**ISSUES IN THE ESTIMATION OF GAMMA**

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9 April 2017

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**EXECUTIVE SUMMARY**

The AER has recently received two reports from Frontier Economics, on behalf of some regulated businesses, and concerned with the estimation of gamma. This paper reviews these two reports, and also addresses a number of questions raised by the AER about these reports or about gamma issues more generally.

In respect of the two Frontier papers, the first of these involves rerunning the DDO methodology invoked in earlier papers by SFG, but using a larger data set, and produces very similar results. However, as with the earlier SFG papers, this methodology suffers from 12 significant problems in providing an estimate of the utilization rate for the imputation credits. The second of these Frontier papers raises a number of new arguments relating to gamma, and cites a number of papers in support of its views. However, I do not agree with any of the new arguments raised by Frontier, or the arguments raised by these other authors, and I also consider that most of Frontier’s claims concerning support from other authors involves Frontier misrepresenting the views of these other authors.

1. **Introduction**

The AER has recently received two reports from Frontier Economics (2016a, 2016b), on behalf of some regulated businesses, relating to the estimation of gamma. This paper reviews these two reports, and also addresses a number of questions raised by the AER about these reports or about gamma issues more generally.

1. **An Updated Dividend Drop-Off Estimate of Theta**

Frontier (2016a, Table 2, Table 3) updates an earlier dividend drop-off (DDO) study (SFG, 2013), using the same methodology but a larger data set, and generates estimates of the coefficient on the imputation credits ranging from 0.17 to 0.40 across eight different models (including 0.36 to 0.40 for the Model 4 specifications). Frontier (ibid, para 100) places primary weight on the Model 4 results and therefore favours an estimate of 0.35, as in its earlier studies (SFG, 2011; SFG, 2013). Since the methodology is unchanged, all of my earlier concerns about this methodology remain and these concerns are as follows (Lally, 2012, section 2.6; Lally, 2013, section 3.5).

Firstly, the appropriate estimate of the utilization rate in these studies is not the coefficient on the credits but the coefficient on the credits divided by that on the cash dividends. Frontier (2016b, paras 91-95) offers arguments in defense of using the coefficient on the credits but these are addressed in section 4 of the current paper. Secondly, other studies using market prices generate a very wide range in the estimates of the utilization rate, even over the same time period, and this damages the credibility of all such estimates unless it can be demonstrated that one such methodology is clearly superior (which has not been done). Thirdly, the variation over time in results from the same methodology does not exhibit a pattern that is consistent with changes in the tax regime, and this also damages the credibility of all such estimates. Fourthly, despite the very large sample size in Frontier’s analysis, there is considerable statistical uncertainty in the results, arising from ‘noise’ in the data (due to bid-ask bounce and to unrelated price movements over the cum to ex-day interval, aggravated by the high correlation between the imputation credits and the cash dividend which makes it difficult to identify the impact of only the credits on market prices even if the aggregate effect from the cash dividend and the credits were clear).

Fifthly, despite applying the same methodology and data filtering rules to data from an almost identical period to that in SFG (2013), being July 2001 to July 2012 versus July 2001 to October 2012, Vo et al (2013) and SFG (2013) generate some quite significant differences in both the point estimates for the coefficients on the credits and their standard errors. This damages the credibility of both sets of estimates. Sixthly, Frontier’s method of assessing the impact of outliers on the result (by progressively removing the 20 most extreme pairs of observations comprising the one that exerts the most upward effect on the estimated franking credit coefficient and the one exerting the most downward effect, and rerunning the model after each pair is deleted) is unconventional and would have the effect of suppressing the apparent impact of outliers upon the estimated franking credit coefficient. Consistent with this, Vo et al’s (2013) more conventional approach (of progressively removing the 30 most extreme observations in absolute terms, and rerunning the model after each deletion) shows more variation in the results.[[1]](#footnote-1) Seventhly, and in respect of the robust regression models used by both Frontier (2016a) and Vo et al (2013), Frontier adopts the default option value for the “tuning coefficient” in the models whilst Vo et al considers various values of this “tuning coefficient” and obtains significantly different estimates of the coefficient on franking credits to that of SFG (2013), across the range of values for the tuning coefficient and for each of SFG’s four models. Eighthly, Frontier do not include a constant in their regression model, the case for doing so is not clear cut, and omission of the constant could materially alter the estimate for the coefficient on the franking credits.

Ninthly, Frontier (2016a) deletes observations from companies with a market cap below 0.03% of the market index. Since they also (sensibly) delete observations if trades are not present on both the cum and ex-dividend dates, this company size rule has no apparent merit. Furthermore, the choice of 0.03% is highly arbitrary, the rule tends to exclude observations that are least likely to be contaminated by tax arbitrage (the best ones), and the rule may have significantly biased Frontier’s results. Tenthly, Frontier (2016a) favours results from Model 4, but their basis for doing so (as described in SFG, 2011) is inadequate in failing to use formal tests and in using the wrong type of graphical analysis.[[2]](#footnote-2) Eleventhly, although the utilisation rate is a value-weighted average over all investors in the market, the use of DDO studies will produce an estimate of it that reflects the actions of tax arbitrageurs, and these investors may be quite unrepresentative of the entire market. Lastly, many DDO studies have identified various anomalies that cannot be attributed to any kind of tax explanation, this raises the possibility that ex-day behaviour is also affected by factors other than taxes, and this concern has been raised by a number of researchers in this area (including Professor Gray himself).

1. **Questions from the AER**

The AER has posed a number of questions about the Frontier (2016a) paper, and these are now addressed.

Firstly, the AER has asked whether DDO studies generally, and this Frontier study in particular, are estimating a “post-tax” value of imputation credits as required under the NGR and NER.[[3]](#footnote-3) These rules are not very specific on the cost of capital, and grant considerable discretion to the regulator; in respect of the NER, the relevant rules are in clause 6.5.2 (AEMC, 2016). However, clause 6.5.3 of the NER requires allowance for the “value of imputation credits” and in such a way as to point to use of the Officer (1994) model, which all Australian regulators use. This model is post-company (and pre-investor) tax, and DDO studies provide an estimate of the utilization rate that is consistent with this. To illustrate this, suppose that all investors can use the imputation credits (so *U* = 1) and capital gains are taxed at the same rate as dividends.[[4]](#footnote-4) Thus, the expected price change around ex-day net of capital gains tax (at rate *T*) would be equal to the gross dividend (cash *D* plus imputation credits *IC*) net of dividend tax (at rate *T*):



Removing the expectation, and therefore recognizing a noise term (*e*), followed by dividing through by (1 –*T*) yields the following regression model:



This is a regression of *ΔP* on *D* and *IC*, which is one form of a DDO study (the others are variants of this). The coefficient on *IC* is then 1, which matches the utilization rate *U*. So, DDO studies provide an estimate of *U* that is consistent with the post-company (and pre-investor) tax nature of the model used to estimate the cost of equity.

