution of imputation credits and are therefore inappropriate as they are not consistent with the characteristics of the BEE.

The reliability of ATO tax statistics

4 The AER uses ATO tax statistics in both steps of its estimate of gamma as follows:

$$\gamma = F \times \theta = \frac{\text{Credits Distributed}}{\text{Credits Created}} \times \frac{\text{Credits Redeemed}}{\text{Credits Distributed}}$$

5 Some questions have been raised about the reliability of the ATO estimate of 'Credits Distributed.' However, that term cancels out in the multiplication above so we are left with:

$$\gamma = \frac{\text{Credits Redeemed}}{\text{Credits Created}}$$

and no questions have been raised about either of the quantities above.

6 The AER reports that the most recent tax statistics estimate of gamma is 0.34.[1]

7 Our view is that this approach to estimating gamma produces, at best, an upper bound and the Australian Competition Tribunal has recently reached the same conclusion.[2] Since both elements of the calculation (credits redeemed and credits created) are reliable, this evidence suggests that gamma must be less than 0.34.

Issues relating to dividend drop-off analysis

8 In its Rate of Return Guideline, the AER set out a number of its concerns with dividend drop-off analysis. This list of issues has been repeated in all of the AER's subsequent decisions. None of these issues would cause us to reduce the weight that we would otherwise apply to dividend drop-off analysis.

9 We recognise that there is increased trading around ex-dividend dates. However, to the extent that this increased trading around has any impact on the dividend drop-off estimate of theta, it will tend to *inflate* that estimate.

Adjustment to the dividend drop-off estimate of theta

10 In its decisions since the Guideline, the AER has maintained that theta should not be estimated as the market value of distributed credits but as the proportion of credits that might be redeemed. The AER's view is that since dividend drop-off analysis estimates the market value of credits, there must be an adjustment to convert those estimates to the correct 'pre-personal cost and tax' basis. In its recent decisions, the AER maintains this view.[3]

11 Our view remains that theta should be interpreted as the value (as in 'worth') of distributed credits, and consequently no such adjustment is relevant. Dividend drop-off analysis provides a direct estimate of the extent to which credits are capitalised into stock prices. Since drop-off analysis already estimates the market value of distributed credits, no adjustment required. The Tribunal concurs with our view that theta should be interpreted as the market value of distributed credits and with our view that no adjustment is required.[4]

1.2 Author of report

12 This report has been authored by Professor Stephen Gray, Professor of Finance at the UQ Business School, University of Queensland and Director of Frontier Economics, a specialist economics and corporate finance consultancy. I have Honours degrees in Commerce and Law from the University of Queensland and

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[1] AusNet Draft Decision, Attachment 4, p. 16.

[2] Applications by Public Interest Advocacy Centre and Ausgrid [2016] ACompT1, Paragraph 1096.

[3] AusNet Draft Decision, Attachment 4, Appendix 15.

[4] PIAC-Ausgrid, Paragraphs 1101-1103.

a PhD in Financial Economics from Stanford University. I teach graduate level courses with a focus on cost of capital issues, I have published widely in high-level academic journals, and I have more than 15 years' experience advising regulators, government agencies and regulated businesses on cost of capital issues. I have published several papers on the estimation of gamma, including in the *Journal of Financial Economics*, one of the leading international finance journals. A copy of my curriculum vitae is attached as an appendix to this report.

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

2 The distribution rate

2.1 Background and context

14 In the Australian regulatory setting, the long-standing approach to estimating the distribution rate is to use data from the Australian Tax Office (ATO) on:

a. Total credits created; and

b. Total credits distributed.

15 It is broadly accepted that this approach produces an estimate of approximately 0.7.[5]

16 In its recent decisions,[6] the AER considers three alternative estimates of the distribution rate:

a. The conventional estimate of 0.7;

b. An estimate based on listed equity only of 0.75; and

c. An estimate based on 20 large listed firms of 0.83.

17 In our view, the preferred approach is to select an estimate based on compatibility with the BEE. However, the AER's approach is to maintain three different estimates and to pair those estimates with different estimates of theta. For the reasons set out below, we consider that approach to be unlikely to lead to an appropriate estimate of gamma.

2.2 The key problem with the '20 firms' estimation approach

The '20 firms' estimation approach

18 In its recent decisions,[7] the AER cites an estimate of the distribution rate developed by Lally (2016).[8] Lally selects the 20 largest listed companies and for each he estimates:

$$\frac{Credits\ Distrubuted}{Credits\ Distributed + Credits\ Not\ Distributed}$$

over a 13-year period, where Credits Distributed is inferred from total dividends paid and Credits Not Distributed is inferred from the change in the firm's

[5] AusNet Draft Decision, Attachment 4, p. 30.

[6] AusNet Draft Decision, Attachment 4, p. 30.

[7] AusNet Draft Decision, Attachment 4, p. 30.

[8] Lally, M., 2016, *Gamma and the ACT Decision*, Report for the AER, May.

