Dividend drop-off estimate of theta

Final Report

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

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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:

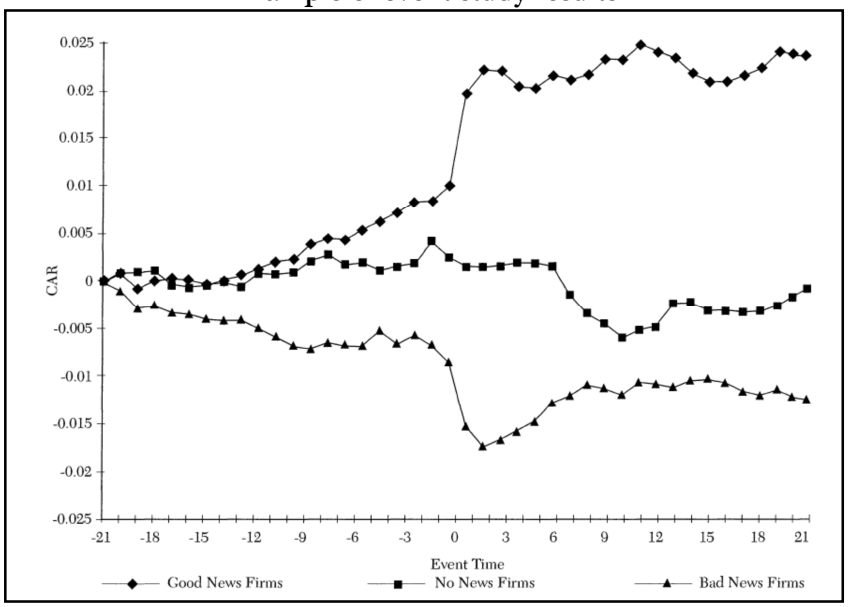
a. Positive announcements (better than forecasts);

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;

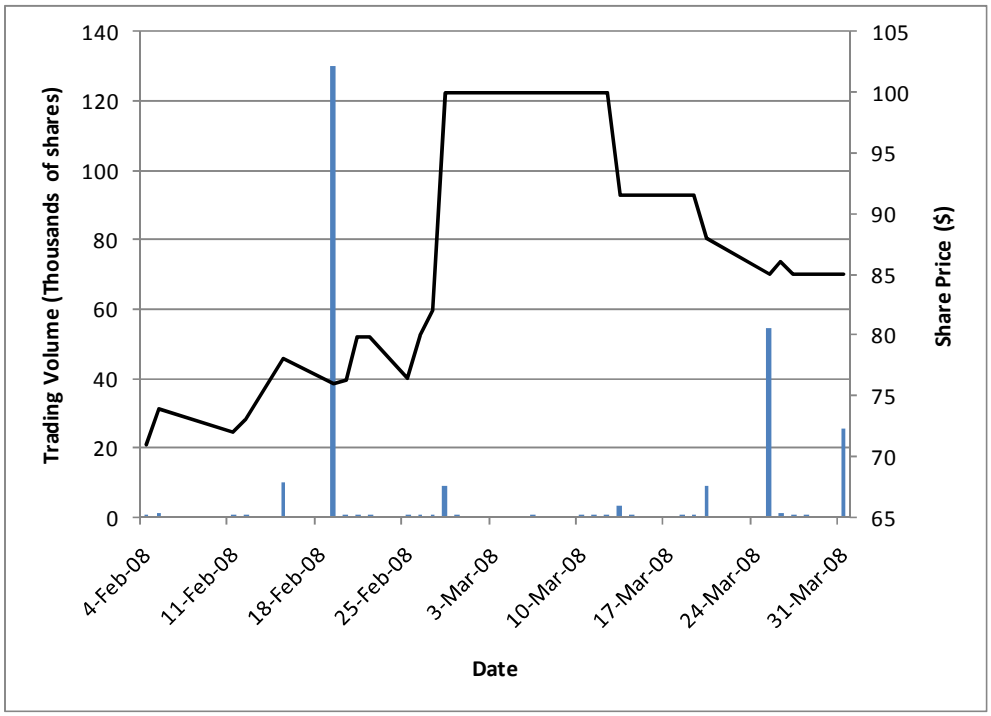
[9] All of the files referred to have been made available to the parties.

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.

[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:

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

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.

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:

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

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:

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

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

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

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%.

