

GAMMA AND THE ACT DECISION

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EXECUTIVE SUMMARY

The Australian Competition Tribunal has recently released a decision on a number of matters including the appropriate method for estimating gamma. In response, the AER has posed a series of questions to me. My principal conclusions are as follows.

Firstly, within the Officer model, theta is a weighted average over the utilization rates for imputation credits by individual investors and these utilization rates are 1 if investors can use the credits and zero otherwise. So, theta is not the market value of the credits. Transactions and administrative costs incurred by investors in dealing with these credits cannot be dealt with by reducing the estimate for theta and, if considered important (which I do not think to be the case) would have to be addressed through an extension to the Officer model. Furthermore, this extension would only matter to the extent that the firm's equity beta differed from 1. Otherwise, such costs that are reflected in the empirical estimate for the MRP that is used by the regulator would deal with this issue.

Secondly, the AER's approach to imputation credits is consistent with the post-tax framework in the NER and NGR. This framework determines the allowance for company taxes but gives discretion over the cost of equity to the AER subject to it reflecting the market situation, being nominal, and consistent with the treatment of imputation credits in the allowance for company taxes. The AER unsurprisingly chose the Officer model, and rigorous proofs of this model reveal that theta is a weighted average over the "utilization rates" of individual investors, with the utilization rate being 1 for investors who are eligible to use the credits and 0 otherwise. So, theta is not the market value of the credits and therefore does not point to sole or primary use of implied market value studies to estimate this parameter. Such studies are merely one of a number of possible approaches to this matter, consistent with the AER's approach.

Thirdly, theta when properly defined in accordance with the Officer model is not affected by personal tax rates whilst the coefficient on imputation credits in a dividend drop-off study is affected by differences in the personal tax rates on capital gains and dividends, and is therefore a deficient estimate unless a correction is made for this issue. In addition, the cost of equity pre personal tax is affected by differences in personal tax rates on capital gains,

dividends and interest but estimates obtained from the Officer model will in general fail to do so correctly because this model assumes that there are no such tax differences.

Fourthly, conditional upon recognizing the existence of foreign investors when estimating theta, this parameter could be estimated in three different ways. In estimating theta from the proportion of Australian equities held by local investors, I favour the use of all equity rather than only listed equity and therefore an estimate for theta of at least 60%. In addition, estimation errors in either direction could arise from deviations from the assumption that the terms other than the value weights on the RHS of equation (8) are uniform across investors. I do not think that the latter is a substantial issue. Accordingly, the reliability of the estimate is high. Furthermore, since any estimate of theta of this type is subject to errors in either direction, it is *not* an upper bound on an estimate of theta. In addition, a correctly measured redemption rate for credits is an upwardly biased estimator for theta because local investors would tilt towards stocks with high imputation credit yields. Furthermore, since the ATO data from which the redemption rate is estimated contains significant unexplained discrepancies, which give rise to two significantly different estimates of the redemption rate, any such estimate of theta is unreliable. In addition, since the AER chooses the lower of the two possible estimates (0.45) that have been generated from the data source it uses, and the other is 0.62, this possible underestimation of the redemption rate may exceed the upward bias resulting from local investors tilting towards stocks with high imputation credit yields. So, the AER's estimate of 0.45 for the redemption rate is *not* an upper bound on an estimate for theta. In respect of the difference between the AER's estimate of 0.45 for the redemption rate and their estimate for the local ownership proportion of local equity of about 60%, I think the most likely explanation is that the figure of 0.45 is too low. In respect of the impact of the 45 day rule, the rule constrains tax arbitrage and therefore minimizes the gap between the correctly estimated redemption rate and the proportion of Australian equities held by local investors. The rule also prevents some 'genuine' investors from obtaining the credits, and therefore drives down the redemption rate, but this downward effect is unlikely to be significant because 'genuine' investors have the option of changing the timing of their transactions and would have strong incentives to do so. Finally, in respect of dividend drop-off studies as estimators of theta, I concur with the AER's view that they warrant very limited weight for reasons identified by the AER. Accordingly, I think that the equity ownership approach (with an estimate of at least 0.60) should be given most weight because the estimate seems quite reliable, lesser weight should be given to the redemption rate (0.45 to 0.62)

because of the upward bias and the significant discrepancies within the data source used to estimate it, and minimal weight to dividend drop-off studies for reasons identified by the AER (with an estimate of 0.35 from the SFG study relied on by the ACT). So, conditional upon recognizing the existence of foreign investors when estimating theta, this evidence suggests an estimate for theta of about 0.60.

Fifthly, when estimating theta from market-based studies, the estimated coefficient on imputation credits should be corrected using the estimate of the coefficient on cash dividends, so as to remove the effect of other factors affecting the value of imputation credits.

Sixthly, since the distribution rate is a firm-specific parameter whilst theta is a market parameter, theta must be estimated using market-wide data whilst the distribution rate could be estimated using firm, industry, or sector-wide data according to which was judged to provide the best estimate for this firm-specific parameter. So, consistency is *not* essential and I therefore disagree with the AER on this point. Furthermore, pragmatic considerations point to use of sector-wide data of some sort. Since the distribution rates for listed and unlisted businesses are significantly different and (private) regulated businesses are listed or owned by listed parents, the distribution rate for regulated businesses should be estimated from that of listed equity. The choices here are ATO data on all listed equity or financial statement data on a subset of high value firms constituting a majority of the value of listed equity. Since the ATO data contains significant unresolved discrepancies, this favours the use of financial statements for a subset of high value firms and an estimate of this type is 0.83 for the top 20 such firms. Finally, Frontier's claim that firms with significant foreign operations have higher distribution rates than firms without such operations, and are therefore unsuitable for estimating the distribution rate of regulated businesses (which do not have foreign operations), appears to be false and the observed opposite pattern can be explained through the investment of profits required to finance these foreign operations. Accordingly, the effect of these firms with foreign operations being included within the set of firms used to estimate the distribution rate for the benchmark firm (with only local operations) is to underestimate rather than overestimate the distribution rate for the benchmark firm. Thus, the estimate for the distribution rate of 0.83 is likely to be too low for the benchmark firm rather than too high.

Finally, and again conditional upon recognizing the existence of foreign investors when estimating theta, coupling my estimate of the distribution rate of at least 0.83 with my estimate of theta of 0.60 yields my estimate for gamma of at least 0.50. This contrasts with the AER's estimate for gamma of 0.40.

1. Introduction

The Australian Competition Tribunal (ACT, 2016) has recently released a decision on a number of matters including the appropriate method for estimating gamma. In response, the AER has posed a series of questions to me (the TOR is in the Appendix). Before seeking to respond to those questions, I present some background discussion.

2. Background

Australian regulatory practice is to invoke the Officer (1994) valuation model for determining the allowed price or revenues in a regulatory situation. In the interests of focusing upon the crucial issue, I consider the case in which the firm is all equity financed and the expected cash flows are constant. Letting Y denote the firm's cash flows before company tax, TAX the company tax payments made by the firm, R_f the risk-free rate before personal tax and other personal costs, R_m the rate of return on the market portfolio exclusive of imputation credits and also before personal tax and other personal costs, Q_m 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, F the distribution rate for the firm's credits, and θ a parameter whose definition and value are contentious, the value now of the firm is as follows:

$$S = \frac{E(Y) - E(TAX) + E(TAX)F\theta}{R_f + [E(R_m) - R_f + E(Q_m)\theta]\beta} \quad (1)$$

It is uncontentious that “gamma” is the product $F\theta$. Turning now to the parameter θ (“theta”), there are a range of opinions about this including the market value per \$1 of distributed imputation credits.¹ One widely cited authority is clause 6.5.3 of the National Electricity Rules (AEMC, 2016), which defines gamma as the “value of imputation credits”. By implication, θ must be the value per \$1 of distributed credits. However, consistent with finance involving considerable recourse to mathematical formulas, the word “value” in a valuation model is capable of meaning the “numerical level” of a parameter. This has no particular market value connotations, and it would not even be true to say that “value”

¹ I will denote this parameter as theta rather than the utilization rate, because the former is a more neutral term.

ordinarily means market value in this context.² Even the ACT (2016, para 1010) implicitly recognizes that “value” could mean “numerical level” because it defines the distribution rate by using the word “value”, by which they must mean the “numerical level” of this parameter because market value has no application here. Furthermore, the NER is not the arbiter on this matter. Nor is the ACT, despite submissions to that effect (United Energy, 2016). Instead, one must look to the relevant academic literature. This commences with Officer (1994), who implicitly assumes that the distribution rate is 1 and hence gamma and θ are equivalent. Officer (1994) initially defines gamma as the “value of the personal tax credits” (ibid, page 1). This may or may not be intended to mean market value. Subsequently, he defines it as the “proportion of tax collected from the company which gives rise to the tax credit associated with a franked dividend” (ibid, page 4), which clearly is not a market value. He then states that “gamma can be interpreted as the value of a dollar of tax credits to the shareholder” (ibid, page 4), with a footnote to this stating that

“For example, if the shareholder can fully utilise the imputation tax credits then gamma = 1, eg a superfund or an Australian resident personal taxpayer... Where there is a market for tax credits one could use the market price to estimate the value of gamma for the marginal investor...”