Franking Account Balance. This approach produces a distribution rate estimate of 0.83.[9]

The AER's use of the '20 firms' approach

19 For a number of years, Dr Lally has been providing regulators with an estimate of the distribution rate that is based on his analysis of 20 large multinational firms. In its October 2015 final decisions, the AER cited this evidence, but did not use it when constructing its estimates of gamma. Rather, the AER stated that it took from this evidence nothing more than that it was consistent with the notion that the distribution rate is higher among listed firms than other firms:

> Lally examined the financial statements of the 20 largest ASX-listed firms by market capitalisation, and found an aggregate distribution rate across these firms of 0.84. We consider that this broadly reinforces the higher cumulative payout ratio estimate across only listed equity.[10]

20 However, in its most recent decisions, the AER has given the Lally estimates equal weight as the standard cumulative payout estimates. The Lally estimates are included in the main table of results and are used directly in the computation of gamma estimates.[11]

21 The AER does not explain why the same evidence that was used in one way in the 2015 decisions has now been elevated to form the basis of gamma estimates that appear to receive as much weight as any other gamma estimates. In any event, as explained below, the top '20 firms' estimate is an inappropriate basis on which to estimate the distribution rate and should not be used at all.

The key problem with the '20 firms' estimation approach

22 In a previous report submitted to the AER,[12] we identify a fundamental flaw in the 20 firms approach to estimating the distribution rate. The 20 companies in the Lally sample are predominantly very large multinationals with a material amount of foreign-sourced income. This foreign income can be used to distribute imputation credits, so that the distribution rate is higher than it could be for a firm that did not have access to foreign income to assist in the distribution of imputation credits. Since the AER's definition of the BEE is a purely domestic firm, the BEE has no access to foreign income. Consequently, estimating the distribution rate for a firm with *no* foreign income by using a sample of 20 firms with *substantial* foreign income is inappropriate.

23 The problem can be explained via a simple numerical example. Consider two firms that each earn a \$100 profit, pay \$30 tax, and then pay a dividend of \$49 (which represents 70% of the \$70 net profit after tax).

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[9] AusNet Draft Decision, Attachment 4, p. 30.

[10] SAPN Final Decision, Attachment 4, p. 89.

[11] AusNet Draft Decision, Attachment 4, Tables 4-3 and 4-4, p. 30.

[12] Frontier Economics, 2015, "An appropriate regulatory estimate of gamma," June.

24 The first firm has no foreign income, so all of the profits and all of the tax occurs within Australia. Thus, the $30 of corporate tax creates $30 of imputation credits. The amount of credits that can be attached to the $49 dividend is only $21.[13] Consequently, the distribution rate is:

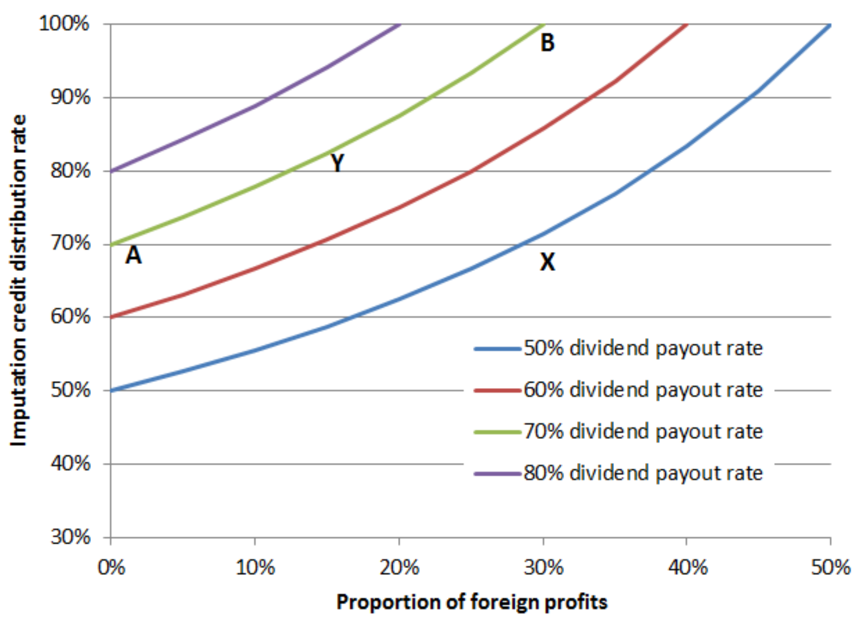
$$\frac{Credits\ Distrubuted}{Credits\ Created} = \frac{21}{30} = 70\% .$$

25 The second firm is identical to the first in all respects except that 70% of its business is in Australia and 30% is offshore. This firm will pay 70% of its corporate tax to the ATO and therefore creates $21[14] of credits. It will then pay the same dividend of $49, representing the same 70% of its net profit after tax. Like the first firm, $21 of credits can be attached to the $49 dividend. This represents a 100% distribution rate:

$$\frac{Credits\ Distrubuted}{Credits\ Created} = \frac{21}{21} = 100\% .$$

26 The second firm is able to attach credits to dividends paid out of offshore profits, whereas the first firm has no access to such offshore profits. For any given dividend payout policy, a firm with foreign profits will be able to distribute a larger proportion of its credits than a firm with no access to foreign profits. This is illustrated in Figure 1 below. Point A on the graph represents the purely domestic firm in the above example and Point B represents the multinational.

Figure 1: The effect of foreign profits on imputation credit distribution rates



Source: Frontier Economics calculations based on corporate tax rates of 30%.

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13 49 × 0.3 / (1-0.3) = 21.

14 70% × 30 = 21.

27 In our view, the AER has erred in using a sample of large multinationals with substantial offshore profits to estimate the imputation credit distribution rate. This is because the BEE, being a purely domestic firm has no access to any such offshore profits, by definition.