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[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

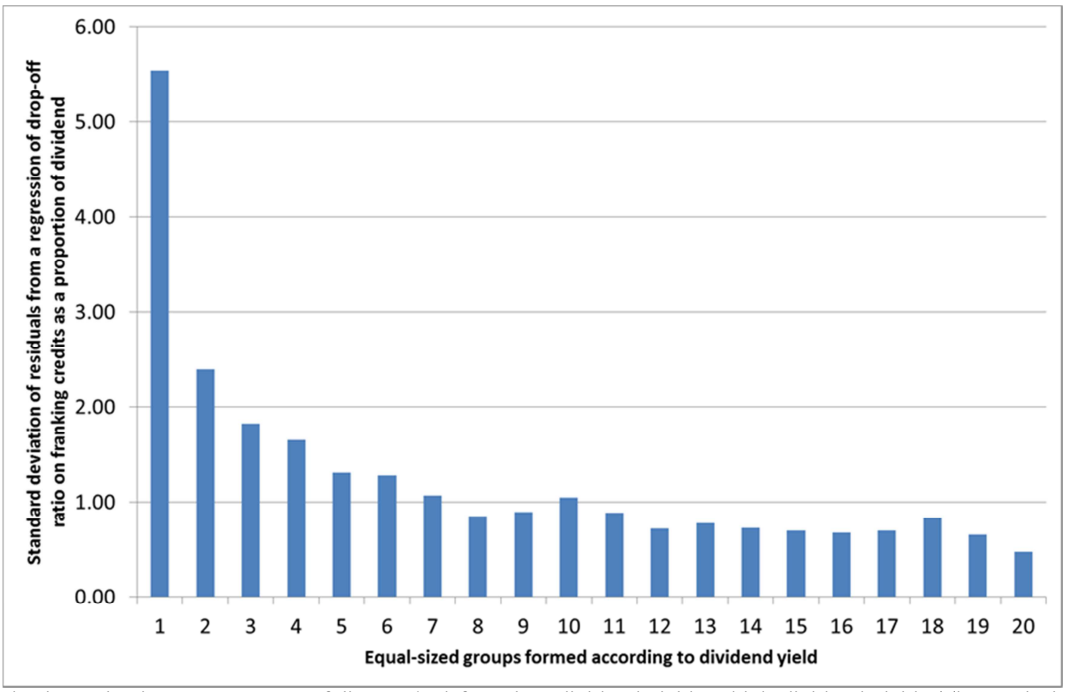
Model 1			
	Estimate	**Std Err (White)**	**Std Err (Firm clustering)**
Cash	0.7964	0.0738	0.0673
Franking credits	0.1640	0.1946	0.1808
Package	0.8667	0.0339	0.0322
R-squared	0.0003		
Adjusted R-Squared	0.0000		
N	3107		
Model 2			
	Estimate	**Std Err (White)**	**Std Err (Firm clustering)**
Cash	0.8070	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