This implies that gamma is not a market price and is instead something that can be *estimated* from market prices. Furthermore, Officer provides no formal derivation of his model and therefore it is not possible to determine unambiguously how the parameter gamma is defined in his model. By contrast, papers by Monkhouse (1993) and Lally and van Zijl (2003) provide rigorous derivations of the Officer model. In particular, Lally and van Zijl (2003, section 3) provide a formal derivation of a generalisation of Officer’s model (with the Officer model being a special case). In this derivation, they show that θ is a complex weighted average over the “utilization” rates for imputation credits of all investors holding risky assets, where the weights involve each investor’s investment in risky assets and other terms. Letting U_i denote the utilisation rate for investor i

$$\theta = \sum x_i U_i \tag{2}$$

² Corrs Chambers Westgarth (2015, para 93), in submissions to the ACT, states that “the word ‘value’ ordinarily means worth”. I think this statement true in ordinary usage, but not in the present context of a valuation model.

In respect of U_i , this appears within the definition of the post-tax rate of return on asset j for investor i (R_{ji}), i.e., letting P_j denote the price of the asset at the beginning of the period, ΔP the price change over the period, D_j the cash dividend during the period, IC_j the attached imputation credits, T_i the tax rate on gross dividends received by investor i , and T_{gi} the tax rate on capital gains received by investor i , then:

$$R_{ji} = \frac{\Delta P}{P_j}(1 - T_{gi}) + \frac{D_j(1 + U_i IC_j)}{P_j}(1 - T_{pi}) \quad (3)$$

So, U_i is the augmentation to the cash dividend received by investor i per \$1 of imputation credit. This reflects the *eligibility* of the investor to use the credits; $U_i = 1$ if the investor is eligible to use the credits and 0 otherwise. So, definitionally, θ is *not* the market value per \$1 of distributed credit (although the two might match under particular circumstances). Furthermore, θ cannot be directly determined because all components of the weights in (2) are not observable. So, it must be estimated and a variety of methods have been invoked.

The ACT (2016, paras 1075-1076) dismisses the relevance of Monkhouse (1993) and Lally and van Zijl (2003) on the grounds that these papers are extensions of the Officer (1994) model, and therefore give rise to different definitions of theta. This claim is *not* correct. Although these additional papers are extensions of the Officer (1994) model, they also embrace the Officer (1994) model as a special case. Thus, the definition for theta that appears in these papers *must* also be the definition in the Officer model.

Having established what theta is, I now turn to certain assumptions that underlie equation (3). Firstly, if an investor is eligible to utilize imputation credits, a \$1 increment to IC_j is as good as a \$1 increment to D_j . Secondly, the only subtraction from the dividends received by an investor is personal tax. Thus, there are assumed to be no transactions costs, administrative costs or delays in receiving dividends or the credits. These assumptions are particularly important because these additional phenomena have been the subject of considerable debate in relation to imputation credits. One view is that these additional phenomena exist, estimates of θ derived from market prices reflect them, and this is an advantage to these estimates (see AGN, 2016, pp. 11-12). Clearly, a proponent of this view would not be

invoking equation (3). Instead they might be thought to be using (3) subject to defining U_i to be the augmentation to the dividend arising from IC_j but net of any transactions costs, administrative costs, and delays in receipt associated with the credits. So, even for an investor who is eligible to use the credits, U_i would be less than 1. However, for an investor who is eligible to use the credits, the tax rate T_i is levied on the sum of D_j and IC_j as shown in equation (3) and therefore U_i must be 1 for such an investor. So, if such costs were recognized, they would have to be recognized through an additional term in equation (3) rather than merely through the estimate for U_i . This additional term would flow through to the denominator of equation (1) and the resulting model would not be the Officer model. Furthermore, if these additional costs were recognized in respect of imputation credits, they would also have to be recognized in respect of cash dividends, and therefore a further term would have to be added to equation (3), with flow through to the denominator of equation (1). Again, this model would not be the Officer model. Letting C denote this additional term for the firm in question, and C_m its counterpart for the market portfolio, equation (3) would become

$$S = \frac{E(Y) - E(TAX) + E(TAX)F\theta - C}{R_f + [E(R_m) - R_f + E(Q_m)\theta - C_m]\beta} \quad (4)$$

In addition, the value for $E(R_m)$ would be higher to reflect the existence of these costs, and this would be reflected in the empirical estimate. Failure to explicitly recognize these costs would not matter if beta were equal to 1, because the omissions net out in the denominator and numerator of equation (4), leaving only the increment in $E(R_m)$ and this would be empirically recognized. For regulatory purposes, with a beta of 1, the allowed rate of return would include the empirical estimate of $E(R_m)$ or the MRP and therefore would allow for these costs. However, with the AER's beta of 0.70, the failure to use a formula that explicitly accounted for them would imply that 30% of these costs were not compensated for. This is not a material issue because these costs are very small (as a proportion of the cash dividend or the imputation credits as appropriate) but I have explored the theoretical implications because these costs have been the subject of so much debate in the present situation.³

³ In respect of the administrative costs of the imputation credits, these 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. In respect of delays in receiving the credits, the amount is certain and therefore the appropriate discount rate would be the risk-free rate. At the current such rate for one year, the discount would be only 2% per year and 30% of this (the uncompensated part) would be only 0.3% per year. This is trivial.

In summary, within the Officer model, theta is a weighted average over the utilization rates for imputation credits by individual investors and these utilization rates are 1 if investors can use the credits and zero otherwise. So, theta is not the market value of the credits. Transactions and administrative costs incurred by investors in dealing with these credits cannot be dealt with by reducing the estimate for theta and, if considered important (which I do not think to be the case) would have to be addressed through an extension to the Officer model. Furthermore, this extension would only matter to the extent that the firm's equity beta differed from 1. Otherwise, such costs that are reflected in the empirical estimate for the MRP that is used by the regulator would deal with this issue.

3. Questions

3.1 Consistency Between the AER and the NER/NGR

The AER's first question concerns whether the AER's approach to imputation credits is consistent with the post-tax framework in the NER and NGR. In respect of the NER/NGR, clauses 6.5.2 and 6.5.3 of the NER (AEMC, 2016) specify how imputation credits are to be dealt with in the cash flows and the discount rate. In respect of the cost of equity, the only requirements are that it be nominal and consistent with the treatment of imputation credits in the cash flows. In respect of the cash flows, the required treatment is quite specific in that it specifies that company taxes net of the "value of imputation credits" should be treated as a cost. Accordingly, the framework is after company tax ("post-tax"). However, as discussed in section 2, the word "value" here does not unambiguously mean market value, the NER is not in any case the arbiter on the matter, and the actual authority on the matter is the academic literature underlying whatever model was chosen by the AER or the AEMC.

Turning now to the AER (2015), and consistent with the wording of clause 6.5.3 of the NER, they elect to use the Officer (1994) model and, consistent with that model, argue that the value of imputation credits is before personal taxes and any other costs (ibid, page 4-12). Accordingly, they consider three approaches to estimating "theta", comprising the equity ownership approach, the use of tax statistics, and implied market value studies.

I consider that the AER's approach is consistent with the NER/NGR. Having elected to use the Officer model, the AER is bound (exceptional circumstances aside) to define its parameters in accordance with the relevant literature, and the same is true of using any formula. As discussed in section 2, this literature clearly reveals that "theta" is a weighted

average over the “utilization rates” of individual investors, and the utilization rate is 1 for investors who can use the credits and 0 otherwise. Accordingly, θ is *not* the market value of the credits and therefore does not point to sole or primary use of implied market value studies to estimate the parameter. Such studies are merely one of a number of possible approaches to this matter.