The AER's response

28 The AER make two points in response to the problems with the 20 firm approach that have been raised above.

Variation in dividend payout policies across firms

29 First, the AER notes that different firms will adopt different dividend payout ratios for a number of reasons.[15] This is self-evidently true. But the problem here is that *for any given dividend payout ratio*, the imputation credit distribution rate is an increasing function of the proportion of foreign profits – as shown in Figure 1 above. Whatever the payout ratio, foreign profits enable the firm to distribute a higher proportion of credits than they would otherwise be able to – and the BEE does not have access to any foreign profits, by definition.

Do large multinationals have higher imputation credit distribution rates?

30 The second response by the AER is based on an examination of 7 of the 20 large multinationals considered by Lally (2016), who concluded that (among these 7 firms) those with relatively more foreign profits had lower imputation credit distribution rates.[16]

31 However, the relevant question is whether large multinationals have higher imputation credit distribution rates than other firms. To answer this question, we consider it logical to compare the distribution rate of large multinationals with the distribution rate of other firms. We do not see how this question can be answered by examining a small selected subset of large multinationals only. That is, we fail to see how one can determine whether A is larger than B by examining only a selected sub-set of A. The more logical approach would be to compare A against B.

32 The AER's own figures clearly show that there is a material difference. The AER adopts a distribution rate of 70% for all firms and 83% for the 20 large multinationals. Clearly, the distribution rate for large multinationals *is* greater than the distribution rate for other firms.[17]

33 Moreover, NERA (2015) use Australian Tax Office data to estimate distribution rates for various types of companies from 2000-2012. Their results are summarised in Table 1 below.

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[15] AusNet Draft Decision, Attachment 4, p. 132.

[16] AusNet Draft Decision, Attachment 4, p. 132.

[17] AusNet Draft Decision, Attachment 4, p. 30.

Table 1: Distribution rate 2000-2012 by company type

Firm type	Distribution rate
Top 20 ASX listed	0.840
Public, but not top 20 ASX listed	0.693
All public	0.755
Private	0.505
All companies	0.676

Source: NERA (2015), Table 3.4, p. 23.[18]

34 In our view, the evidence clearly supports the proposition that large multinationals are able to distribute a higher proportion of the imputation credits that they create, relative to the average Australian firm. Since large multinationals have access to foreign profits and the benchmark efficient firm does not, it is not appropriate to use them to estimate the distribution rate.

35 This only leaves the question of why Lally (2016) concludes, from the 7 firms he considered, that more foreign profits did not lead to a higher credit distribution rate. This is because Lally (2016) has not controlled for differences in dividend payout rates. Figure 1 above shows that a firm with a low dividend payout rate and high foreign profits (Point X) can have a lower credit distribution rate than a firm with a higher dividend payout rate and lower foreign profits (Point Y). This is precisely what happens among the 7 firms. For all but the mining firms, the dividend payout ratio is high enough to enable essentially all of the credits to be distributed. The two mining firms have low payout ratios, so even a substantial proportion of foreign earnings is insufficient to enable them to distribute a higher proportion of credits. This is why it is important to consider samples of reasonable size rather than to try to draw conclusions from comparisons among a few companies.

36 Finally, we note that our Figure 1 cannot be compared directly with Lally (2016) Table 1 because Lally uses a cash-based estimate of the dividend payout rate whereas we use dividends relative to after-tax profits, and because Lally's Table 1 combines some figures from 2015 with other figures averaged over several years. However, the conceptual points are clear:

a. Mathematically, *for any given dividend payout ratio*, the imputation credit distribution rate is an increasing function of the proportion of foreign profits; and

b. The evidence clearly supports the proposition that large multinationals are able to distribute a higher proportion of the

[18] NERA, 2015, "Estimating distribution and redemption rates from taxation statistics," March.

imputation credits that they create (83%), relative to the average Australian firm (70%).

Conclusion on the 20 firms approach

37 Our conclusion is that, since large multinationals have access to foreign profits and the benchmark efficient firm does not, it is not appropriate to use them to estimate the distribution rate for the BEE.

3 The reliability of ATO tax statistics

38 ATO tax statistics are used for two purposes:

a. To estimate the credit distribution rate as the ratio of credits distributed to credits created; and

b. As an upper bound for theta, estimated as the ratio of credits redeemed to credits distributed.[19]

39 In its recent decisions, the AER questions the reliability of using tax statistics to inform the estimate of theta and states that it applies limited weight to such estimates.[20] The issue is as follows:

a. Each year a certain amount of credits are created, some of those are distributed to shareholders, and some of those are redeemed by shareholders.

b. The ATO provides data on the quantum of credits that are created each year and on the quantum of credits that are redeemed each year. There has never been any dispute about either of these items.

c. The ATO does not provide direct data on the number of credits that are distributed each year – so that quantity has to be derived. Two approaches have been proposed:

   i. The FAB approach – whereby the amount of distributed credits is derived as the sum of all credits created less those that are retained by firms as reported in the firms' franking account balances; and

   ii. The dividend approach – whereby the amount of distributed credits is estimated by tracking dividend payments and making assumptions about the flow of dividends between companies, trusts and life offices.

d. The FAB and dividend approaches produce different estimates of the amount of credits that are distributed each year.