Secondly, the AER has asked whether the DDO methodology used in the Frontier study is appropriate. The previous section details my numerous concerns about Frontier’s analysis. Many of these points are inherent in the approach, and cannot be overcome by an alternative DDO methodology. The points that can be overcome are the first, sixth, seventh, eighth, and ninth, involving dividing the estimated coefficient on the credits by that on cash dividends, assessing the effect of outliers individually rather than in pairs, presenting results for a range of values for the tuning coefficient in robust regression, additionally presenting results with a constant in the regression models, and desisting from deleting observations from small companies.

Thirdly, the AER has asked whether the manner in which the primary data set was compiled by Frontier was appropriate. As noted in the previous section, Frontier (2016a) has deleted observations from companies with a market cap below 0.03% of the market index. Since observations are also (sensibly) eliminated if trades are not present on both the cum-dividend and ex-dividend dates, this company size rule has no apparent merit. Furthermore, the choice of 0.03% is highly arbitrary, the rule tends to exclude observations that are least likely to be contaminated by tax arbitrage (and which are very desirable because of that fact), and the rule may have significantly biased Frontier’s results.

Fourthly, the AER notes that Frontier uses the updated theta estimates to test whether the estimate of 0.35 from SFG (2011) is still an appropriate estimate, and asks whether this sensitivity analysis is appropriate or whether the updated data should be used to generate a new point estimate of theta. The analysis in Frontier (2016a, section 4.6) has the rather odd feature that the rationale for the preferred estimate for the coefficient on the credits of 0.35 does not appear until the last sentence in the paper. This suggests that the figure of 0.35 is simply drawn from SFG (2011) and the only purpose of Frontier (2016a) is to further advocate for that figure. However, the important issue here is what conclusion should be reached about this parameter based upon the results in Frontier (2016a, Table 2, Table 3). These results average 0.32, and 0.38 if only the Model 4 results are considered. Frontier (ibid, para 100) favours more weight on the Model 4 results, and favours an estimate of 0.35. Given the preference for Model 4, such a conclusion is reasonable. SFG (2011) also favoured the results from robust regression, and these now average 0.34 (Frontier, 2016a, Table 3). So, even if Frontier (2016a) had exhibited the same preferences as SFG (2011), for both Model 4 and robust regression results, a figure of 0.35 would still be reasonable. Thus, given Frontier’s methodology and results, and applying greater weight to either the Model 4 results or both the Model 4 results and the robust regression results, an estimated coefficient on the credits of 0.35 is appropriate. However, all of my concerns about this methodology that have been expressed in the previous section still remain.

Fifthly, the AER asks whether the manner in which the robust regression analysis has been conducted is appropriate. As noted in the previous section, SFG (2013) and Frontier (2016a) present results using only the default option values for the tuning coefficient whilst Vo et al (2013) presents results with a range of values for the tuning coefficient in the model, and obtain significantly different estimates of the coefficient on franking credits. So, Frontier’s failure to disclose the sensitivity of their results to this parameter is a deficiency in their analysis. For example, in respect of Model 4, the estimated coefficient on the credits varied from 0.32 to 0.64 as the tuning coefficient was varied (Vo et al, 2013, Table 11 and Figure 19).[[5]](#footnote-5) Furthermore, although the associated coefficients on cash dividends are not given and therefore the result of dividing this into the coefficient on credits to obtain an estimate of the utilization rate is not possible, it could be presumed that the range in estimates for *U* would be at least as great as that for the coefficient on franking credits. Faced with such variation, and no argument from Frontier (2016a) in support of using the default option value for the tuning coefficient, the merits of this DDO methodology are undercut.

Sixthly, the AER asks whether other DDO studies are available to estimate the value of distributed imputation credits. The previous section has referred to two further studies: Vo et al (2013) and Mero et al (2016). These studies reinforce the fifth, sixth and seventh concerns about the DDO methodology described in the previous section: the failure to reproduce SFG’s results, the significant impact of outliers on the estimate of estimate of the coefficient on the credits (when considered in a conventional fashion), and the significant impact of the choice of the tuning coefficient in robust regression.

1. **Issues in the Estimation of Gamma**

Frontier (2016b) raises a number of points concerning gamma. In response to the estimate of 0.84 for the distribution rate of the 20 largest ASX companies in Lally (2014), Frontier (2016b, paras 22-31) notes that these companies have material levels of foreign income, that such income permits the distribution rate to be raised, and therefore use of these companies overestimates the distribution rate of the BEE (which has no foreign income). Frontier also notes that Lally (2016a, section 3.5) has examined seven of these firms (those with the largest tax payments to the ATO), shown that the distribution rate for credits decreases as the proportion of income from foreign operations rises (contrary to Frontier’s claim), and that Lally provides an explanation for this pattern. In response, Frontier argues that the correct comparison is between firms without foreign income and those with it rather than amongst firms that all have some foreign income. So, if the available firms comprised those without foreign income (type 1), those with a tiny proportion of foreign income (type 2), and those with a very large proportion of foreign income (type 3), Frontier would presumably aggregate the type 2 and type 3 firms and compare them with the type 1 firms. If the type 2 firms were much more numerous than the type 3 firms, the result might be a trivial (and statistically insignificant) difference between the distribution rates of firms without foreign income and those with it. The far superior approach would be to examine the entire distribution of firms, as Lally (2016a, section 3.5) has done. One could still object to this if none of the firms examined had a foreign income proportion that was close to zero, because one would then have to engage in significant extrapolation in order to estimate the distribution rate of a firm with no foreign income. However, the seven firms examined have foreign income proportions ranging from 6% to 60% (Lally, 2016a, Table 1), and therefore the degree of extrapolation is minor. One could still claim that it would be desirable to include firms with no foreign income. This is true but, since the purpose of the exercise is to estimate the distribution rate of the market in the absence of foreign activities, the most important requirement is that the firms examined have large company tax payments to the ATO, so as to obtain the best estimate of the distribution rate for the market in aggregate. Doing so does not produce any firms without foreign income, but it does produce some with low proportions and this is sufficient. By contrast, examining a set of firms that had no foreign activities but constituted 10% of the value of the market would be very unsatisfactory.