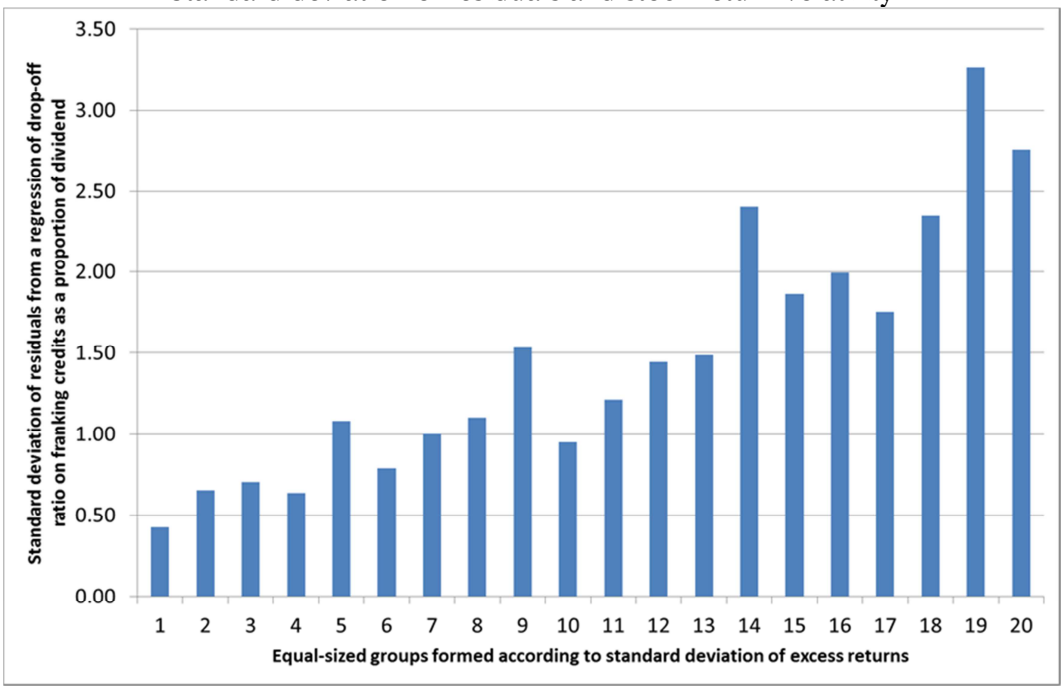


The horizontal axis sets out 20 portfolios ranked from low dividend yield to high dividend yield. The vertical axis shows the standard deviation of residuals from Model (1) for each of the 20 groups.

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

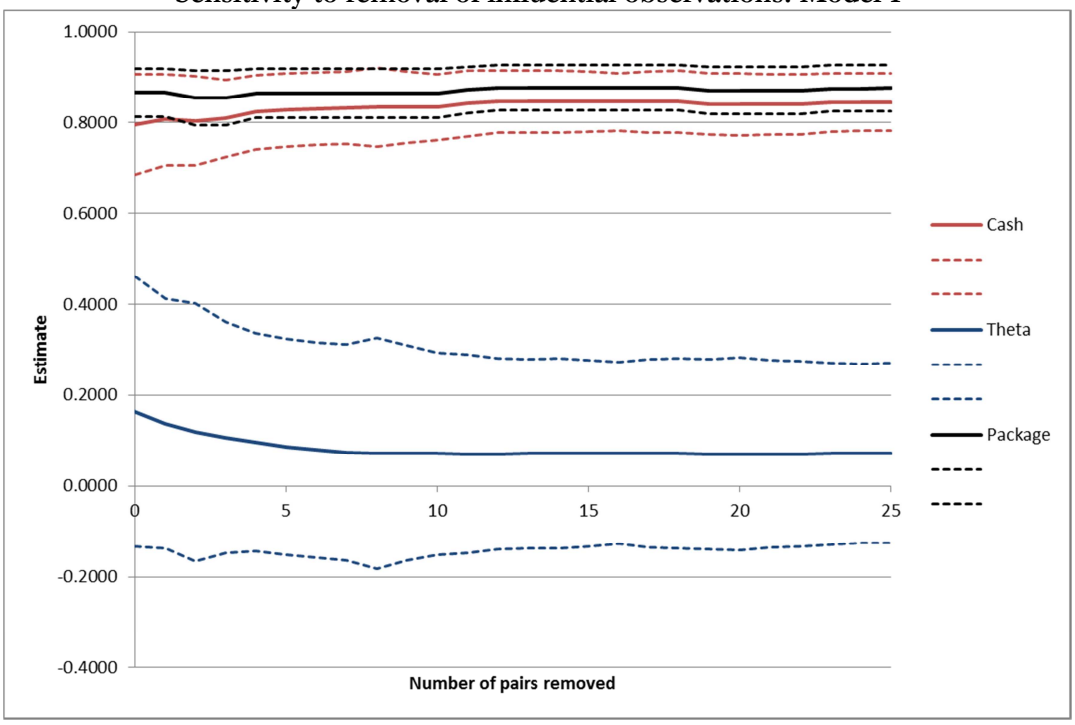
	OLS		Robust regression	
Number removed	409		409	
	Cash dividends	**Theta**	**Cash dividends**	**Theta**
Model 1	0.88	0.08	0.89	0.29
Model 2	0.85	0.38	0.91	0.35
Model 3	0.93	0.20	0.93	0.27
Model 4	0.92	0.34	0.94	0.36