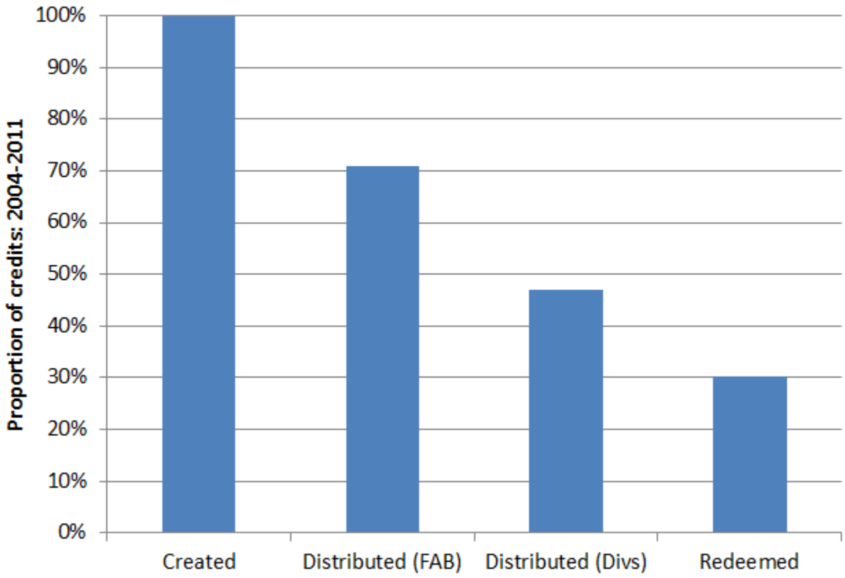
40 The difference between the FAB and dividend estimates of the amount of credits distributed was first identified by Hathaway (2013).[21] His estimates are summarised in Figure 2 below.

[19] We note below that the AER considers this to be a point estimate of theta.

[20] AusNet Draft Decision, Attachment 4, p. 13.

[21] Hathaway, N., 2013, "Franking credit redemption ATO data 1988 to 2011," Capital Research, September.

Figure 2: Summary of ATO tax statistics



Source: Hathaway (2013), p. 9.

41 Figure 2 shows that the FAB method indicates that 71% of created credits are distributed, whereas the dividend method produces a distribution rate of 47%.

42 The AER's recent decisions propose that the ATO tax statistics can be used to estimate theta, and consequently gamma. Under this approach:

$$\gamma = F \times \theta = \frac{\text{Credits Distributed}}{\text{Credits Created}} \times \frac{\text{Credits Redeemed}}{\text{Credits Distributed}}.$$

43 Note that the amount of credits distributed cancels out, so we are left with:

$$\gamma = \frac{\text{Credits Redeemed}}{\text{Credits Created}}.$$

44 In this case, there is no issue with the measurement of either term, so no reason to consider the estimate to be unreliable. Hathaway (2013) recognises this point and reports that the proportion of credits redeemed to credits created is 30%.[22]

45 Moreover, it is clear from Figure 2 above that the same outcome would be obtained whether one adopted the FAB approach:

$$\gamma = F \times \theta = \frac{\text{Credits Distributed}}{\text{Credits Created}} \times \frac{\text{Credits Redeemed}}{\text{Credits Distributed}} = \frac{71}{100} \times \frac{30}{71} = 0.30$$

or whether one adopted the dividend approach:

$$\gamma = F \times \theta = \frac{\text{Credits Distributed}}{\text{Credits Created}} \times \frac{\text{Credits Redeemed}}{\text{Credits Distributed}} = \frac{47}{100} \times \frac{30}{47} = 0.30.$$

46 In its October 2015 Final Decisions, the AER recognised that it must adopt the same estimate of credits distributed in the two places it appears in the above

[22] Hathaway (2013), Paragraph 99.

equation.[23] The AER favoured the FAB method and adopted an (updated) gamma estimate of 0.31 based on that approach,[24] and would clearly have arrived at the same estimate of gamma if it had used the dividend approach in both places in the above equation.

47 In its most recent decisions, the AER has updated this estimate to 0.34.[25]

48 We note that the Tribunal has concluded, and we agree, that the redemption proportion is at most an upper bound for theta so that:

$$\theta < \frac{\text{Credits Redeemed}}{\text{Credits Distributed}},$$

which implies that $\gamma < 0.34$.

49 Thus, the only point of contention is whether the 0.34 figure should be interpreted as a point estimate or an upper bound. There is no question about the reliability of either of the two terms that are required to estimate it.

50 However, in its most recent decisions, the AER raise concerns about the reliability of tax statistics :

> In this final decision, we consider there are potential underlying data issues with tax statistics and as a result, the utilisation rate cannot be estimated reliably from this data. As outlined by Lally, the data issues with tax statistics are generally accepted by service providers, the Tribunal, Hathaway, NERA, Handley and Frontier. For this reason, in this decision, we have placed limited weight on tax statistics.[26]

51 In this regard, the AER notes that Lally (2016) has restated the issue relating to using the tax data to estimate the amount of distributed credits. Lally (2016) does not present any new evidence, but simply restates the well-known issue in relation to the quantum of credits distributed:

> …variation arising from two possible approaches (ATO dividend data and ATO tax data) whose results should match and the divergence cannot be reconciled. This variation casts doubt on all estimates using ATO data, and this problem with the ATO data alleged by Hathaway is generally accepted.[27]

52 As set out above, the fact that it is generally accepted that there are two different estimates of the amount of credits distributed does not mean that the ATO data should be abandoned entirely. The 0.34 upper bound (which had been used as a point estimate by the AER) does not require an estimate of the amount of credits distributed. It is a ratio of redeemed credits to created credits, and there has been no question raised about the reliability of either of these quantities.

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[23] See, for example, SAPN Final Decision, Attachment 4, p. 18.