Frontier (2016b, paras 32-34) also claims that the average Australian company has a distribution rate of about 70%, compared to the 84% for the 20 largest ASX firms, that the latter firms have foreign income, and therefore are not suitable for estimating the distribution rate of the BEE. However, as shown in Lally (2016a, section 3.5), the effect of foreign activities is to *reduce* the distribution rates of these 20 firms, removal of this effect would therefore raise the distribution rate rather than lower it, and therefore magnify the difference from the other firms rather than explain it. Thus the other firms would have to be preferred to the 20 largest on some other basis, and I do not see any basis for doing so. In particular, the unlisted firms are unsuitable because their distribution rates seem to be much lower than for listed firms (50% versus 75%, as reported in Frontier, 2016b, Table 1), the likely cause of this is lower dividend payout rates (of which the extreme case is sole traders who corporatize to reduce their taxes, which requires a low dividend payout rate), and regulated businesses are either listed or subsidiaries of firms that are (see Lally, 2016b, pp. 34-35). In respect of using listed firms other than the top 20, some of these will have foreign activities, the effect of this would have to be determined before their average distribution rate could be used, and Frontier have not done so. Furthermore, the estimated distribution rate for these listed (but not top 20) firms (70%, as claimed by Frontier, 2016b, Table 1) draws upon ATO data and such data is unreliable because it generates markedly different estimates of the credits distributed according to whether dividend or company tax data is used (and even Frontier, ibid, section 3, now accepts this reliability problem). So, since unlisted firms are unsuitable, the only suitable firms to use are therefore publicly listed ones, and the only suitable means of estimating the distribution rate of these firms (stripped of the effect of foreign activities) is from their financial statements. In doing so, the goal is to estimate the aggregate distribution rate of these firms (stripped of the effect of foreign activities), and therefore the best ones to examine are the largest companies. This is the approach in Lally (2016a, section 3.5), leading to an estimate for the distribution rate of the BEE of at least 83%.

Frontier (2016b, para 35) states that Lally (2016a, section 3.5) failed to conclude that more foreign income raises the distribution rate because he did not control for differences in dividend payout rates. It is true that Lally (2016a) did not control for differences in payout rates. However, Frontier fails to offer any argument for controlling the payout rate, and none is evident. Furthermore, the purpose of the exercise is to estimate the distribution rate of the market without foreign activities from a set of firms, some or all of which have foreign activities. So, one must strip out *all* phenomena that arise from foreign activities, which comprise not only the foreign income but any change in the dividend payout rate arising from foreign activities. Controlling for any changes in the dividend payout rate would subvert that purpose.

To illustrate this point, consider a firm (A) without foreign income, involving income of $100m, company taxes of $30m, and retention of $15m. This leaves $55m paid as dividends, and therefore maximum credits attachable of $23.6m, and therefore a distribution rate for the credits of $23.6m/$30m = 0.78 (see column 1 of Table 1 below). Now suppose another firm (B), differing only in that it engages in some foreign activities, which involves an investment of $10m and yields pretax profits of $1m per year (taxed at 30% in that foreign jurisdiction). In the first year of this process, during which the investment occurs and the first payoff arises, the dividends fall to $45.7m, implying maximum attachable credits of $19.6m, and therefore a distribution rate of $19.6m/$30m = 0.65 (see column 2 in Table 1). So, the distribution rate for this firm underestimates the rate that would have arisen if the firm had not engaged in foreign activities. Holding constant the dividend payout rate (and hence the retention rate) would instead yield a distribution rate of $23.8m/$30m = 0.79 (see column 3 of Table 1), but this distribution rate is that of a fictional rather than a real firm. Furthermore, even if such a firm (C) did exist (because it financed the foreign activities without reducing its payout rate), it would still be useful in estimating the distribution rate of a firm without foreign activities (0.78) by including it amongst the set of firms examined. Averaging over the distribution rates of firms B and C would yield 0.72, and this would still be an underestimate of that for firms without foreign activities. By contrast, what Frontier appears to be interested in doing is to observe the distribution rates of firms with foreign activities and to assert (without any evidence) that the average of such rates is too high. This would be incorrect. Some firms that engage in foreign operations will experience a reduced distribution rate (0.65: see column 2) whilst others will experience an increase (0.79: see column 3), and the average may also involve a reduced rate (as in this case, with an average of 0.72).

Table 1: Distribution Rates for Imputation Credits

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Firm A Firm B Firm C

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Pre-Tax Profit $100 $101 $101

Company Tax $30 $30.3 $30.3

Post-Tax Profit $70 $70.7 $70.7

Retention $15 $25 $15.15

Dividends $55 $45.7 $55.55

Max Credits Attachable $23.6 $19.6 $23.8

Distribution Rate 0.78 0.65 0.79

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Frontier (2016b, para 35) also seems to argue that the seven firms examined by Lally (2016a, section 3.5), for the purpose of assessing whether the distribution rate is positively or negatively correlated with the extent of foreign activities, are too few to draw conclusions from. However the purpose of the exercise is to estimate the imputation credit distribution rate of the market, these seven firms collectively account for 79% of the taxes paid to the ATO by the 20 largest ASX firms, and the latter account for 62% of the value of the equity in the ASX200 (Lally, 2014, page 30). Furthermore, the last ten of these firms only raised the share of the ASX200 from 50% to 62%. Thus, the set of firms is large and the gains from further increases in the sample size would be small. Put another way, if a market comprised 100 firms of equal size, sampling 90 of them would clearly be sufficient. If those 90 merged into a single firm, sampling that single firm would provide the same information as before and therefore be equally good. So, the number of firms sampled is not important; it is the collective size of those firms that is important.

Frontier (2016b, section 3) notes that gamma is the product of the distribution rate for credits (credits distributed/credits created) and the utilization rate (credits utilized/credits distributed), that concerns about the reliability of the credits distributed from the ATO data do not affect the estimate of gamma, and therefore such ATO data is useful for estimating gamma. However, this argument has a number of shortcomings. Firstly, in addition to the estimate of gamma appearing within the cash flows, the Officer model requires an estimate of the utilization rate in order to estimate the MRP, that estimate would have to use the ATO data if gamma were estimated from the ATO data, and the unreliability of the ATO data in estimating the utilization rate (which Frontier now seems to accept) would then be problematic. Secondly, such an approach requires recourse to the same set of companies for estimating both the utilization and distribution rates, there is no necessity to do so, and good reason for not doing so (because one would not want to use unlisted firms for estimating the distribution rate, which is firm-specific, whilst one would want to use all firms to estimate the utilization rate because it is a market-wide parameter). Thirdly, whilst the problems in the ATO data *may* be limited to the credits distributed (because the data offers two conflicting estimates of that quantity, from dividend data and franking account balance data), the credibility of the entire ATO database is damaged by both the conflicting estimates of the distribution rate and the inability of the ATO to identify the source of that conflict.

Frontier (2016b, para 48) also asserts that gamma estimated from ATO data would be an upper bound, because the redemption proportion estimated from ATO data (credits redeemed/credits distributed) would be an upper bound on the estimate for theta, for reasons given by the ACT (2016). Frontier does not elaborate upon these reasons. However, the ACT (2016, para 1093, 1095, 1066) argues that the redemption rate is an upper bound on the estimate of theta, due to time delays, administrative costs in distributing the credits, portfolio effects, and the effect of the 45 day rule. Given the ACT’s belief that theta is the market value of the credits, and the fact that these phenomena would depress the market value of the credits, this would seem to follow. However, as noted in Lally (2016b, page 41), the ACT’s belief that theta is by definition the market value of the credits is wrong; it is a weighted-average of investors’ utilization rates for the credits, and this alone undercuts their reasoning. Furthermore, the inability to reliably estimate the redemption rate from ATO data would also preclude any such estimate being an upper bound on theta.