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



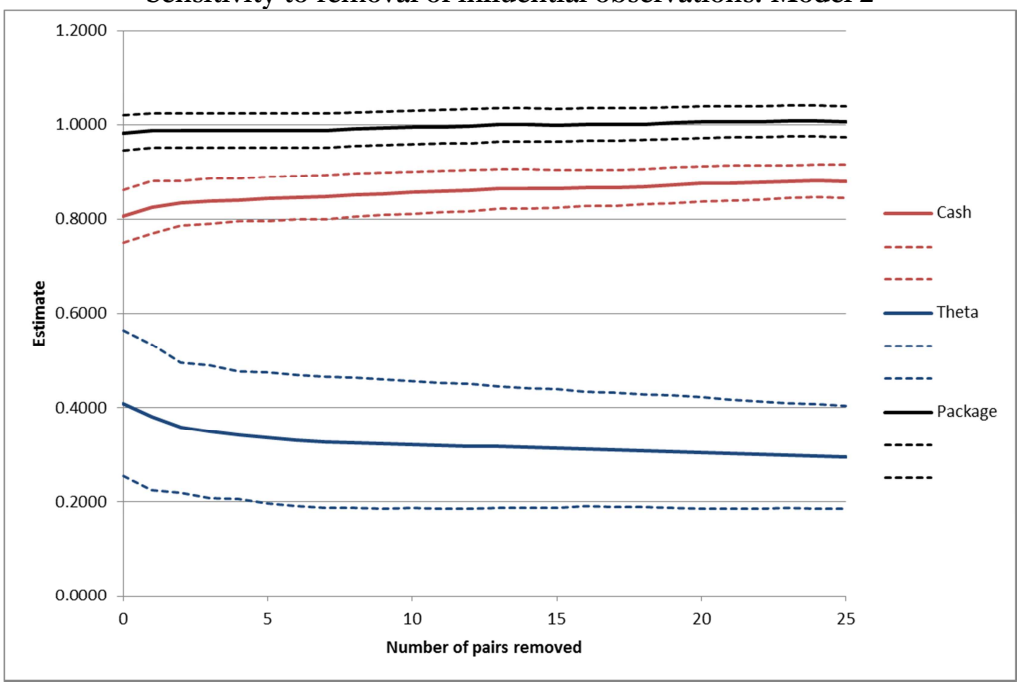
81. Figure 5 shows that the original point estimate of theta from Model 1 was 0.16. When the first pair of observations (i.e., one observation that would maximally increase the estimate of theta and one that would maximally decrease the estimate of theta) is removed, the point estimate of theta falls 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