The AER also raises the question of whether, under the NER/NGR, the cash flows going to capital providers (coupon payments, cash dividends, capital gains on equity and imputation credits) are the “face value”, i.e., the amount before personal taxes, administrative costs, and the effect of delays. Since the AER uses the Officer model, which is consistent with the NER/NGR, as shown in equation (1) and the definitions of the terms used there, the answer to this question is yes.

The AER also raises the question of whether the fact that the costs of debt and equity are market rates implies that estimates of theta should be based only or primarily on market based studies. Both the cost of equity and theta appear in equation (1), with the cost of equity being a market rate and theta *not* being a market value. This equation arises from the set of assumptions underlying the Officer (1994) model. So, there is no inconsistency within the model. However, market costs of equity reflect the actual model used by investors to value assets. If the model chosen by the AER differs from this, then there will be an inconsistency between empirically determined estimates of the cost of equity and the model into which they are inserted. One example of this problem is administrative costs associated with using imputation credits. In the presence of imputation credits, the market cost of equity exclusive of the credits will fall in recognition of the credits. So, as the administrative costs associated with the credits rise, so too will the market cost of equity. So, any empirically determined cost of equity will reflect the extent of these costs. However, as discussed in section 2, the Officer model does not recognize these costs in the structure of the model. This is an inconsistency between the model and empirical estimates of its parameters, but as discussed in section 2 could only be resolved by an extension to the Officer model (rather than by modifying the definition of theta) and would not warrant the effort because the costs are so small and most of them are dealt with through the empirical estimate of the MRP. Furthermore, all valuation models make assumptions, many of these are not entirely realistic, and these administrative costs associated with imputation credits are likely to be one of the least important such discrepancies. A much more important discrepancy here is that market

determined costs of equity will reflect the presence of foreign investors in the Australian market whilst the Officer (1994) model assumes that the Australian equity market is segregated from other equity markets. In addition, since capital gains are taxed less heavily at the personal level in Australia than dividends, the market cost of equity is likely to reflect this differential personal tax treatment whilst the Officer (1994) model implicitly assumes that both types of income are equally taxed at the personal level.

In summary, the AER's approach to imputation credits is consistent with the post-tax framework in the NER and NGR. This framework essentially determines the numerator in equation (1) but gives discretion over the cost of equity to the AER subject to its reflecting the market situation, being nominal, and consistent with the treatment of imputation credits in the cash flows. The AER unsurprisingly chose the Officer model, and rigorous proofs of this model reveal that θ is a weighted average over the "utilization rates" of individual investors, with the utilization rate being 1 for investors who are eligible to use the credits and 0 otherwise. So, θ is not the market value of the credits and therefore does not point to sole or primary use of implied market value studies to estimate this parameter. Such studies are merely one of a number of possible approaches to this matter, consistent with the AER's approach.

3.2 Consistency Between Market Rates of Return and the Face Value of Credits

The AER's second question concerns whether the fact that the costs of debt and equity are market rates is inconsistent with θ being a face value. This issue has been addressed in the previous section. The AER has also raised the question of whether estimates of the costs of debt and equity are affected by differential personal tax rates in materially the same way as for estimates of θ from dividend drop-off studies. The important issues here are limited to the costs of equity and estimates of θ from dividend drop-off studies, and I will therefore restrict my analysis accordingly.

I start with estimates of θ from dividend drop-off studies. To focus upon the key issue, suppose that there is no risk, no transactions costs or other frictions, all investors are able to fully use imputation credits for tax relief, and all investors are taxed on capital gains at 10% and dividends at 30%. Since all investors can fully use the credits, θ is 1. Letting D denote the cash dividend, IC the imputation credits, ΔP the price change from cum to ex-div, arbitrage would ensure that

$$(D + IC)(1 - .30) = \Delta P(1 - .10)$$

and hence

$$\Delta P = D \left(\frac{1 - .30}{1 - .10} \right) + IC \left(\frac{1 - .30}{1 - .10} \right) \quad (5)$$

Thus, in conducting the cross-sectional regression of ΔP on D and IC , the coefficient on IC would be 0.78. Since theta is 1, this regression coefficient would underestimate theta, because capital gains are taxed less heavily than dividends. So, the correct estimate of theta is invariant to personal tax rates whereas the coefficient on imputation credits in a dividend drop-off study will reflect the difference in personal tax rates on dividends and capital gains.

Turning now to estimates of the cost of equity, these are determined from the Officer (1994) model shown in the denominator of equation (1). To focus upon the crucial issue, consider a company with a beta of zero. In this case, the cost of equity under the Officer model is the risk-free rate:

$$k_e = R_f$$

This result reflects the assumption in the Officer model that interest, dividends and capital gains are taxed at the same rate at the personal level. Thus, in the absence of systematic risk, the expected return on equity is the same as that on the risk-free asset (both pre personal tax) so as to yield the same result after personal tax. However, if capital gains were taxed less heavily than dividends and interest, as is the case in Australia, then the expected rate of return on zero beta equity pre personal tax would be less than on the risk-free rate to ensure that their expected rates of return after personal tax were the same. In particular, Lally and van Zijl (2003, equation (9)) show that under the simplifying assumptions adopted above:

$$k_e = R_f \left(\frac{1 - .30}{1 - .10} \right) + \frac{(D + IC)}{P} \left(\frac{.30 - .10}{1 - .10} \right) \quad (6)$$

So, with a gross dividend yield less than the risk-free rate, the cost of equity before personal tax is less than the risk-free rate. In the extreme case of no dividends, and therefore all equity returns are in the form of capital gains, the cost of equity in equation (5) becomes:

$$k_e = R_f \left(\frac{1-.30}{1-.10} \right) \quad (7)$$

So, the expected rate of return pre personal tax on this zero beta and zero dividend yield equity would be 78% of the risk-free rate, in order to ensure that the expected rates of return on these two assets after personal tax were the same. This matches equation (5), in principle.

The difference here in the costs of equity from the Officer (1994) and Lally and van Zijl (2003) models is alleviated as the firm's beta and expected dividend yield approach the values for the market portfolio. At this point, both the Officer (1994) and Lally and van Zijl (2003) model state that the expected rate of return on this firm's equity matches that for the market portfolio, $E(R_m)$, and the empirical estimate for the latter will reflect the actual situation. For example, equities that are zero beta and zero dividend yield will have an expected rate of return that is 78% of the risk-free rate as shown in equation (7).

The AER has also sought my comment on para 1073 of the ACT's decision (AEMC, 2016). The ACT asserts here that the pre personal tax costs of debt and equity reflect the impact of personal tax and the value of theta should be similarly affected. Clearly the ACT thinks that the appropriate estimate for theta in the example discussed above and shown in equation (5) would be 0.78. This is incorrect. As discussed in section 2, theta reflects only investor eligibility to use the credits. So, in that example, theta is 1. By contrast, the price impact of the credits is 0.78 due to differential tax. So, differences in personal tax rates on different types of income should affect the pre personal tax costs of debt and equity, they do affect the coefficient on imputation credits in a dividend drop-off study, but they should *not* affect the estimate of theta.

In summary, theta when properly defined in accordance with the Officer model is not affected by personal tax rates whilst the coefficient on imputation credits in a dividend drop-off study is affected by differences in the personal tax rates on capital gains and dividends, and is therefore a deficient estimate unless a correction is made for this issue. In addition, the cost of equity pre personal tax is affected by differences in personal tax rates on capital gains, dividends and interest but estimates obtained from the Officer (1994) model will in general fail to do so correctly because this model assumes that there are no such tax differences.