Frontier (2016b, paras 60-67) argues that tax-induced trading around ex-dividend days would “inflate” the estimate of the utilization rate, and cites McKenzie and Partington (2011, pp. 9-10) in support of this. Frontier’s statements could reasonably be interpreted as claiming that such trades impart an upward bias to estimates of the utilization rate. However, McKenzie and Partington make no such claim. Furthermore, the statements quoted by Frontier represent a summary from McKenzie and Partington of only two of the many papers examined by them. Subsequently, in expressing their own views, McKenzie and Partington (2011, page 10) state that “Arbitrageurs can be engaged in both dividend avoidance (eg: foreign investors with lower franking credit values) and dividend capture (eg: domestic investors with higher franking credit values).” The latter of these activities would raise the estimate of the utilization rate but the former would have the reverse effect. McKenzie and Partington (2011, page 11) also state that “..if short-term traders did determine prices, then the observed price drop would underestimate the value of dividends and franking credits…” due to the effect of transactions costs. McKenzie and Partington (2011, page 13) also summarise results from various papers that examine contemporaneous trades on cum and ex-dividend shares, which suggests that the dividend drop-off studies give “downward biased estimates of dividends and franking credit value.” Thus, Frontier’s claim that McKenzie and Partington (2011) believe that tax-induced trading around ex-dividend days would “inflate” the estimate of the utilization rate is wrong.

To explore this matter further, suppose that the utilization rate *U* (the weighted-average over investors’ utilization rates) is 0.50. So, if the share price cum-dividend were *PC* = $100, *D* = $4, *IC* = $2, and dividends and capital gains are taxed at the same rate, then the expected ex-div share price consistent with *U* = 0.50 would be $95 as follows:[[6]](#footnote-6)

 (1)

Thus, if the expected share price ex-div were determined in this fashion, then a regression of the actual share price change around the ex-day on the cash dividend and the imputation credits would yield an expected coefficient on the credits of 0.50, and therefore would be an unbiased estimator of *U*. However, at such an expected ex-div share price of $95, investors who could use the credits would be tempted to buy cum-div at $100 and sell at the expected ex-div price of $95, thereby receiving a dividend of $4 and imputation credits of $2, yielding an expected pre-tax profit of $1. Their efforts in doing this would drive the expected price drop up from $5. However, such activity would be discouraged by the transactions costs and risks of holding shares around the ex-day, and these risks would be aggravated by the need to hold the shares for 45 days in order to obtain the credits. Furthermore, investors who could not use the credits would also change their behavior. Shorting the cum-div shares and buying at the ex-div price may not be feasible. However, with the expected price drop of $5, investors who could not use the credits but who held the shares at the cum-div date and desired to hold them in the long-term would be tempted to sell cum-div and repurchase ex-div, yielding an expected capital gain of $5 and loss of a dividend of $4, for a pre-tax expected profit of $1. Their efforts in doing so would drive the expected price drop below $5. Furthermore, investors who could not use the credits and were holding the shares at the cum-div date but were also planning to sell them would be more inclined to sell cum-div rather than ex-div if the expected price drop were $5, thereby receiving $100 rather than $95 and losing the dividend of $4 for a pre-tax expected gain of $1, and the effect of doing so would also reduce the expected price drop. Furthermore, investors who could not use the credits and were not holding the shares at the cum-div date but were planning to buy them would be more inclined to buy ex-div rather than cum-div if the expected price drop were $5, thereby paying $95 rather than $100 and losing the dividend of $4 for a pre-tax expected gain of $1, and the effect of doing so would also reduce the expected price drop. The last two types of transactions would also be free of any incremental transactions costs and the penultimate case would also involve less risk rather than more (by selling at the known cum-div price rather than the unknown ex-div price). Accordingly, their frequency relative to the other types of transactions would rise and this too would drive the expected price drop towards $4. These four types of transactions and their net impact on the investor are shown in Table 2.

Table 2: Profits from Tax Motivated Trades Around Ex-Dividend Day

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Local Foreigner Foreigner Foreigner

Buy, Sell Sell, Buy Sell cum-div Buy ex-div

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Cum Price -$100 $100 $100 $100

Ex Price $95 -$95 -$95 -$95

Dividend $4 -$4 -$4 -$4

Imputation Credits $2 0 0 0

Profit $1 $1 $1 $1

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The net effect of all of these transactions could produce an expected price drop anywhere in the range from $4 to $6. If the expected drop were $5.60, comprising the cash dividend of $4 and $1.60 for the credits (80% of their face value) as follows



then regressing the price change on the cash dividends and the imputation credits would produce an expected coefficient on the credits of 0.80, which would exceed the utilization rate (of 0.50). So, the coefficient would be significantly biased up.[[7]](#footnote-7) Alternatively, if the expected drop were $4.40, comprising the cash dividend of $4 and $0.40 for the credits (20% of their face value of $2) regressing the price change on the cash dividends and the imputation credits would produce an expected coefficient on the credits of 0.20, which would be less than the utilization rate (of 0.50). So, the coefficient would be significantly biased down. Thus, Frontier’s belief that tax-induced trading around ex-dividend days would necessarily “inflate” the estimate of the utilization rate is wrong; such trading could drive the estimate of the utilization rate in either direction, and there is no apparent means of determining which is the case.

Frontier (2016b, para 78) cites Ainsworth et al (2015, page 17) in support of the claim that imputation credits do not add to the value of a business. This claim is false. Ainsworth et al (2015, page 17) summarise evidence on the value of credits and conclude that “imputation credits are priced at about $0.38 in the dollar”. Ainsworth et al (ibid) also note that some types of studies point to no valuation impact but they are sceptical of such studies. Thus, Frontier are misrepresenting Ainsworth et al (2015) by selective referencing.

Frontier (2016b, paras 79-80) cite Ainsworth et al (2015, page 27) in respect of the claim that Australian companies in general do not explicitly take account of imputation credits in their assessment of investment projects. However, Frontier fails to note that Ainsworth et al (2015, page 26) approvingly cite another paper that argues that there are potentially offsetting errors from not explicitly accounting for credits and that this mitigates the consequences of not explicitly accounting for them. So, again, Frontier are misrepresenting Ainsworth et al (2015) by selective referencing. Furthermore, Lally (2013, section 3.7) argues that, even without explicit allowance for imputation credits, practitioners will on average correctly value firms in a world in which the utilization rate is positive so long as they correctly estimate the values of other parameters, and therefore the crucial issue is not whether practitioners explicitly allow for the utilization rate but what value for the utilization rate is embedded in market prices and whether analysts reflect this in their estimate of the MRP. Frontier (2016b, footnote 37) are aware of Lally (2013), because they cite it on another matter, but do not cite it on this point.