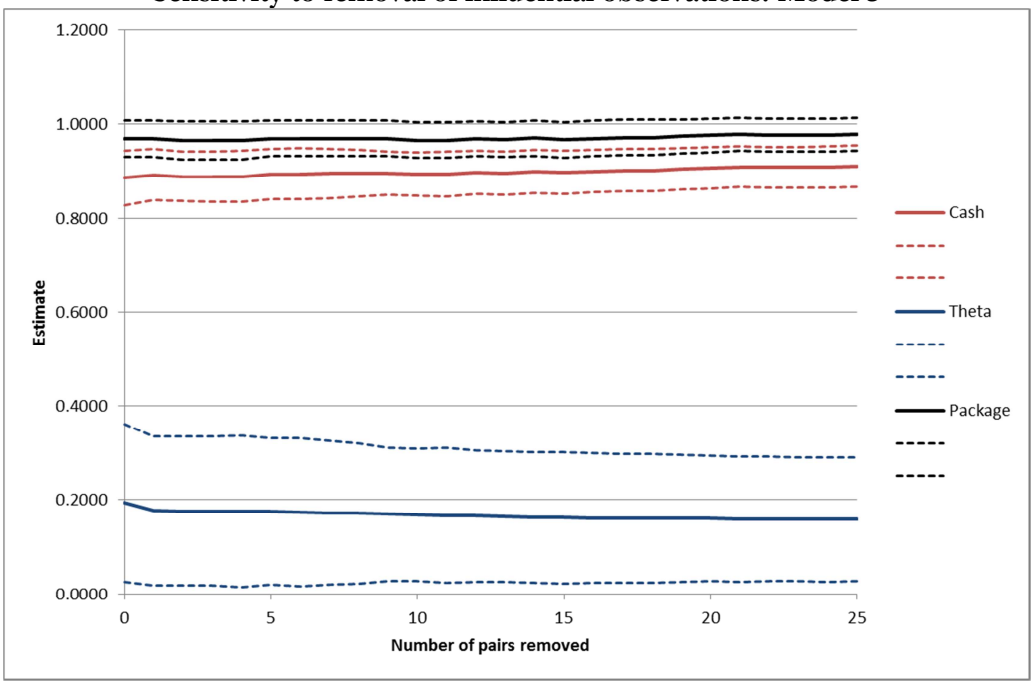
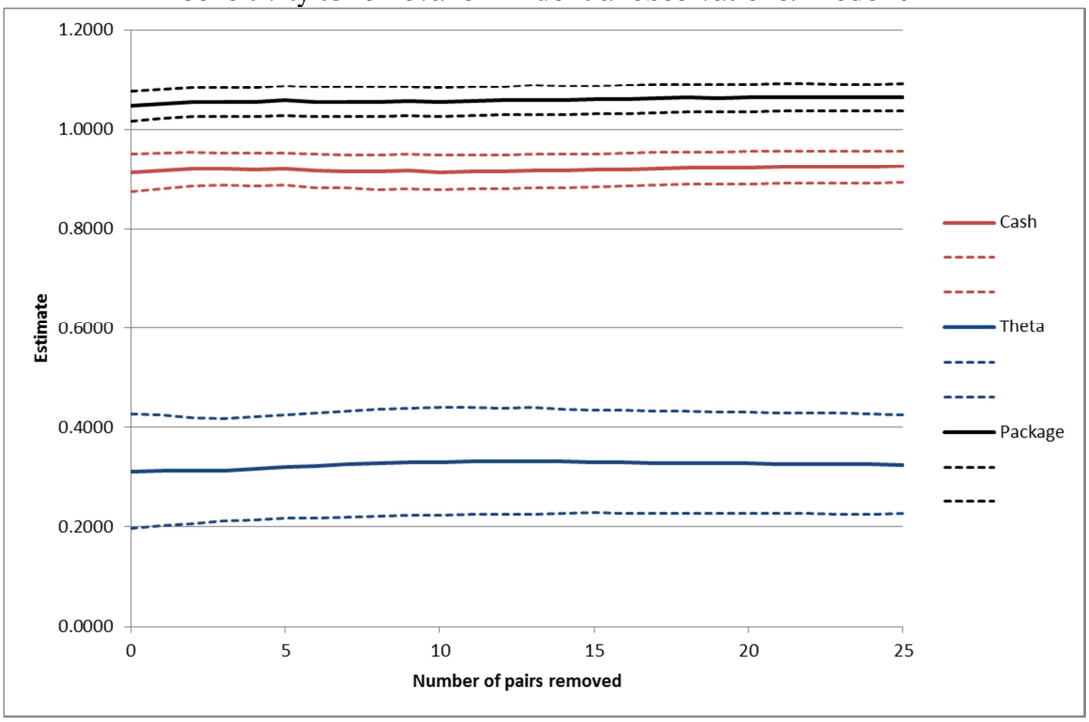


Figure 8
Sensitivity to removal of influential observations: Model 4



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,

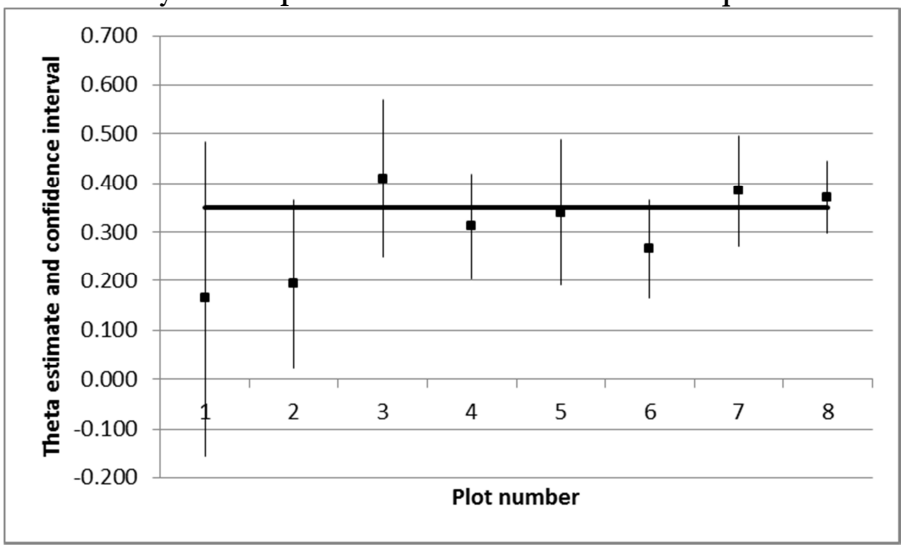
but rather examine whether the proposed estimate is consistent with a whole range of different estimations.