3.3 Estimation of Theta

The AER's third set of questions concern estimates of theta. The first such question is whether estimates of theta from the equity ownership approach are unreliable and/or should be limited to use as an upper bound. As shown in section 2, theta is a weighted average over the utilization rates for investors, equal to 1 for those who are eligible to use the credits and zero otherwise. Letting w_i denote the fraction of aggregate risky assets held by investor i , R_{Ki} the rate of return after personal tax and inclusive of imputation credits on the "tangency portfolio" chosen by investor i , R_{fi} the risk-free rate received by investor i after personal tax, and T_{gi} the tax rate on capital gains faced by investor i , Lally and van Zijl (2003, equation (7)) show that the weight for investor i in equation (2) is as follows:

$$x_i = \frac{\left[\frac{w_i}{\left(\frac{E(R_{Ki} - R_{fi})}{\text{Var}(R_{Ki})} \right) (1 - T_{gi})} \right]}{\sum_{j=1}^n \left[\frac{w_j}{\left(\frac{E(R_{Kj} - R_{fj})}{\text{Var}(R_{Kj})} \right) (1 - T_{gj})} \right]} \quad (8)$$

The terms in the RHS of this formula other than the value weights may vary over investors and do not readily lend themselves to estimation. In view of this, one could act as if they are equal across investors, in which case equation (8) reduces to

$$x_i = \frac{w_i}{\sum_{j=1}^n w_j} = w_i$$

This says that the weight applied to investor i in equation (2) is the proportion of Australian equities held by investor i . Substituted into equation (2), with those investors who are eligible to use the credits designated as investor type 1 and the rest as type 2, theta becomes

$$\theta = w_1(1) + w_2(0) = w_1$$

So, theta is estimated as the proportion of Australian equities held by those investors who are able to use the credits. At this point, the question of which investors are recognized arises. The Officer (1994) model assumes that the Australian equity market is segregated from the rest of the world, which would imply no foreign investors. Accordingly, all investors would be locals and therefore theta would be 1. However, foreign investors do exist, and therefore the assumptions of the model collide with an empirical reality. One approach to this, which I favour, would be to ignore foreign investors and therefore estimate theta as 1 (Lally, 2013). However, none of the parties to the dispute considered by the ACT share this view and instead all of them consider that foreign investors should be recognized. Conditional on this view being correct, the market weight of investors who can use the credits is the market weight of local investors, i.e., the proportion of Australian equity held by local investors. This is the AER's equity ownership approach. Thus, if foreign investors are recognized and absent any information on the terms other than the value weights on the RHS of equation (8), the equity ownership approach is *not* an upper bound on theta but an unbiased estimate.

In addition to errors in this estimate arising from the assumption that the terms other than the value weights on the RHS of equation (8) are uniform across investors, errors can arise from the choice of whether to use only listed equity or all equity, and which historical time period to average results over. The AER (2015, page 4-26) presents estimates ranging from 38% to 55% if only listed equity is used, and 56% to 68% if all equity is used, with the variation within each data set representing the range of values over the 2000-2014 period (AER, 2015, Figure 4-3). The latest (2014) values of these two parameters are 47% and 61% respectively, and these values are well within the range of the recent experience. If one judged these time series to be random walks, one would estimate the future values (over the next regulatory cycle of five years) using the latest observations. Alternatively, if one judged these series to be mean reverting, the estimate would be the current observation adjusted upwards (downwards) if the current observation was unusually low (high). However, the current observations are not unusually high or low. So, even if these series are mean reverting, reasonable point estimates for the next five years would still be approximately the latest values of 47% and 61% respectively, with moderate uncertainty around these estimates. My own estimate for all equity is moderately higher, at 66% in 2013 (Lally, 2015a, page 28) versus the AER's (2015, Figure 4-3) estimate of 60% at the same point in time. So, my estimate for all equity is at least 60%.

In respect of the choice between listed and all equity, my views on this matter appear in Lally (2014, pp. 34-35). In particular, the fact that only listed equity is used to estimate the MRP and beta suggests that the same limitation be applied to the present issue. However, the limitation is only imposed for the MRP and beta because data from unlisted firms is entirely inadequate for estimating returns. Furthermore, MRP estimates are generally based on a subset of listed equity (such as the ASX200), the subsets used may vary and are sometimes never specified (in surveys), and betas are sometimes estimated from foreign returns data. All of these results could reasonably be viewed as proxies for the results that would arise from using Australian data on all equities. In addition, treating the CAPM as a model that applies to only listed equities would rule out using it to estimate the cost of equity for an unlisted company (and some regulated businesses are unlisted). Thus, in principle, I favour inclusion of unlisted equity for estimating the proportion of Australian equities held locally. Some concerns about the quality of this data seem warranted, as argued by SFG (2014, pp. 30-33), but the results showing that the local ownership proportion of unlisted equity is higher than for listed equity (Frontier, 2016, Table 4) are entirely plausible (because foreigners would be expected to favour listed equity due to its higher liquidity).

In summary, conditional upon recognizing the existence of foreign investors when estimating theta, in estimating theta from the proportion of Australian equities held by local investors, I favour the use of all equity rather than only listed equity and therefore an estimate for theta of at least 60%. In addition, estimation errors in either direction could arise from deviations from the assumption that the terms other than the value weights on the RHS of equation (8) are uniform across investors. I do not think that the latter is a substantial issue. Accordingly, the reliability of the estimate is high. Furthermore, since any estimate of theta of this type is subject to errors in either direction, it is *not* an upper bound on an estimate of theta.

The next question is whether estimates of theta from tax statistics (the redemption rate) are unreliable and/or should be limited to use as an upper bound. To explore this question, let IC_1 denote the imputation credits issued to local investors over a one-year period, IC_2 those to foreign investors, and TR the total credits redeemed over the same period. Accordingly the redemption rate is

$$R = \frac{TR}{IC_1 + IC_2}$$

Assuming (reasonably) that all (or virtually all) imputation credits that are issued to locals are redeemed, and that none (or virtually none) of those issued to foreigners are redeemed, it follows that

$$R = \frac{IC_1}{IC_1 + IC_2}$$

Assuming further that local investors choose Australian stocks with the same ratio of imputation credits to equity value (V) as do foreign investors, and hold them over the full one-year period in question, it follows that

$$R = \frac{V_1}{V_1 + V_2}$$

So, under these assumptions, the redemption rate is equal to the proportion of Australian equities held by local investors, which matches the result from the equity ownership approach. However, the last two assumptions described above are unrealistic. Firstly, tax arbitrage is likely to involve Australian investors temporarily buying shares from foreigners (rather than vice versa), and this would raise the redemption rate over the market weight of local investors. Secondly, even without tax arbitrage, local investors are likely to tilt towards stocks with high IC/V ratios because only they can use the credits and the valuation of these credits is unlikely to fully reflect their full face value because the influence of foreign investors is significant; this too would raise the redemption rate over the market weight of local investors. Thus, since there are no grounds to consider that the market weight of local investors is too high an estimate of theta, the redemption rate would be biased up. The effect of tax arbitrage may not be substantial because the legislative rules that discourage such behaviour are extensive and are likely to have significantly constrained such activity.⁴ However, even without tax arbitrage, local investors would be very likely to tilt towards stocks with high imputation credits, and the upward bias from this could be significant.

⁴ These rules comprise the “holding period rule” (requiring investors who can utilize the credits to hold the shares for at least 45 days around the dividend ex-day as a condition of receiving the benefit from the credits), the 30% delta rule (requiring investors who can utilize the credits and hold shares around the dividend ex-day to be at least 30% exposed to movements in the stock as a condition of receiving the benefit from the credits), and the “related payments rule” (proscribing certain classes of transactions between investors who can and cannot utilize the credits), as discussed in Beggs and Skeels (2006, Appendix A).

Turning now to the reliability of the redemption rate as an estimate of theta, the AER (2015, page 4-28) estimates this at 0.45 from NERA (2015, section 4.2), who use ATO tax data on all Australian companies from 2004-2012. However, using the same type of data from 2004-2011, Hathaway (2013, section 1.3) estimates this proportion at 0.62 or 0.44, with the variation arising from two possible approaches (ATO dividend data and ATO tax data) whose results should match and the divergence cannot be reconciled. This variation casts doubt on all estimates using ATO data, and this problem with the ATO data alleged by Hathaway is generally accepted (NERA, 2013, pp. 5-6; Handley, 2014, section 6; Frontier, 2016, para 97; AGN, 2016, page 10; ACT, 2016, para 1092).

In summary, the redemption rate if correctly measured is an upwardly biased estimator for theta because local investors would tilt towards stocks with high imputation credit yields. Furthermore, the ATO data from which the redemption rate is estimated contains significant unexplained discrepancies, which give rise to two significantly different estimates of the redemption rate. Accordingly, any estimate of theta of this type is unreliable. In addition, since the AER chooses the lower of the two possible estimates (0.45) that have been generated from the data source it uses, and the other is 0.62, this possible underestimation of the redemption rate may exceed the upward bias resulting from local investors tilting towards stocks with high imputation credit yields. So, the AER's estimate of 0.45 for the redemption rate is *not* an upper bound on an estimate for theta.