Frontier (2016b, paras 82-87) cite Ainsworth et al (2015, page 14) in support of the claim that the AER’s approach to estimating the utilization rate is “inconsistent with standard economic concepts of equilibrium”. In turn, Ainsworth et al (2015, page 14) make numerous critical comments about what they call the “aggregation approach” of Monkhouse (1993) and Lally and van Zijl (2003). The first of these claims is that the aggregation approach assumes that investors have found their equilibrium position and thus does not directly address how the market equilibrium emerges (Ainsworth et al, 2015, page 27). The exact nature of their concern is not clear to me. Prima facie, their point is that this aggregation approach should be accompanied by a description of the mechanics by which equilibrium is attained, which would be something of the following kind:

*Equilibrium is attained by each investor treating prices as given, estimating expected returns and the covariance matrix, and choosing a portfolio (desired units for each asset) that maximizes their expected utility. If the aggregate of these desired holdings over all investors matches the supply for each asset, equilibrium has been attained. If not, the assets with excess demand will face upward price pressure and those with insufficient demand will face downward price pressure. These prices will continue moving until equilibrium has been attained.*

However, the failure to append such a description to the aggregation approach could not constitute a criticism of the approach itself, or even constitute an unwarranted omission (because the mechanics by which equilibrium is attained could be expected to be understood by any reader of this literature). So, their concern is presumably otherwise.

Alternatively, Ainsworth et al (2015) may be simply questioning where the equilibrium condition arises in the derivation of these aggregation models. I therefore elaborate upon this issue for the model of Lally and van Zijl (2003). Defining *Ki* to be the tangency portfolio chosen by investor *i*, *wi* to be the fraction of risky assets desired by investor *i*, *Rm* to be the rate of return on the market portfolio, and *Rki* to be the rate of return on portfolio *Ki*, Lally and van Zijl (2003, page 194) note that the following condition must be satisfied when aggregating across investors:

 (2)

This is a consequence of the equilibrium condition. To see this, letting *xj* denote the market weight of asset *j* and *wij* the desired weight of risky asset *j* in the tangency portfolio of investor *i*, the last equation is equivalent to:



The order of addition does not affect the result, and therefore the last equation is equivalent to



The bracketed term here is the desired weight of asset *j* in the aggregate portfolios of all investors, and is denoted *wj*. So, the last equation is



This implies that *wj* = *xj* for each asset *j*. In plain English, this says that the aggregate demand for each asset equals its supply. So, equation (2) is a consequence of the equilibrium condition. However, if Ainsworth et al (2015) are simply questioning where the equilibrium condition arises in the derivation of these aggregation models, it is simply a request for clarification rather than a criticism of the approach itself. So, again, their concern is presumably otherwise.

Alternatively, since Ainsworth et al (2015) contrast this aggregation approach with a “marginal investor” approach as shown in their Figure 3, Ainsworth et al’s (2015) concern may instead be that this aggregation approach does not include a graph of demand and supply at each possible level of expected return, as in their Figure 3. However, the expected return in Figure 3 is for the market portfolio, it assumes that investors are risk neutral, and it treats the ERP and the dividend yield as exogenous. By contrast, equilibrium requires the matching of demand to supply for each asset. Thus, one would require a figure of this kind for every asset, not simply for the market. Furthermore, for any such asset, the aggregate demand would depend not only on the expected rate of return on that asset but the expected rates of return on all assets. In addition, investors are risk averse, and therefore the aggregate demand for any asset would also depend upon the covariance matrix and the utility functions of all investors. This cannot be reduced to a two-dimensional diagram as in Figure 3. Even if it could, the utility functions chosen would be entirely speculative and therefore the exercise would serve only to illustrate one of the numerous possible scenarios. Furthermore, the ERP and the dividend yield are endogenous to the equilibrium process rather than exogenous. So, Figure 3 does not reflect the process by which equilibrium is attained and is at best a highly simplified version of it. The actual process by which equilibrium would be attained has been provided earlier. So, again, nothing here constitutes a criticism of the aggregation approach. In summary, I cannot discern any criticism of the aggregation approach resulting from Ainsworth et al’s (2015, page 14) claim that this approach assumes that investors have found their equilibrium position and thus does not directly address how the market equilibrium emerges.

Ainsworth et al’s (2015, page 14) second claim is that there is “no clear consensus on the appropriate approach” to pricing imputation credits, with the choices being the aggregation approach of Monkhouse (1993) and Lally and van Zijl (2003) or the marginal investor approach (as in Figure 3). I do not think that this claim is correct. As explained above, Figure 3 is not an alternative to the aggregation approach but at best a highly simplified version of that process. Furthermore, since the AER uses the Officer (1994) model, as do all Australian regulators, the relevant approach to pricing imputation credits must be that reflected in a rigorous derivation of the model, and this appears in Lally and van Zijl (2003). Having chosen the Officer model, which is an “aggregation approach”, the regulator is not free to then choose an alternative approach to pricing imputation credits.

Ainsworth et al’s (2015, page 14) third claim is that “both approaches are often applied as if tax were the only determinant of differences in demand”. Again I do not think that this claim is correct in respect of the aggregation approach. As with all versions of the CAPM, risk aversion of investors is recognized and therefore the demand for an asset is affected by its volatility and its correlation with all other assets. This is reflected in the fact that all CAPMs contain the parameter beta, which is determined by the asset’s volatility and its correlations with other assets.

In summary, I do not think that there is anything in the analysis by Ainsworth et al (2015, page 14) that would support Frontier’s claim that the aggregation approach is “inconsistent with standard economic concepts of equilibrium”. Furthermore, it would be remarkable if this were the case because the “aggregation approach” is the CAPM and the CAPM is the standard equilibrium economic model for pricing financial assets. Frontier (2016b, paras 82-84) adds the claim that the “AER’s aggregation approach simply counts up the number of credits that are distributed to domestic investors and assumes that those investors value all credits at the full face amount and that this is reflected in the equilibrium share price and cost of capital”. The AER adopts the Officer (1994) CAPM, as do all Australian regulators. Having made that choice, the AER must then adopt definitions for parameters within that model in accordance with a rigorous derivation of the model. This leads to the utilization rate being defined as the weighted average over investors’ utilization rates for imputation credits. Consistent with Australian tax law, the AER (sensibly) adopts utilization rates of 1 and 0 for local and foreign investors respectively. Frontier’s critique is clearly referring to this process, but fails to identify which part of it they object to and why. Presumably, their objection is to defining a parameter within a model (the utilization rate) in accordance with a rigorous derivation of the model, but such an objection has no merit. Parameters must be defined in accordance with a proof of the model; they cannot be defined according to the whims or the intuition of an observer.