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



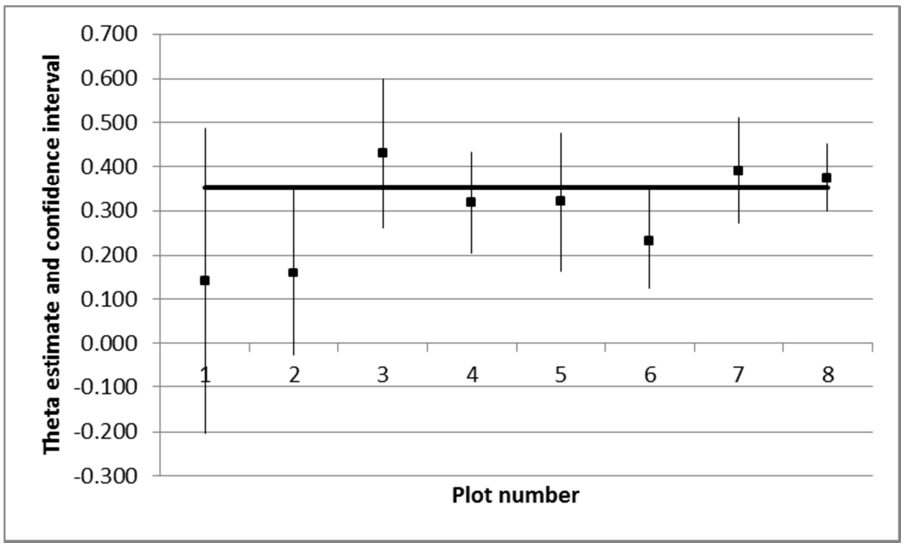
For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35. For all models, the announcement threshold is set to two standard deviations.

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

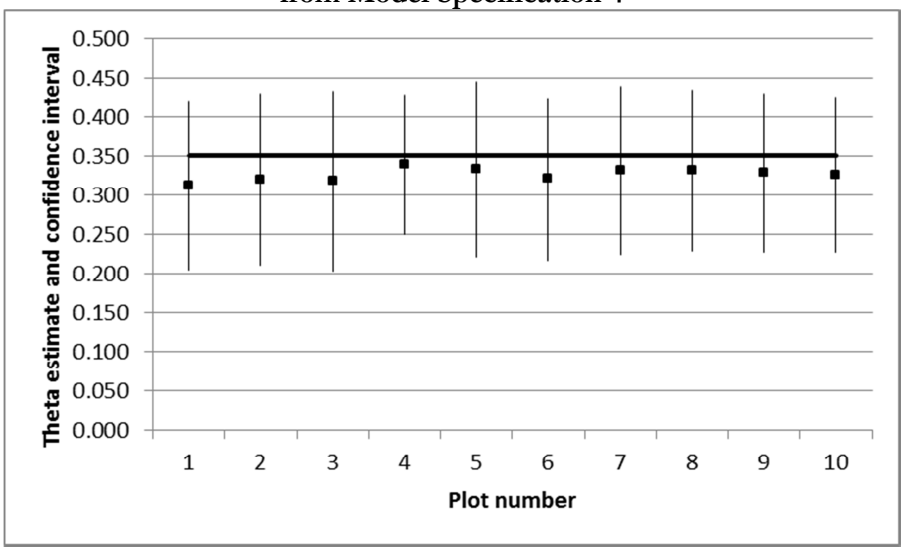


For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35. For all models, all observations for which the firm made a "market sensitive"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