The next question is that of what might be causing differences between estimates of theta from the equity ownership approach and the redemption rate. Implicit in this question is that the AER's estimate for the redemption rate on all equity is 0.45 and an estimate for the market weight for local investors on all equity is about .60. One possibility raised by the AER is that of local investors not being able to use the credits due to the 45 day holding rule. This rule constrains tax arbitrage, and therefore reduces the uplift to the redemption rate arising from this activity. So, this cannot explain why the AER's estimate for the redemption rate is *below* its estimate for the market weight of local investors. The 45 day rule also prevents some 'genuine' investors from obtaining the credits, and therefore drives down the redemption rate whilst not affecting the market weight of local investors. So, this could explain at least part of the difference in question here. However, I doubt if this downward effect is significant because 'genuine' investors have the option of changing the timing of their transactions, the timing change would not be material, and they would have strong

incentives to do so. For these reasons, I do not think that the 45 day rule could explain much of the difference presented by the AER.

Another possibility raised by the AER is that investors do not value the credits at their face value. For example, the market value of the credits is lowered by administrative costs or personal taxes on capital gains being less than on dividends. Since the value of the credits would tilt Australian investors towards local stocks with such credits, anything that lowers the value of the credits would incline Australian investors to tilt more towards foreign equities, due to their diversification benefits, but this tilt would have the same downward effect on the proportion of Australian equities held by locals and the redemption rate. Another possible explanation is offered by Frontier (2016, section 4.2.4), involving investors failing to redeem credits that they receive due to the administrative burden, thereby reducing the redemption rate but not the proportion of Australian equities held by local investors. This is possible, but presumably only for small investors whose lethargy would presumably exert little effect upon the result. Another possible explanation is offered by Frontier (2016, section 4.2.2), involving errors in the ABS data from which the equity ownership data is drawn. However the most obvious explanation for the difference in estimates from these two approaches is that the AER's estimate for the redemption rate is too low. If the correct figure is more like 0.62, as discussed above, then even a moderate deduction to account for local investors tilting towards stocks with high imputation credit yields would be compatible with the estimate for the equity weight of local investors of about 0.60. Furthermore, even Frontier (2016, para 97) accepts that estimates of the redemption rate from ATO data are problematic.

The next question is whether the 45 day rule could be expected to affect estimates of theta. As discussed above, the rule constrains tax arbitrage and therefore reduces the uplift to the redemption rate arising from this activity. Since the rules in this area strongly discourage tax arbitrage, the downward impact on the redemption rate may be significant, but even if so this would merely help to better align the redemption rate with the proportion of Australian equities held by local investors. In addition, as discussed above, the rule also prevents some 'genuine' investors from obtaining the credits, and therefore drives down the redemption rate. However, I doubt if this downward effect is significant because 'genuine' investors have the option of changing the timing of their transactions, the timing change would not be material, and they would have strong incentives to do so.

The next question is whether it is reasonable to give most weight to estimates of theta from the equity ownership approach, less to the redemption rate, and the least to dividend drop-off studies. My views on the relative merits of the first two of these methods are presented above. The redemption rate estimates come from a data source that contains significant unexplained errors, which damages the credibility of all parameter estimates drawn from this source. They are also biased up as estimates of theta. No such problems afflict estimates of the proportion of equity owned by local investors. So, the estimate of theta from the equity ownership approach warrants much higher weight than the redemption rate. In respect of dividend drop-off studies, my views on the merits of this approach appear in Lally (2013, section 3.5) and they are highly adverse. In particular, the results from such studies are subject to considerable statistical uncertainty, to the tax positions and transactions costs incurred by arbitrageurs who may be quite unrepresentative of investors in general, the contentious question of which model to use, data filtering rules, deletion of outliers, the choice of the “tuning constant” in robust regression models, the wide divergence in results from other types of studies using market evidence, the wide range of evidence on anomalous behavior around ex-days, and the need to correct the estimated coefficient on imputation credits for the difference in the tax rate on capital gains and dividends. Collectively, these drawbacks are so severe as to warrant giving the lowest weight on the results from these studies. So, when estimating theta from the equity ownership approach, the redemption rate, and dividend drop-off studies, I consider the first method warrants the highest weight, followed by the second, and then the third.

The last question is whether the AER’s reasons for giving limited weight to market-based studies are reasonable. The AER (2015, pp. 4-29 to 4-30) offers five reasons for doing so. These reasons largely correspond to the list in Lally (2013, section 3.5) and I therefore concur with the AER on this point.

In summary, conditional upon recognizing the existence of foreign investors when estimating theta, this parameter could be estimated in three different ways. In estimating theta from the proportion of Australian equities held by local investors, I favour the use of all equity rather than only listed equity and therefore an estimate for theta of at least 60%. In addition, estimation errors in either direction could arise from deviations from the assumption that the terms other than the value weights on the RHS of equation (8) are uniform across investors. I

do not think that the latter is a substantial issue. Accordingly, the reliability of the estimate is high. Furthermore, since any estimate of theta of this type is subject to errors in either direction, it is *not* an upper bound on an estimate of theta. In addition, a correctly measured redemption rate for credits is an upwardly biased estimator for theta because local investors would tilt towards stocks with high imputation credit yields. Furthermore, since the ATO data from which the redemption rate is estimated contains significant unexplained discrepancies, which give rise to two significantly different estimates of the redemption rate, any such estimate of theta is unreliable. In addition, since the AER chooses the lower of the two possible estimates (0.45) that have been generated from the data source it uses, and the other is 0.62, this possible underestimation of the redemption rate may exceed the upward bias resulting from local investors tilting towards stocks with high imputation credit yields. So, the AER's estimate of 0.45 for the redemption rate is *not* an upper bound on an estimate for theta. In respect of the difference between the AER's estimate of 0.45 for the redemption rate and their estimate for the local ownership proportion of local equity of about 60%, I think the most likely explanation is that the figure of 0.45 is too low. In respect of the impact of the 45 day rule, the rule constrains tax arbitrage and therefore minimizes the gap between the correctly estimated redemption rate and the proportion of Australian equities held by local investors. The rule also prevents some 'genuine' investors from obtaining the credits, and therefore drives down the redemption rate, but this downward effect is unlikely to be significant because 'genuine' investors have the option of changing the timing of their transactions and would have strong incentives to do so. Finally, in respect of dividend drop-off studies as estimators of theta, I concur with the AER's view that they warrant very limited weight for reasons identified by the AER. Accordingly, I think that the equity ownership approach (with an estimate of at least 0.60) should be given most weight because the estimate seems quite reliable, lesser weight should be given to the redemption rate (0.45 to 0.62) because of the upward bias and the significant discrepancies within the data source used to estimate it, and minimal weight to dividend drop-off studies for reasons identified by the AER (with an estimate of 0.35 from the SFG study relied on by the ACT). So, conditional upon recognizing the existence of foreign investors when estimating theta, this evidence suggests an estimate for theta of about 0.60.

3.4 Correction for the Effect of Personal Taxes

The AER's fourth question is whether estimates of the coefficient on imputation credits in market-based studies should be corrected using the estimate of the coefficient on cash dividends, in order to obtain an estimate of theta.

To address this question, I return to the analysis in section 3.2, in a world in which there is no risk, no transactions costs or other frictions, all investors are able to fully use imputation credits for tax relief, and all investors are taxed on capital gains at 10% and dividends at 30%. Under such conditions, arbitrage would ensure that the price change from cum to ex-div (ΔP) would be related to the cash dividend (D) and the imputation credits (IC) as follows:

$$\Delta P = D \left(\frac{1-.30}{1-.10} \right) + IC \left(\frac{1-.30}{1-.10} \right)$$

Relaxing the assumptions relating to risk, transactions costs and other frictions (which would also affect cash dividends and imputation credits), the relationship would then become

$$\Delta P = \delta D + \delta(IC) + \varepsilon$$

where δ reflects the effect of the personal tax differential, risk, transactions costs and other frictions, and ε reflects noise in the data. Further recognizing that some investors cannot use the credits then leads to insertion of theta into the model (because this is the only factor that theta can account for, in accordance with the definition of this parameter):

$$\Delta P = \delta D + \delta\theta(IC) + \varepsilon$$

So, when regressing ΔP on D and IC , the estimated coefficient on IC is not θ but $\delta\theta$, and therefore the estimated coefficient on IC must be divided by that on D to obtain an estimate of θ . This corresponds to the AER's approach. Accordingly, I agree with the AER's approach.