[24] See, for example, SAPN Final Decision, Attachment 4, p. 18.

[25] AusNet Draft Decision, Attachment 4, p. 16.

[26] AusNet Draft Decision, Attachment 4, p. 15.

[27] Lally (2016), p. 20.

53 Moreover, the AER has been inconsistent in its treatment of the ATO data. The AER relies on the FAB estimate of credits redeemed when it estimates the distribution rate[28] as $F = \frac{\text{Credits Distributed}}{\text{Credits Created}}$ but it questions the use of that same figure when estimating theta as $\theta = \frac{\text{Credits Redeemed}}{\text{Credits Distributed}}$. Both require the same estimate of credits distributed, so it cannot be that the same figure is reliable in one case and unreliable in the other.

54 In our view, the 0.34 upper bound for gamma is relevant evidence that is unaffected by any concerns about the estimate of the quantum of distributed credits. In our view, the 0.34 figure is a reliable estimate of the upper bound for gamma that is entirely consistent with our preferred point estimate of 0.25 being somewhat below that upper bound. The issues raised by Dr Lally and the AER about the unreliability of tax statistics are not relevant to the calculation of the 0.34 upper bound for gamma. The 0.34 figure is independent of the estimate of the quantum of credits distributed, which is the only figure about which concerns have been raised. Consequently, 0.34 remains a robust upper bound for gamma, against which point estimates can be compared for reasonableness.

[28] AusNet Draft Decision, Attachment 4, p. 11.

4 AER issues with dividend drop-off analysis

55 In its recent decisions, the AER sets out what it considers to be a number of limitations relating to dividend drop-off analysis.[29] This list of limitations was first raised by the AER during the Guideline process and again in its November 2014 draft decisions. My previous report, SFG (2015, pp. 38-39), provides responses to these issues and provides references to where responses were provided on two previous occasions: as part of the Guideline process and prior to the 2014 draft decisions.

56 Also, my previous report, SFG (2014, pp. 27-28), summarises the Tribunal's scrutiny of the SFG drop-off study and its adoption of the SFG estimate.

57 In its recent final decisions,[30] the AER summarises some empirical estimation issues in relation to the SFG dividend drop-off analyses. As set out above, these points have been responded to twice before, but I briefly summarise them here:

Possibly implausible estimates

58 The AER again raises the point that it is possible for dividend drop-off analyses to produce implausible estimates. Of course it is possible that any empirical analysis might produce an implausible estimate, particularly if it is a low-quality study that has not been carefully performed and which has not been scrutinised. The AER now accepts that the fact the SFG study produces a stable, precise and plausible estimate means that this criticism is irrelevant.[31]

Drop-off studies measure the market value of credits

59 The AER considers that dividend drop-off studies reflect the actual market value of credits, whereas the AER seeks an estimate of what the value would be in the absence of considerations such as personal taxes and personal costs such that all redeemed credits were valued at the full face amount by the redeeming investor. In our view, the fact that dividend drop-off analysis measures the market value of credits is a great advantage because the approaches that assume that redeemed credits are valued at the full face amount produce nothing more than an upper bound. In this regard, the Tribunal has recently stated that:

> Given that two of the three approaches adopted by the AER are considered no better than upper bounds, it follows that the assessment of theta must rely on market studies. The Tribunal considers that, of the various methodologies for estimating gamma employed by the AER, market value studies are best placed to capture the considerations that investors make in determining the worth of imputation credits to them.[32]

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[29] AusNet Draft Decision, Attachment 4, p. 173.

[30] AusNet Draft Decision, Attachment 4, p. 173.

[31] AusNet Draft Decision, Attachment 4, p. 173.

[32] PIAC-Ausgrid, Paragraph 1096.

Dividend drop-off estimates might be affected by trading around the ex-dividend date

60 In its Guideline materials, the AER cites evidence of abnormal trading being associated with an increase (or "run-up") in the cum-dividend price.[33] The AER cites the report that it commissioned from McKenzie and Partington (2011), who survey the relevant research and report that there is:

> Direct evidence of the presence of short term trading about the ex-dividend date in Australia,[34]

and that:

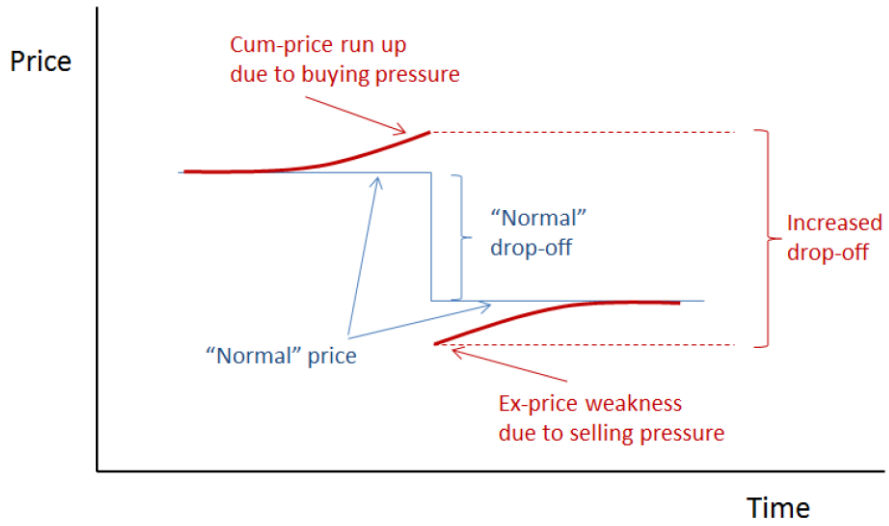
> Short term traders appear to be arbitraging higher yield franked dividends and low spread stocks.[35]

61 They conclude that the result is:

> Buying pressure cum dividend, selling pressure ex dividend, and an abnormal volume of trades. Note however, that these price effects are not just from short term trading.[36]

62 In summary, McKenzie and Partington advise that there is buying pressure from a range of investor types that causes the cum-dividend price to be higher than it would otherwise be (the price run-up) and selling pressure from a range of investor types that causes the ex-dividend price to be lower than it would otherwise be. The result is that the abnormal trading volume causes the dividend drop-off to be *larger* than it would have been if trading among market participants had been at more normal levels. This is illustrated in Figure 3 below.