Frontier (2016b, paras 91-93) argues that the AER’s practice of dividing the estimated coefficient on the imputation credits in a DDO study by the estimated coefficient on the cash dividend, to produce an estimate of the utilization rate on credits, is unwarranted. In particular, they argue that if the estimated coefficient on cash dividends is less than 1, the effect of dividing this estimated coefficient into the estimated coefficient on the credits is to increase the estimate of the utilization rate, which reduces the allowed revenues under the Officer model. By contrast, if the coefficient on cash dividends is less than 1, this implies that shareholders do not value dividends as highly and would therefore require higher revenues. So, the AER’s behavior is in the opposite direction to that required. This argument is wrong. Using DDO studies to estimate the utilization rate *U* (the weighted average over investors’ utilization rates) presumes that the expected price change around ex-day net of capital gains tax (at rate *Tg*) is equal to the gross dividend (cash *D* plus proportion *U* of the imputation credits *IC*) net of dividend tax (at rate *Td*):[[8]](#footnote-8)



Removing the expectation, and therefore recognizing a noise term (*e*), followed by dividing through by (1 –*Tg*) yields the following regression model:

 (3)

This is a regression of *ΔP* on *D* and *IC*, which is one form of a DDO study (the others are variants of this). Letting the tax ratio (1 – *Td*)/(1 – *Tg*) be denoted *δ*, then the coefficient on cash dividends in equation (3) is *δ* and that on franking credits is *δU*. Dividing the estimated coefficient on the franking credits by that on cash dividends then produces an estimate of *U*. Thus, if *δ* falls, so does the coefficient *δU* on the credits, and dividing the latter by the former will not change the estimate of *U*. So, Frontier’s claim that a fall in *δ* will reduce the estimate of *U* is false.

Furthermore, if *δ* is less than 1, it implies that shareholders do not value dividends as highly as capital gains, but this does not imply that regulatory revenues must be increased. Starting at a position in which dividends and capital gains are equally taxed, and hence *δ* = 1, a reduction in capital gains tax would cause *δ* to fall below 1, but the tax reduction would warrant a reduction in regulatory revenues if the model for determining these revenues recognized such effects (which the Officer model does not because it assumes that *δ* = 1). Alternatively, starting at a position in which dividends and capital gains are equally taxed, and hence *δ* = 1, an increase in tax on dividends would cause *δ* to fall below 1, and the tax increase would warrant an increase in regulatory revenues if the model for determining these revenues recognized such effects (which the Officer model does not). Thus, even if the Officer model did provide for such personal tax effects (which it doesn’t because it assumes that *δ* is 1), a fall in *δ* does not imply that regulatory revenues should be increased. For both reasons, Frontier’s claim that a fall in *δ* warrants an increase in regulatory revenues is wrong. The source of Frontier’s errors here is the failure to appreciate that *δ* reflects the relative levels of the personal tax rates on cash dividends and capital gains.

Frontier (2016b, paras 94-95) also argues that, since the AER adopts the Officer (1994) model and this model assumes that *δ* = 1, the AER should act as if *δ* = 1 when estimating the utilization rate on credits from the estimated coefficient on the credits in a DDO study.[[9]](#footnote-9) To assess this point, suppose that *U* = 0.5 and *δ* = 0.80 (because dividends are taxed at a higher rate than capital gains). Accordingly, the coefficient on the credits in the regression model shown in equation (3) would be 0.40. Suppose further that this coefficient and *δ* were both accurately estimated. In this case, dividing the estimate of the coefficient on the credits (0.40) by the estimate of *δ* (0.80) as the AER does would produce an accurate estimate of *U* (of 0.50). By contrast, Frontier would estimate *U* at 0.40. So, Frontier’s approach would give rise to a biased estimate of *U*, and is therefore undesirable. The fact that the Officer model assumes that *δ* = 1 is a shortcoming in the model, which should not be compounded by using a biased estimate for a parameter in the model.

1. **Questions from the AER**

The AER has posed a number of questions about the Frontier (2016b) paper, and these are now addressed.

Firstly, the AER has asked whether the distribution rate for the BEE should be determined by listed equity, all equity, both listed and all equity, or some other measure. As discussed in the previous section, unlisted firms are unsuitable because their distribution rates seem to be much lower than for listed firms (50% versus 75%, as reported in Frontier, 2016a, Table 1), the likely cause of this is lower dividend payout rates (of which the extreme case is sole traders who corporatize to reduce their taxes, which requires a low dividend payout rate), and regulated businesses are either listed or subsidiaries of firms that are (see Lally, 2016b, pp. 34-35). Thus, listed firms should be used to estimate the distribution rate of the BEE.

Secondly, the AER has asked whether it is appropriate to use the largest 20 listed firms to estimate the distribution rate. As discussed in the previous section, ATO data on the distribution rate is unreliable because it generates markedly different estimates of the credits distributed according to whether dividend or company tax data is used. So, the only suitable means of estimating the distribution rate of (listed) firms (stripped of the effect of foreign activities) is from their financial statements. In doing so, the goal is to estimate the aggregate distribution rate of these (listed) firms (stripped of the effect of foreign activities), and therefore the best ones to examine are the largest companies. The top 20 of these firms account for 62% of the value of the equity in the ASX200 (Lally, 2014, page 30), and the last ten of these firms raised the share of the ASX200 that was examined from only 50% to 62%. Thus, the sample is large in value terms and the gains from further increases in the sample size would be small. This is the approach in Lally (2016a, section 3.5), leading to an estimate for the distribution rate of the BEE of at least 0.83.

Thirdly, the AER notes that Frontier submits that foreign income allows more imputation credits to be distributed, that Lally (2016a) shows that foreign income is negatively related to imputation distribution, that Frontier considers that Lally has not controlled for the difference in the dividend payout rates, and therefore seeks my views on Frontier’s response. As discussed in the previous section, Frontier fails to offer any argument for controlling the dividend payout rate, and none is evident. Furthermore, since the purpose of the exercise is to estimate the distribution rate of the market without foreign activities from a set of firms (some or all of which have foreign activities), one must strip out *all* phenomena that arise from foreign activities, which comprise not only the foreign income but any change in the dividend payout rate arising from foreign activities. Controlling for any changes in the dividend payout rate would subvert that purpose.

Fourthly, the AER has asked whether it is reliable to estimate gamma directly as the ratio of credits redeemed to credits created using ATO data. As discussed in the previous section, this approach has three shortcomings. Firstly, in addition to the estimate of gamma appearing within the cash flows, the Officer model requires an estimate of the utilization rate in order to estimate the MRP, that estimate would have to use the ATO data if gamma were estimated from the ATO data, and the unreliability of the ATO data in estimating the utilization rate (which Frontier seems to accept) would then be problematic. Secondly, such an approach requires recourse to the same set of companies for estimating both the utilization and distribution rates, there is no necessity to do so, and good reason for not doing so (it is not desirable to use unlisted firms for estimating the distribution rate, which is firm-specific, whilst it is desirable to use all firms to estimate the utilization rate because it is a market-wide parameter). Thirdly, whilst the problems in the ATO *may* be limited to the distribution rate (because the data offers two conflicting estimates of that rate), the credibility of the entire ATO database is damaged by the conflicting estimates of the distribution rate.