3.5 Estimation of the Distribution Rate

The AER's final set of questions relates to the distribution rate. The first such question is whether estimates of the distribution rate should be based upon the same data set as that for

theta. As discussed in section 1, the distribution rate is a firm-specific parameter whilst theta is a market parameter. Thus, theta must be estimated using market-wide data whilst the distribution rate could be estimated using firm, industry, or sector-wide data according to which was judged to provide the best estimate for this firm-specific parameter. In short, consistency is *not* essential but nor is it precluded. So, on this point, I disagree with the AER (2015, section 4.4.1). Handley (2015b, pp. 7-8) discusses this issue and first acknowledges that the distribution rate is firm-specific whilst theta is not firm-specific, but then goes on to say that both parameters must be estimated from “consistent data sets which relate to the same market”. This seems contradictory.

As argued in Lally (2013, section 4.2), estimates of the distribution rate for a firm based only on its data are subject to the difficulty that, if the firm’s dividends are fully franked, then it will be able to manipulate (raise) its price or revenue cap by reducing its dividends (so as to reduce its distributed credits, which lowers its distribution rate and therefore raises its cost of capital estimated from the Officer model used by regulators). An alternative would then be some kind of industry average, and the relevant industry is regulated businesses. However many of them are publicly owned and do not pay dividends. Another alternative would then be to examine a set of large private-sector Australian firms that contain significant regulated businesses. However the set of firms is not large and therefore the choice of whether or not to include certain marginal cases is likely to materially affect the resulting estimate. All of this points to the use of some type of sector-wide data. However there is considerable variation in the distribution rate across firms (see Lally, 2014, Table 2) and therefore any sector-wide average could be a poor indicator of the situation for any industry. This issue could be framed as a trade-off between statistical reliability (greater from a sector-wide estimate) versus potential bias (worse from a sector-wide estimate).⁵ The same point arises in estimating the asset beta and the leverage of the benchmark firm. Since regulators use industry rather than market averages in these cases, consistency might suggest the same decision in respect of the distribution rate. However the proper choice depends upon the severity of the bias and statistical reliability problems in each of these areas, and different decisions might be warranted.

⁵ Bias will arise if industry or market-level data are used because the parameter value varies over firms. Industry-level data is likely to be less biased because firms within the same industry are likely to be less variable than firms in general.

Turning to sector-wide averages, the principal choice here is between all equity or only listed equity. This matters because the difference in distribution rates is quite substantial: Frontier (2016, Table 4) reports estimates of about 50% for unlisted firms and 75% for listed firms, and Lally (2014, Table 2) estimates the rate at 84% for the largest 20 listed firms in Australia. Since it is always sensible to distribute credits if possible, and the only restriction on doing so is the size of the firm's cash dividends, the presumed cause of the difference in distribution rates between listed and unlisted firms is lower dividend payout rates in unlisted companies. Handley (2014, page 28) argues that unlisted equity should be ignored because such companies "by definition are financed in entirely different ways". Handley does not elaborate on this comment. However, he may be alluding to the fact that listed companies are generally widely held, and therefore most shareholders have very little knowledge of the actual state of affairs within these companies. Accordingly, dividends can be used to credibly signal the true state of affairs and the higher the dividend the stronger the signal of the firm's profits (Copeland et al, 2005, Ch. 16). These considerations are much less pronounced for unlisted companies, which might explain the lower payout rate and hence the lower distribution rate for imputation credits. Furthermore, since privately-owned regulated businesses in Australia are typically listed firms or subsidiaries of listed firms, the appropriate set of firms to use to estimate the distribution rate of regulated businesses would seem to be listed firms.

The second question is whether the top 20 firms should be excluded from the set of firms used to estimate the distribution rate, when sector-wide data is used. The source of this issue is an analysis by Lally (2014, Table 2) of the distribution rates of the 20 largest listed companies in Australia, leading to an estimate of 0.84, with further analysis in Lally (2015b, Table 1) yielding 0.83.⁶ Frontier Economics (2016, section 2.3) argues that such firms should be excluded because they have foreign-sourced profits that elevate their distribution rate for credits (by raising their dividends and hence the maximum credits they can attach but not the imputation credits that they create), and foreign-sourced profits are not a feature of the

⁶ Lally (2014, section 8.1) describes the problems in the ATO data and why these problems are avoided by use of financial statement data. In particular, financial statement data has three features that virtually guarantees protection against the problems in the ATO data: the financial statement data is audited, the researcher is able to personally identify the source data (the figures of interest for particular firms) rather than having to rely upon the aggregation exercise carried out by the ATO (and is therefore protected against double-counting and other aggregation problems), and the financial statement data is internally consistent, i.e., there are no unexplained discrepancies in the financial statement data whereas there are major inconsistencies in the ATO data (which casts doubt on all of it).

benchmark firm that the AER is regulating (a pure play regulated energy network business operating within Australia). Furthermore, Frontier (2016, Table 4) estimates the distribution rate for listed equity in aggregate at 0.75 rather than the 0.83 figure in Lally (2015, Table 1). Implicitly, Frontier attributes the difference between 0.75 and 0.83 to these foreign operations, but does not empirically assess the question. In response to Frontier's argument, Handley (2015a, page 21) argues that dividend policies are affected by many factors, but again he does not elaborate, and the AER cites his comment.

Frontier's claim can be empirically assessed. Amongst the 20 firms examined by Lally (2015, Table 1), the seven with the largest tax payments to the ATO account for 79% of the taxes paid to the ATO by this set of 20 firms, and I will therefore focus upon these seven. Table 1 below shows their distribution rates for credits (from Lally, 2015, Table 1), an estimate of the proportion of profit from their foreign operations (from the 2015 Annual Report), and the payout rate (dividends to cash flow from operations, from the Cash Flow Statement in the 2015 Annual Report).⁷ The proportion of profit from foreign operations is monotonically decreasing in the distribution rate, which is in the opposite direction to that claimed by Frontier, and the correlation between the two variables is the very striking figure of -0.95. Furthermore, the payout rate is positively correlated with the distribution rate (0.50).

A possible explanation for these results is as follows. Firms with a large proportion of their profit from foreign operations (like BHP and Rio Tinto) retain a larger proportion of their cash flow in order to finance such operations, which reduces dividends and hence the distribution rate by more than the profits from these operations raise dividends in the same year, at least for many years. This can be modelled with a simple example. Suppose a firm has pre-tax profit of \$100 (all from Australia), pays tax to the ATO of \$30, and pays the \$70

⁷ The data sources are BHP (2015), Telstra (2015), Westpac (2015), CBA (2015), NAB (2015), ANZ (2015), and Rio Tinto (2015). For BHP, the profit share from foreign operations is proxied by the proportion of foreign employees, shown on page 47 of the Annual Report, and averaged over the last three years. For Telstra, the profit share from foreign operations is proxied by the proportion of foreign customers, shown on page 97 of the Annual Report, and averaged over the last two years. For Westpac, the profit share from foreign operations (NZ) is provided on page v of the Annual Report, for the latest year. For CBA, the profit share from foreign operations (NZ and IFS) is shown on page 10 of the Annual Report, and averaged over the last two years. For NAB, the profit share from foreign operations (NZ and UK) is shown on page 6 of the Annual Report, and averaged over the last two years. For ANZ, the profit share from foreign operations (NZ) is shown on pp. 24-27 of the Annual Report, and averaged over the last two years. For Rio Tinto, the profit share from foreign operations is proxied by the proportion of foreign employees, shown on page 158 of the Annual Report, and averaged over the last three years.

residue as a dividend. All \$30 of the credits created can then be attached to the dividend, and therefore the distribution rate for the credits is 1. Now suppose the firm retains 30% of the after-tax profit every year to invest in foreign operations, and every such \$1 invested generates an increment to pre-tax profit of \$0.1 per year thereafter. The firm's distribution rate will then initially fall to 70% as follows:

$$F = \frac{Dist}{TAX(ATO)} = \frac{DIV(3/7)}{TAX(ATO)} = \frac{\$70(.7)(3/7)}{\$30} = .70$$

The denominator here will remain fixed over time whilst the pre-tax profits (and hence the numerator here) will rise at 2.1% per year ($0.70 \times 0.30 \times 0.10$). So, the distribution rate will rise over time at the same rate, and will take 17 years to recover to the original level of 1. So, Frontier's claim seems to be false and an explanation for the opposite pattern is readily apparent.