Figure 3: Trading activity and drop-off ratios



[33] AER, 2013, Rate of Return Guideline, Explanatory Statement, Appendices, p. 170.

[34] McKenzie, M. and G. Partington, 2011, *Report to the AER: The estimation and theory of theta*, March, p. 9.

[35] McKenzie and Partington (2011), p. 10.

[36] McKenzie and Partington (2011), p. 10.

63 That is, to the extent that the increased trading around the ex-dividend date (that is identified by McKenzie and Partington) has an impact on the dividend drop-off estimate of theta, it will tend to *inflate* that estimate.

64 In its recent decisions, the AER cites a report by Lally (2013)[37] which pre-dates the Guideline. Lally agrees that the abnormal trading set out above would tend to inflate the estimate of theta but rejects the drop-off estimate on the basis that it does not reflect the complex weighted-average utilisation rate that the AER is seeking to estimate under its conceptual definition of gamma.

65 In our view, these are two separate issues. Conditional on seeking an estimate of the market value of credits, the analysis above suggests that, if anything, trading around the ex-date will tend to inflate the estimate of theta – as that trading may be motivated by traders who value the credits most.

66 The AER's recent decisions also cite a report by SACES (2015)[38] which pre-dates the recent Tribunal decision. SACES conclude that the SFG studies are high-quality and consistent with best practice, but they reject all dividend drop-off analyses on the basis that the traders who are most active around ex-dates may not reflect the broad market. SACES do not address the analysis presented by McKenzie and Partington (2011) or the analysis above which shows that, to the extent that the increased trading around the ex-dividend date has an impact on the dividend drop-off estimate of theta, it will tend to *inflate* that estimate.

67 The AER's recent decisions do not respond to our previous submissions that this trading is, if anything, likely to inflate the estimate of theta. Nor do the AER's recent decisions cite McKenzie and Partington (2011) in this regard.

Dividend drop-off analysis uses a large data set and 'complex' estimation methods

68 The AER's recent decisions follow all of its decisions since the Guideline in noting that the SFG studies use a large data set with many observations.[39] In my view, this is a strong positive as large data sets are more able to provide robust and precise estimates, and can be used to demonstrate the stability of the estimate over time.

69 The AER's recent decisions also follow its previous decisions in commenting on the 'complexity' of dividend drop-off analysis.[40] However, the methodology applied is regression analysis, which is the same as the AER uses to estimate beta. Moreover, dividend drop-off analysis is a standard empirical approach that has been performed in many empirical studies. We would also make the general

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[37] AusNet Draft Decision, Attachment 4, p. 174. See Lally, M., 2013, *The estimation of gamma*, November.

[38] AusNet Draft Decision, Attachment 4, p. 175. See SA Centre for Economic Studies, 2015, *Independent estimate of the WACC for SA Power Networks 2015 to 2020: Report commissioned by the SA Council of Social Services*, January.

[39] AusNet Draft Decision, Attachment 4, p. 176.

[40] AusNet Draft Decision, Attachment 4, p. 176.

point that estimation techniques should be selected primarily on the basis of whether they are appropriate for the task at hand – we should not adopt inappropriate estimation techniques on the basis that they are simple.

The combined value must be allocated between dividend and imputation credits

70 The AER's recent decisions follow all of its decisions since the Guideline in noting that dividend drop-off analysis provides separate estimates of the value of cash dividends and the value of imputation credits.[41] The former is estimated with reference to unfranked dividends and the latter is estimated with reference to franked dividends. In an ideal world, we would have access to traded prices of imputation credits or to stocks that distributed credits in the absence of dividends. However, because such data does not exist, it is necessary to use a mixture of franked and unfranked dividends to separate the value of dividends from the value of imputation credits.

Academic 'concerns' about dividend drop-off analysis.

71 The AER's recent decisions follow all of its decisions since the Guideline in setting out a set of 'academic concerns' with dividend drop-off analysis.[42]

72 The examples provided by the AER fall into two groups:

a. Those expressed by consultants for energy users and the AER; and

b. Those that suggest that dividend drop-off analysis might *overestimate* theta.

73 The AER does not reference any of the dozens of dividend drop-off analyses that have been published over many years in the world's leading finance journals.

74 The AER also does not reference Ainsworth, Partington and Warren (2015)[43] who "examine the implications of the imputation system for…cost of capital," among other things. They begin by drawing the important distinction between what they call "value in use" and "value in exchange." Specifically, they make the point that just because some investors may receive a benefit at the time they redeem an imputation credit, it does not necessarily follow that credits must have a material effect on traded stock prices or the cost of capital. This is because share prices (and consequently the cost of capital) will be the equilibrium outcome of the complex interaction of trading among all investors, and certain types of investors may be more influential in determining the equilibrium price:

> Also relevant is the basic economic distinction between 'value in use' and 'value in exchange'. There is no doubt that imputation credits have considerable value in use to Australian resident investors, who can use them to

[41] AusNet Draft Decision, Attachment 4, p. 176.