Fifthly, if the ATO data is reliable, the AER has asked whether they would produce an upper bound estimate for gamma of 0.34 for the BEE, and whether they could be used as a point estimate for gamma for the BEE. As discussed in the previous section, the ACT (2016, para 1093, 1095, 1066) argues that the redemption rate is an upper bound on the estimate of theta, due to time delays, administrative costs in distributing the credits, portfolio effects, and the effect of the 45 day rule. Given the ACT’s belief that theta is the market value of the credits, and that these phenomena would depress the market value of the credits, this would seem to follow. However, as noted in Lally (2016b, page 41), the ACT’s belief that theta (as defined within the Officer model) is by definition the market value of the credits is wrong (it is a weighted-average of investors’ utilization rates for the credits), and this alone undercuts their reasoning. Nevertheless, if the ATO data were reliable, they would produce an upper bound on the estimate for the utilization rate because Australian investors would tilt their portfolios towards stocks with imputation credits (see Lally, 2016a, page 19). However, the ATO data are not reliable and therefore the most that could be said is that the estimate of this parameter using ATO data would be biased up.

Sixthly, the AER has asked whether there are issues with using DDO studies to estimate theta and how material they are. These problems are summarized in section 2. Collectively, these drawbacks are so severe as to warrant giving the lowest weight on the results from these studies.

Seventhly, the AER has asked whether DDO studies provide an appropriate post-company tax (pre-personal tax and cost) estimate of the value of distributed imputation credits that is consistent with the post-tax WACC required by the National Electricity Rules. These rules are not very specific on the cost of capital, and grant considerable discretion to the regulator; in respect of the NER, the relevant rules are in clause 6.5.2 (AEMC, 2016). However, clause 6.5.3 requires allowance for the “value of imputation credits” and in such a way as to point to use of the Officer (1994) model, which all Australian regulators use. This model is post-company tax and pre-personal tax. DDO studies provide an estimate of the utilization rate on credits that is consistent with this, as explained in section 3. By contrast, in respect of personal costs, the Officer model specifies the cost of equity pre personal costs (and hence *U* is defined pre personal costs) whilst the estimate of the utilization rate from DDO studies would be lowered by any personal costs other than taxes. To see this, suppose that all investors can use the imputation credits (so *U* = 1), capital gains are taxed at the same rate as dividends, and the transactions costs associated with the credits are proportion *k* of the credits. Following the earlier analysis leading up to equation (3), the price change around ex-day would then be the sum of the cash dividend *D*, proportion (1- *k*) of the imputation credits *IC*, and the noise term *e*:



Accordingly, the coefficient on the credits would be (1- *k*) rather than 1. Regressing the price change on *D* and *IC* would then produce an expected coefficient on the credits of (1 – *k*), and therefore the estimate of *U* would be biased down. Nevertheless, as discussed in the previous section, these transactions costs are trivial and therefore this conceptual inconsistency is without practical significance. A potentially more important issue is transactions costs on the purchase and sale of shares. If these are proportion *ks* of the price change, the last equation becomes



and so



So, if *kS* exceeds *k*, the effect of these transactions costs is that the estimate of *U* is biased up rather than down.

Eighthly, the AER has asked whether increased trading around the ex-dividend date is an issue for estimating theta from DDO studies, whether the increased trading increases the theta estimate in such studies, and whether this implies that the DDO studies overestimate theta. As discussed in the previous section, such trading could exert either an upward or a downward effect upon the estimate of theta, the effect could be material, and there is no apparent means of determining which of these two cases applies. This is one of the many disadvantages of the DDO methodology.

Ninthly, the AER has asked me to critically review the comments by Frontier (2016a) on the Ainsworth et al (2015) paper. As discussed in the previous section, Frontier either misrepresents points made by Ainsworth et al (2015) or the comments made by Ainsworth et al (2015) and referred to by Frontier are themselves incorrect.

Tenthly, the AER has asked whether theta estimates from DDO studies should generally be adjusted in order to make them consistent with the post-company tax (pre-personal tax and cost) framework in the NGR/NER. As discussed earlier, the only adjustment to the coefficient on imputation credits in a DDO study that is feasible is to divide by the estimated coefficient on the cash dividends.

Eleventhly, the AER has asked me to assess Frontier’s claim that, since DDO studies determine that dividends are worth less than their face value, the total revenues of a regulated firm should be increased not decreased. As discussed in the previous section, I do not agree with this claim. DDO studies show that dividends are not valued as highly as capital gains rather than showing that dividends are worth less than their face value. Furthermore, this does not imply that regulatory revenues should be increased.

Finally, the AER has asked me to assess Frontier’s claim that the AER is inconsistent by making adjustments for cash dividends being worth less than face value and then estimating the cost of equity assuming that cash dividends are worth face value. As discussed in the previous section (see footnote 8), in framing this argument, Frontier (2016a, paras 94-95) equates cash dividends being worth face value with a coefficient on cash dividends in a DDO (*δ*) that is equal to 1. Since the words “worth face value” are unclear, and the Officer model assumes that *δ* = 1, I have analysed Frontier’s argument expressed in terms of *δ* = 1. As discussed in the previous section, Frontier is correct to observe that there is an inconsistency here but acting as if *δ* = 1 when estimating the utilization rate from a DDO study would give rise to a biased estimate of the utilization rate, and is therefore undesirable. The fact that the Officer model assumes that *δ* = 1 is a shortcoming in the model, which should not be compounded by using a biased estimate for a parameter in the model.

1. **Further Questions**

The AER has posed a further set of questions, which are addressed here. The first of these is whether the AER’s approach to estimating gamma (post company tax and before personal costs and taxes) is consistent with the way that the AER estimates the cost of equity. The AER estimates the cost of equity using the Officer model, gamma is a parameter within that model, and therefore the AER must estimate gamma as defined within the Officer model. A rigorous derivation of the Officer model (Lally and van Zijl, 2003) reveals that gamma is the product of the distribution rate for credits (the proportion of company taxes paid to the ATO that are attached to dividends as credits) and a utilization rate for credits (a weighted-average over investors’ utilization rates for the credits). The methods used by the AER for estimating these two parameters are consistent with their definitions.

The AER’s second question is whether the AER’s approach to estimating gamma (post company tax and before personal costs and taxes) is likely to lead to an overall revenue allowance to equity holders (inclusive of the value of imputation credits to equity investors) that is at least sufficient to contribute to an allowed return on capital that would be expected to meet the Allowed Rate of Return Objective. As discussed in Lally (2016a), I favour an estimate for theta of 1. In addition, conditional upon recognizing the existence of foreign investors when estimating theta as the AER does, I favour an estimate of theta of 0.60. Coupled with an estimate for the distribution rate of at least 0.83, my estimate for gamma is therefore at least 0.50. Accordingly, I consider the AER’s estimate of 0.40 to be too low.