Table 1: Distribution Rates and Foreign Operations

Company	F	Foreign Ops	Payout
BHP	0.64	0.50	0.26
Telstra	1.00	0.06	0.43
Westpac	0.94	0.12	0.56
CBA	0.98	0.12	0.50
NAB	0.93	0.19	0.41
ANZ	0.98	0.15	0.24
Rio Tinto	0.26	0.60	0.29

In summary, since the distribution rate is a firm-specific parameter whilst theta is a market parameter, theta must be estimated using market-wide data whilst the distribution rate could be estimated using firm, industry, or sector-wide data according to which was judged to provide the best estimate for this firm-specific parameter. So, consistency is *not* essential and I therefore disagree with the AER on this point. Furthermore, pragmatic considerations point to the use of sector-wide data of some sort. Since the distribution rates for listed and unlisted businesses are significantly different and (private) regulated businesses are listed or owned by

listed parents, the distribution rate for regulated businesses should be estimated from that of listed equity. The choices here are ATO data on all listed equity or financial statement data on a subset of high value firms constituting a majority of the value of listed equity. Since the ATO data contains significant unresolved discrepancies, this favours the use of financial statements for a subset of high value firms and an estimate of this type is 0.83 for the top 20 such firms. Finally, Frontier's claim that firms with significant foreign operations have higher distribution rates than firms without such operations, and are therefore unsuitable for estimating the distribution rate of regulated businesses (which do not have foreign operations), appears to be false and the observed pattern can be explained through the investment of profits required to finance these foreign operations. Accordingly, the effect of these firms with foreign operations being included within the set of firms used to estimate the distribution rate for the benchmark firm (with only local operations) is to underestimate rather than overestimate the distribution rate for the benchmark firm. Thus, the estimate for the distribution rate of 0.83 is likely to be too low for the benchmark firm rather than too high.

4. Conclusions

My principal conclusions are as follows. Firstly, within the Officer model, theta is a weighted average over the utilization rates for imputation credits by individual investors and these utilization rates are 1 if investors can use the credits and zero otherwise. So, theta is not the market value of the credits. Transactions and administrative costs incurred by investors in dealing with these credits cannot be dealt with by reducing the estimate for theta and, if considered important (which I do not think to be the case) would have to be addressed through an extension to the Officer model. Furthermore, this extension would only matter to the extent that the firm's equity beta differed from 1. Otherwise, such costs that are reflected in the empirical estimate for the MRP that is used by the regulator would deal with this issue.

Secondly, the AER's approach to imputation credits is consistent with the post-tax framework in the NER and NGR. This framework determines the allowance for company taxes but gives discretion over the cost of equity to the AER subject to it reflecting the market situation, being nominal, and consistent with the treatment of imputation credits in the allowance for company taxes. The AER unsurprisingly chose the Officer model, and rigorous proofs of this model reveal that theta is a weighted average over the "utilization

rates” of individual investors, with the utilization rate being 1 for investors who are eligible to use the credits and 0 otherwise. So, theta is not the market value of the credits and therefore does not point to sole or primary use of implied market value studies to estimate this parameter. Such studies are merely one of a number of possible approaches to this matter, consistent with the AER’s approach.

Thirdly, theta when properly defined in accordance with the Officer model is not affected by personal tax rates whilst the coefficient on imputation credits in a dividend drop-off study is affected by differences in the personal tax rates on capital gains and dividends, and is therefore a deficient estimate unless a correction is made for this issue. In addition, the cost of equity pre personal tax is affected by differences in personal tax rates on capital gains, dividends and interest but estimates obtained from the Officer model will in general fail to do so correctly because this model assumes that there are no such tax differences.

Fourthly, conditional upon recognizing the existence of foreign investors when estimating theta, this parameter could be estimated in three different ways. In estimating theta from the proportion of Australian equities held by local investors, I favour the use of all equity rather than only listed equity and therefore an estimate for theta of at least 60%. In addition, estimation errors in either direction could arise from deviations from the assumption that the terms other than the value weights on the RHS of equation (8) are uniform across investors. I do not think that the latter is a substantial issue. Accordingly, the reliability of the estimate is high. Furthermore, since any estimate of theta of this type is subject to errors in either direction, it is *not* an upper bound on an estimate of theta. In addition, a correctly measured redemption rate for credits is an upwardly biased estimator for theta because local investors would tilt towards stocks with high imputation credit yields. Furthermore, since the ATO data from which the redemption rate is estimated contains significant unexplained discrepancies, which give rise to two significantly different estimates of the redemption rate, any such estimate of theta is unreliable. In addition, since the AER chooses the lower of the two possible estimates (0.45) that have been generated from the data source it uses, and the other is 0.62, this possible underestimation of the redemption rate may exceed the upward bias resulting from local investors tilting towards stocks with high imputation credit yields. So, the AER’s estimate of 0.45 for the redemption rate is *not* an upper bound on an estimate for theta. In respect of the difference between the AER’s estimate of 0.45 for the redemption rate and their estimate for the local ownership proportion of local equity of about 60%, I

think the most likely explanation is that the figure of 0.45 is too low. In respect of the impact of the 45 day rule, the rule constrains tax arbitrage and therefore minimizes the gap between the correctly estimated redemption rate and the proportion of Australian equities held by local investors. The rule also prevents some ‘genuine’ investors from obtaining the credits, and therefore drives down the redemption rate, but this downward effect is unlikely to be significant because ‘genuine’ investors have the option of changing the timing of their transactions and would have strong incentives to do so. Finally, in respect of dividend drop-off studies as estimators of theta, I concur with the AER’s view that they warrant very limited weight for reasons identified by the AER. Accordingly, I think that the equity ownership approach (with an estimate of at least 0.60) should be given most weight because the estimate seems quite reliable, lesser weight should be given to the redemption rate (0.45 to 0.62) because of the upward bias and the significant discrepancies within the data source used to estimate it, and minimal weight to dividend drop-off studies for reasons identified by the AER (with an estimate of 0.35 from the SFG study relied on by the ACT). So, conditional upon recognizing the existence of foreign investors when estimating theta, this evidence suggests an estimate for theta of about 0.60.

Fifthly, when estimating theta from market-based studies, the estimated coefficient on imputation credits should be corrected using the estimate of the coefficient on cash dividends, so as to remove the effect of other factors affecting the value of imputation credits.

Sixthly, since the distribution rate is a firm-specific parameter whilst theta is a market parameter, theta must be estimated using market-wide data whilst the distribution rate could be estimated using firm, industry, or sector-wide data according to which was judged to provide the best estimate for this firm-specific parameter. So, consistency is *not* essential and I therefore disagree with the AER on this point. Furthermore, pragmatic considerations point to use of sector-wide data of some sort. Since the distribution rates for listed and unlisted businesses are significantly different and (private) regulated businesses are listed or owned by listed parents, the distribution rate for regulated businesses should be estimated from that of listed equity. The choices here are ATO data on all listed equity or financial statement data on a subset of high value firms constituting a majority of the value of listed equity. Since the ATO data contains significant unresolved discrepancies, this favours the use of financial statements for a subset of high value firms and an estimate of this type is 0.83 for the top 20 such firms. Finally, Frontier’s claim that firms with significant foreign operations have

higher distribution rates than firms without such operations, and are therefore unsuitable for estimating the distribution rate of regulated businesses (which do not have foreign operations), appears to be false and the observed opposite pattern can be explained through the investment of profits required to finance these foreign operations. Accordingly, the effect of these firms with foreign operations being included within the set of firms used to estimate the distribution rate for the benchmark firm (with only local operations) is to underestimate rather than overestimate the distribution rate for the benchmark firm. Thus, the estimate for the distribution rate of 0.83 is likely to be too low for the benchmark firm rather than too high.

Finally, and again conditional upon recognizing the existence of foreign investors when estimating theta, coupling my estimate of the distribution rate of at least 0.83 with my estimate of theta of 0.60 yields my estimate for gamma of at least 0.50. This contrasts with the AER's estimate for gamma of 0.40.