[42] AusNet Draft Decision, Attachment 4, p. 178.

[43] Ainsworth, A, G. Partington and G. Warren, 2015, "Do franking credits matter?" Research working paper, Centre for International Finance and Regulation.

> reduce taxes. Whether they have value in exchange – in other words, whether they are priced – is a separate matter.[44]

75 Ainsworth, Partington and Warren (2015) also set out the basic economic principle that the fact that an investor receives and redeems an imputation credit does not mean that the investor must value that credit at the full face amount:

> The fact that a domestic investor holds a stock and can fully utilise any imputation credits does not provide incontrovertible evidence that they attribute full value to imputation in exchange. It is entirely possible that a domestic investor could be holding a domestic stock due to expectations of receiving high pre-tax returns or other reasons, and not pricing in the imputation credits in the process. <u>Just because an investor receives imputation credits does not necessarily mean they fully price them, and hence require a commensurately lower pre-imputation return from the company as a consequence</u>.[45]

76 We note that the AER's current approach to gamma is based entirely on the proposition that every domestic investor who receives imputation credits *does* fully price every one of them and hence require a commensurately lower pre-imputation return from the company as a consequence.

77 Ainsworth, Partington and Warren (2015) go on to suggest that the relevant consideration is an empirical one – whether stock prices in financial markets are bid up to reflect some value for imputation credits:

> This fundamental issue can be posed as follows. Consider two companies with identical assets, with the exception that one also has a positive balance in its franking account and can distribute imputation credits, while the other has a zero balance. The question is: "Do the two companies sell for the same price?"[46]

78 Ainsworth, Partington and Warren (2015) note that the evidence generally suggests that the two companies above *do* sell for the same price.[47]

79 The fact that share prices might be independent of the amount of imputation credits the firm has available is consistent with the observation that, in practice, firms have little regard to imputation when estimating the cost of capital that they would use when evaluating potential new projects. In this regard, Ainsworth, Partington and Warren (2015) conclude that:

> Removing imputation would probably have no major impact on the manner in which most companies estimate cost of capital and evaluate investments. Imputation is typically *not* built into the cost of capital for most companies.[48]

80 Ainsworth, Partington and Warren (2015) give special consideration to the regulatory approach to lowering allowed returns to reflect the assumed effect of imputation credits on the corporate cost of capital. They note that this approach

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44 Ainsworth, Partington and Warren (2015), p. 9.

45 Ainsworth, Partington and Warren (2015), p. 14, emphasis added.

46 Ainsworth, Partington and Warren (2015), p. 9.

47 Ainsworth, Partington and Warren (2015), p. 17.

48 Ainsworth, Partington and Warren (2015), p. 27.

is very different from the commercial practice of making no adjustments at all to corporate valuation or cost of capital estimates in relation to imputation:

> The treatment of imputation credits for regulatory purposes stands in stark contrast to the approach elsewhere. Regulators make explicit allowance for imputation in their regulatory decisions (e.g. see AER, 2015). The regulators employ the model of Officer (1994), where imputation is taken into account and other tax effects incurred by investors are ignored. The application involves reducing the cost of corporate tax by the 'value of imputation credits', which lowers the pre-tax return that utilities are allowed to earn on regulatory capital. This has the effect of limiting the prices that utilities are permitted to charge.[49]

81 They go on to summarise the AER's recent approach as follows:

> The regulators estimate the value of imputation credits as the product of the distribution rate (i.e. the portion of income that is assumed to be distributed to shareholders), and the utilisation rate. The latter parameter reflects an estimate of the value of imputation credits in the hands of investors. In a recent decision, the Australian Energy Regulator (AER) applied a value of 0.4 to imputation credits (AER, 2015). While this value was formed with reference to a range of estimates and measures, it roughly equates to the product of a 70% distribution rate and a 60% utilisation rate. That is, regulatory practice assumes that distributed imputation credits are worth about $0.60 in the dollar.
>
> A notable feature of the regulatory approach is the hierarchy that is applied in considering various estimates of the utilisation rate. The AER firstly relies on the proportion of Australian equities holdings held by domestic investors, which it indicates to be in the range of 0.56 to 0.68 for all equity, and 0.38 to 0.55 for listed companies. They secondly consider the reported utilisation of imputation credits according to taxation statistics, suggesting a range for the utilisation rate for all equity of 0.4 to 0.6, with reference to analysis by Hathaway (2013). They place least reliance on what they call 'implied market value studies'. Thus least weight is placed on the body of research aiming to extract the value of imputation credits from market prices and returns, as described in Section 4.1. Their reasons are that the equity holding and tax data provide more direct and simple evidence, meanwhile downplaying market-based studies based on their methodological limitations and variable estimates.[50]

82 Ainsworth, Partington and Warren (2015) then call into question the basis of the AER's approach, in the context of their discussion about the standard economic concept of market equilibrium:

> The discussion in Section 3.2 around how market equilibrium is determined is directly relevant to this issue. It raises some questions over the philosophy underpinning the regulatory approach.[51]

83 They further spell out the problems with the AER's approach. They note that investors will consider many factors when determining what assets they will purchase and what price they would be prepared to pay for them. This prevents problems for the AER's "aggregation" approach, which simply counts up the number of credits that are distributed to domestic investors and *assumes* that

[49] Ainsworth, Partington and Warren (2015), p. 27, emphasis added.