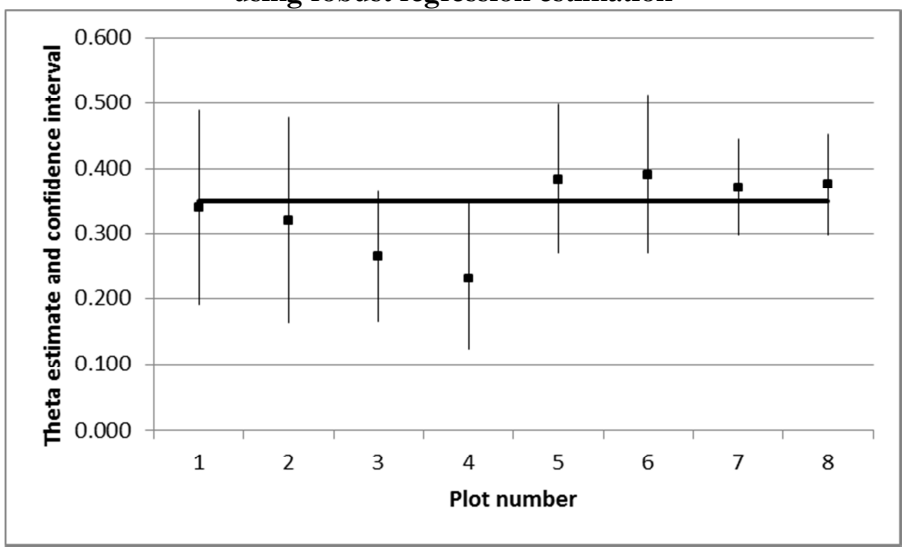
For each estimate, the narrow line represents the 95% confidence interval for theta and the solid black marker represents the point estimate. The solid black horizontal line represents the recommended point estimate of 0.35. All estimates relate to Model Specification 4.

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.

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.

[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 To*R.

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).

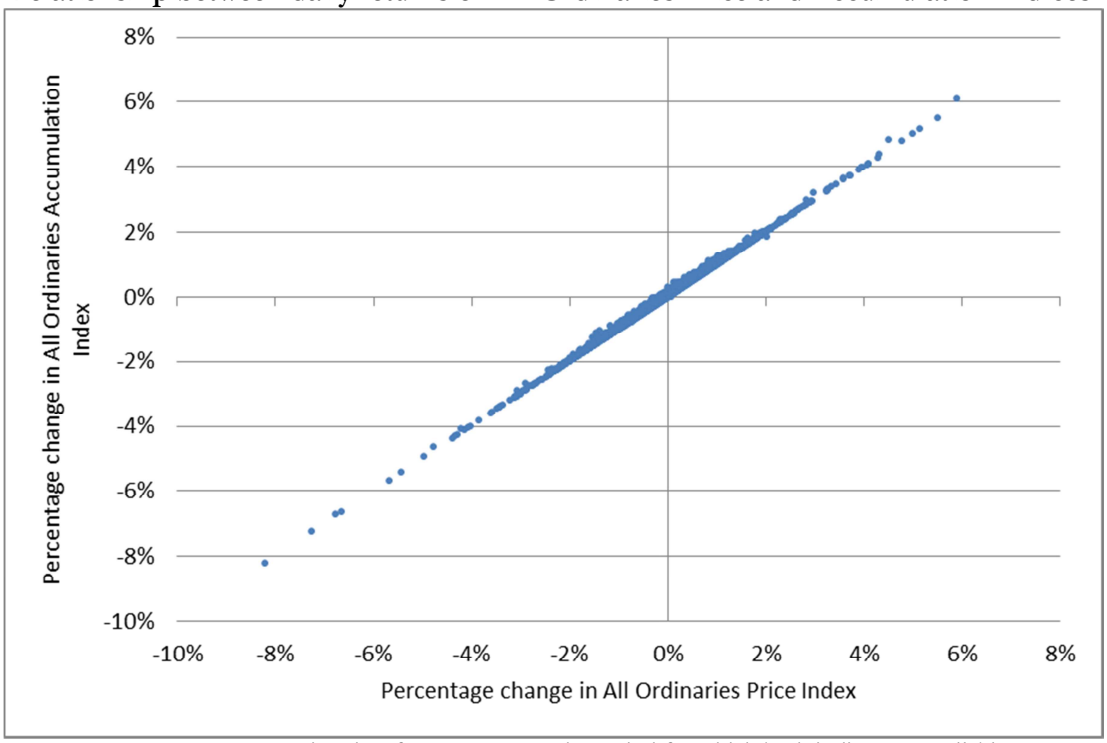
Conceptually, it is the Accumulation Index, as used in the study, that should be used to adjust ex-day stock returns. To see this, consider a conceptual example in which every company in the market pays a 2% dividend on a particular day that is completely neutral from a news perspective (i.e., there 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 To*R.

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.

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

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

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Manual checking of data items, under instruction and supervision.