The AER’s third question is whether transaction costs associated with imputation credits are likely to be material. These costs consist of retaining the notice relating to the credits that accompanies the dividend payment and a few minutes additional time in the course of filling out a tax return. This is trivial.

The AER’s fourth question is whether the transaction costs associated with imputation credits will be reflected in the observed MRP. Such costs will lower the value of equities, thereby raising the expected rate of return on the market, and hence also raise the MRP. Any empirical estimate of the MRP would then reflect these costs.[[10]](#footnote-10) As discussed in Lally (2016a, pp. 9-10), in principle, such costs should also be explicitly recognized in the valuation model but failure to do so would not matter if beta were equal to 1, because in that case the omissions net out in the denominator and numerator of the valuation formula, leaving only the increment in the MRP and this would be empirically recognized. To better appreciate this point in a regulatory context, let *OPEX* denote the allowance for operating cash flows before company tax, *TAX* the allowance for company tax payments by the firm, *DEP* the depreciation allowance, *Rf* the risk-free rate before personal tax and other personal costs, *Rm* the rate of return on the market portfolio exclusive of imputation credits and also before personal tax and other personal costs, *Qm* the ratio of imputation credits attached to dividends on the market portfolio to the value of that portfolio one year earlier, *β* the beta for this firm, *A* the regulatory asset book value, *F* the distribution rate for the firm’s credits, and *θ* the utilization rate for the credits. The expected revenues allowed by the regulator under the Officer (1994) model would then be as follows (for an all-equity firm):

 (4)

Letting *C* denote the transactions costs of the imputation credits for this firm (per dollar of regulatory asset book value *A*), and *Cm* its counterpart for the market portfolio, recognition of these costs would transform equation (4) as follows:



 (5)

Using equation (5), the increment to *E*(*Rm*) resulting from these costs would be offset by *Cm* in the MRP, and therefore the allowed revenues would rise in accordance with *C*. So, if beta were 1 (and *C* were equal to *Cm*), equations (4) and (5) would be equivalent because *C* and *Cm* would then offset. Thus, the use of equation (4) rather than (5) would not matter if beta were 1 (and *C* were equal to *Cm*). However, with the AER’s beta of 0.70, the use of equation (4) rather than (5) would imply that 30% of these costs were not compensated for because the increment to *E*(*Rm*) would be multiplied by 0.70. This is not a material issue because these costs are very small (as a proportion of the imputation credits), as discussed in the previous paragraph, and 30% of them would be even less significant.

The AER’s fifth question is whether, in light of the answers to the two previous questions, any upward adjustment to the AER’s MRP estimate is required to ensure that investors are compensated at least sufficiently for incurring any transactions costs associated with claiming imputation credits. As discussed in the previous paragraph, no such adjustment to the MRP is required because empirical estimates of the MRP will reflect the existence of any such costs. However, in principle, what is required is explicit allowance for such costs in the valuation model but, as discussed in the previous two paragraphs, the impact of this omission would be trivial.

The AER’s last such question is whether the AER’s current gamma estimate of 0.40 remains appropriate to ensure that regulated firms expect to receive a cost of equity capital (inclusive of imputation credits) that is at least sufficient to meet the ARORO. As discussed in Lally (2016a), I favour an estimate for theta of 1. In addition, conditional upon recognizing the existence of foreign investors when estimating theta as the AER does, I favour an estimate of theta of 0.60. Coupled with an estimate for the distribution rate of at least 0.83, my estimate for gamma is therefore at least 0.50. Accordingly, I consider the AER’s estimate of 0.40 to be too low.

1. **Conclusions**

This paper has addressed a set of questions raised by the AER about two recent papers from Frontier, and a number of additional questions about gamma. I have also reviewed the two papers by Frontier. The first of these Frontier papers involves rerunning the DDO methodology invoked in earlier papers by SFG, but using a larger data set, and produces very similar results. However, as with the earlier papers by SFG, this methodology suffers from 12 significant problems in providing an estimate of the utilization rate for the imputation credits. The second of these Frontier papers raises a number of new arguments relating to gamma, and cites a number of papers in support of its views. However, I do not agree with any of the new arguments raised by Frontier, or the arguments raised by these other authors, and I also consider that most of Frontier’s claims concerning support from other authors involves Frontier misrepresenting the views of these other authors.

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1. The analysis on this question by Vo et al (2013) does not apply a market adjustment to the ex-dividend share price. However, Mero et al (2017, Figure 1, Figure 2, Figure 3) reruns the analysis with this adjustment and still finds significant variation in the estimates for the coefficient on the credits as the extreme observations are deleted. For example, their estimated coefficients range from 0.3 to 0.55 for Model 3 with OLS and from 0 to 0.35 for Model 4 with OLS. [↑](#footnote-ref-1)
2. Mero et al (2017) conduct a number of formal tests of these models. Remarkably, they find that only Model 4 fails the heteroscedasticity test despite the fact that SFG (2011) develops it in order to address this problem and Frontier (2016a) favours it. [↑](#footnote-ref-2)
3. In presenting the questions posed by the AER, I use the AER’s words. However, in responding to the questions, I avoid language that is ambiguous. In particular, the word “theta” could refer to the coefficient on the credits in a DDO or to the parameter in the Officer (1994) model, and these two uses are not equivalent. Accordingly, I refer to the “coefficient on the credits in a DDO” or the “utilization rate for the credits” as appropriate. [↑](#footnote-ref-3)
4. The assumption that capital gains are taxed at the same rate as (gross) dividends is adopted purely to simplify the example. An example will be shown later in which this assumption is relaxed. [↑](#footnote-ref-4)
5. Table 11 is actually labelled Table 8, but should be labelled Table 11. [↑](#footnote-ref-5)
6. At Australia’s current tax rate of 30%, the maximum credits that could be attached to a $4 dividend would be $1.71 rather than $2, but the figure of $2 is used to simplify the presentation. [↑](#footnote-ref-6)
7. In this example, the personal tax rates on capital gains and dividends are assumed to be equal, and therefore the expected coefficient on cash dividends would be 1. So, no adjustment to the estimated coefficient on the credits would be required in order to produce an estimate of the utilization rate. [↑](#footnote-ref-7)
8. This reduces to equation (1) if the tax rates *Tg* and *Td* are equal. However, the discussion following equation (1) demonstrates that tax arbitrage may push the coefficient on the credits within the gross dividend above or below the utilization rate *U*. However, for the purposes of examining Frontier’s current argument, it is necessary to ignore tax arbitrage so as to focus upon their argument. [↑](#footnote-ref-8)
9. In expressing this point, Frontier equates *δ* = 1 with cash dividends being valued at face value. However, the phrase “valued at face value” is much less precise than *δ* = 1, the latter is assumed in the Officer model, and I have therefore examined Frontier’s argument expressed in terms of *δ* = 1 rather than in terms of cash dividends being “valued at face value”. [↑](#footnote-ref-9)
10. MRP estimates using historical data would only incorporate these costs from 1987, when imputation was introduced. [↑](#footnote-ref-10)