[50] Ainsworth, Partington and Warren (2015), p. 27.

[51] Ainsworth, Partington and Warren (2015), Footnote 21, p. 27, emphasis added.

those investors value all credits at the full face amount *and* that this is reflected in the equilibrium share price and cost of capital:

> In practice, an investor's demand for assets may reflect a whole range of considerations, including their expectations, the broader portfolio context, their liabilities, constraints, other costs, etc. <u>This issue is particularly problematic for applying the aggregation approach through reference to observed holdings</u>.[52]

84 In my view, Ainsworth, Partington and Warren (2015) reinforce the view that the AER's approach of simply counting up the number of credits that might be distributed to domestic investors has no proper basis to it and is inconsistent with standard economic concepts of equilibrium and with standard commercial practice.

85 In response to the concerns that are expressed in this paper, the AER has concluded that:

> …while the paper raises a number of points highlighted by Gray (for Frontier), we do not consider the paper provides evidence that the equity ownership approach that uses the aggregation approach to estimate the value of theta is not reasonable.[53]

86 The AER then cites a passage from Ainsworth, Partington and Warren (2015) that summarises a number of dividend drop-off estimates and other market value studies and notes that the average estimated value of distributed credits (theta) is 0.38,[54] which is of course very close to our own preferred dividend drop-off estimate of 0.35.

87 In our view, a paper that "raises some questions over the philosophy underpinning the regulatory approach",[55] concludes that there are issues that are "particularly problematic"[56] for the regulatory approach, and which reports an average theta estimate over a number of studies of 0.38 is very much consistent with what we have proposed in relation to the estimation of gamma and quite inconsistent with the AER's approach and estimates.

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52 Ainsworth, Partington and Warren (2015), p. 14, emphasis added.

53 AusNet Draft Decision, Attachment 4, p. 95.

54 AusNet Draft Decision, Attachment 4, p. 96.

55 Ainsworth, Partington and Warren (2015), Footnote 21, p. 27, emphasis added.

56 Ainsworth, Partington and Warren (2015), p. 14, emphasis added.

5 Conversion of market value estimates into redemption proportion estimates

88 In its decisions since the Guideline, the AER has maintained that theta should not be estimated as the market value of distributed credits but as the proportion of credits that might be redeemed. The AER's view is that since dividend drop-off analysis estimates the market value of credits, there must be an adjustment to convert those estimates to the correct 'pre-personal cost and tax' basis. In its recent decisions, the AER maintains this view.[57]

89 Our view remains that theta should be interpreted as the value (as in 'worth') of distributed credits, and consequently no such adjustment is relevant. Dividend drop-off analysis provides a direct estimate of the extent to which credits are capitalised into stock prices. Since drop-off analysis already estimates the market value of distributed credits, no adjustment required. The Tribunal concurs with our view that theta should be interpreted as the market value of distributed credits and with our view that no adjustment is required.[58]

90 We have previously provided two other reasons why any such adjustment should not be made, as set out below.[59]

The proposed adjustment produces perverse outcomes

91 First note that the proposed adjustment is to divide theta by the estimated value of cash dividends, which can be defined as δ. Suppose the regulator applies the scaling approach, but that the dividend drop-off analysis suggests that $\delta = 1$, so that the scaling has no effect. The regulator then determines the allowed revenue for the firm of say $X.

92 Now consider a case that is identical in all respects to the one above, except that the drop-off analysis produces an estimate of $\delta < 1$. In this case, *everything* is identical to the previous case, except that shareholders do not value dividends as highly. If anything, this should require an *increase* in the allowed revenues – because shareholders do not value dividends as highly, they would need to receive more of them in order to be left equally well off.[60] However, under the proposed approach the drop-off estimate of theta would be increased (by dividing by $\delta < 1$) which would in turn result in *lower* allowed revenues.

93 Under the AER's proposed approach, as the dividends paid by the firm become less valuable to investors, the allowed revenues are further reduced – which is the exact opposite of what should occur.

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[57] AusNet Draft Decision, Attachment 4, Appendix 15.

[58] PIAC-Ausgrid, Paragraphs 1101-1103.

[59] SFG, 2015, *Estimating gamma for regulatory purposes*, 6 February, p. 40.

[60] See for example, Lally, M. and T. van Zijl, 2003, "Capital gains tax and the Capital Asset Pricing Model," *Accounting and Finance*, 43, 187-210.

The proposed adjustment would need to apply throughout the regulatory process

94 In using the Sharpe-Lintner CAPM to estimate the required return on equity, the AER imposes an estimate of $\delta = 1$ – it estimates the required return on the basis that shareholders value dividends at their full face value. There are more complex versions of the CAPM that allow for $\delta < 1$, but the AER does not use them. For example, Lally and van Zijl (2003) develop a version of the CAPM that allows for the case where $\delta < 1$. These more complex models simplify to the Sharpe-Lintner CAPM for the case where $\delta = 1$.

95 It would be inconsistent and wrong for a regulator to adjust the estimate of theta on the basis that $\delta < 1$, but then to estimate the required return on equity in the same WACC estimation process on the basis that $\delta = 1$. That is, if $\delta < 1$ when estimating theta, then $\delta < 1$ should apply throughout the WACC estimation process.

6 Declaration

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

Professor Stephen Gray

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