APPENDIX 1: Terms of Reference

Gamma Request for Quote

Background

Service providers have submitted that the AER should follow the recently released Tribunal decision. The AER requests limited advice on a number of disputed matters including:

- The post-tax framework in the NER/NGR (which appears to be based on Officer's 1994 work) and if the AER's approach to estimating gamma is consistent with this framework
- If the AER's use of estimates of the utilisation value from the equity ownership (EO) approach and tax statistics are valid approaches for estimating the utilisation value
- If it is reasonable to place more weight on estimates from the EO approach than estimates from tax studies and is it reasonable to place the least weight on estimates from market based studies
- If the estimates from market based studies, and in particular SFG's dividend drop off study, require adjustment for the apparent impact of differential personal taxation impacts apparent in the estimates of the value of cash dividends
- If in estimating the value for gamma as the product of the distribution rate and the utilisation value it is reasonable to combine estimates of the utilisation value and distribution rate estimated from consistent data sets
- If the use of the SLCAPM, which does not explicitly take into account imputation credits (noting the MRP is adjusted for their value), means that estimates from the equity EO or tax statistics should not be used in preference to market base studies (e.g. dividend drop off studies)

The AER expects the consultant to read the following material in considering the above points and in providing the services required:

- The Australian Competition Tribunal decision for JGN released on 26 February 2016 (and to the extent necessary the AER decision underpinning this)
- The gamma proposal from Australian Gas Networks (AGN).
We note the proposals of all service providers with decisions to be released this month by the AER (Ausnet DX, CitiPower, Powercor, United Energy, JEN, AGN, Amadeus, and ActewAGL Gas Network) are all substantively the same. These are also largely the same as those that were before the tribunal (only a few incremental additions to arguments). Given this, we have attached the AGN proposal and are happy for the consultant to just read this proposal (we will check and let the consultant know if they should read anything in any other proposals – however even if there is something else to read it will not be material).
- The new consultants' reports from the Frontier economics on gamma submitted with the revised regulatory proposals on 6 January 2016: Frontier economics: *The appropriate use of tax statistics when estimating gamma*.
- Associate Professor Handley's advice to the AER received in September 2014 and 2015 as it relates to the questions in this brief
- Submission from parties on gamma on the current decisions, with a particular focus on any late submissions made on the recently released Tribunal decision

- AER drafting on the consistency of parameter estimates in the rate of return framework and why an adjustment to the dividend drop off studies is required to make the estimate pre-personal tax. (for review)
- Officer's 1994 paper, *The cost of capital of a company under an imputation tax system*
The consultant should read more broadly to the extent they consider it necessary to provide the services required.

Service required

The consultant is required to write a short report that answers the following questions in light of the decision by the Australian Competition Tribunal handed down on 26 February 2016. In answering each question the consultant should give a brief explanation on why they hold their view.

Where relevant to a given question, the consultant should express a view on whether they consider the Tribunal view and reasoning is correct (or not) and why they hold this view.

Where they consider it desirable, the consultant is free to add commentary on others matters they consider of relevance to the question of whether the AER's approach to estimating gamma (including reasoning for approaches and their relative weighing) appears reasonable.

The consultant will be required to provide a draft report for comment of AER staff and a final report taking into account AER staff comments. The consultant is only required to take into account AER staff comments to the extent the consultant thinks this is warranted (noting the AER expects and wants the consultant to provide their honest expert opinion).

The consultant is also required to review a short piece of drafting by AER staff with respect to both logic and clarity.

Questions for the consultant

- (1) Is the AER's approach to estimating the value of imputation credits consistent with the post-tax framework in the National electricity rules (NER)/National gas rules (NGR)? For clarity, please also explain:
 - a. What does post-tax mean in the NER/NGR
 - b. What are the cash flows going to capital providers under the post-tax framework in NER/NGR, and do the cash flows going to capital providers of the firm under this framework effectively include:
 - i. The face value (FV) of coupon payments on debt
 - ii. The FV of principal repayments on debt
 - iii. The FV of distributed dividends
 - iv. The FV of realisable capital gains
 - v. The FV of claimed imputation credits
 - c. Is the AER approach to gamma, effectively based on the assumption that imputation credits with a face value of \$1 have a post-tax value of \$1 when utilised, consistent with the post-tax framework in the NER/NGR? In this context:

- i. Does the fact estimates of the utilisation value from the equity ownership approach and tax statistics are not “market values” derived from observable prices invalidate estimates from these approaches.
- ii. Does the fact the estimate of the required returns on debt and equity are derived from market prices invalidate the use of estimates of the utilisation value from the equity ownership approach or tax statistics?
- iii. Does the fact estimates of the required return on debt and equity are derived from market prices mean estimates of the utilisation value from dividend drop off (or other “market” based studies) should be used in preference to estimates from the equity ownership approach and from taxation statistics?

In answering the above question and to the extent you consider it relevant, please have regard to the relevant formulas and definition of cash flows for the post tax vanilla WACC in Officer’s 1994 paper *The cost of capital of a company under an imputation tax system*.

- (2) Does the AER’s estimation of rate of return parameters (that utilise the market value of shares and bonds) combined with the estimation of a utilisation value (largely based on the face value of distributed imputation credits expected to be utilised) appear reasonable? In this sense, are their different methods of estimation (mixture of market value and face value) consistent?

In answering this question please consider whether estimates of the required return on debt and equity are likely to be impacted by differential personal taxes in materially the same way as estimates of the utilisation value from dividend drop off studies. Also please consider the Tribunal’s comments at paragraph 1073.

- (3) With respect to different estimates of the utilisation rate:

- a. Can the equity ownership approach produce a valid point estimate for the utilisation value? In considering this, please consider if:
 - i. estimates from the equity ownership approach should be limited to use as an upper bound for the utilisation rate?
 - ii. there is any reason the estimate is likely to be unreliable?
- b. Can Tax Statistics provide a valid point estimate for the utilisation value? In considering this, please consider if:
 - i. estimates from tax statistics should be limited to use as an upper bound for the utilisation rate?
 - ii. there is any reason the estimate is likely to be unreliable?
- c. Can you briefly explain what may be driving the difference between the estimates of the utilisation value from the equity ownership approach and from taxation statistics? In considering this, please consider if the difference is likely to be driven by:
 - i. domestic investors not being able to utilise imputation credits (i.e. the 45 day holding rule)
 - ii. investors not valuing imputation credits at their full face value
 - iii. Data issues with the different estimates

- d. Would the 45 day holding rule be expected to be having a material impact on the utilisation of imputation credits relative to estimates derived from the equity ownership approach?
 - e. Is it reasonable to give the most weight to estimates of the utilisation value from the equity ownership approach, less weight to estimates from taxation statistics, and the least weight to estimates from dividend drop off studies?
 - f. Are the AER reasons for giving limited weight to market based studies reasonable?
- (4) To the extent market based studies are used to estimate the utilisation value, should an adjustment be made to the estimated utilisation value from a study where the study estimates the value of cash dividends at less than its face value? If yes, what adjustment is likely to be required? Is the AER's approach appropriate?
- (5) Should the utilisation value and the distribution rate be estimated on a consistent data set? In answering this please consider:
- a. If it is reasonable to combine estimates of the distribution rate and utilisation value from a consistent date set (e.g. to combine a listed equity distribution rate with a listed equity utilisation value)?
 - b. If it is reasonable to conclude the top 20 firms should not be excluded from the estimate of the distribution rate for listed firms?

REFERENCES

ACT, 2016. *Application by Public Interest Advocacy Centre Ltd and Ausgrid [2016] ACompT 1* (www.competitiontribunal.gov.au).

AEMC, 2016. *National Electricity Rules* (<http://www.aemc.gov.au/getattachment/f18d8d43-c49b-4a31-b8b6-246073ee2d17/National-Electricity-Rules-Version-79.aspx>).

AER, 2015. *Draft Decision Australian Gas Networks Access Arrangement 2016 to 2012 Attachment 4 – Value of Imputation Credits* (www.aer.gov.au).

AGN, 2016. *Response to Draft Decision: Cost of Tax*, submission to the AER (www.aer.gov.au).

ANZ, 2015. *Annual Report* (https://www.shareholder.anz.com/sites/default/files/2015_annual_report.pdf).

Beggs, D., and Skeels, C., 2006, 'Market Arbitrage of Cash Dividends and Franking Credits', *Australian Economic Papers*, vol 82, pp. 239-252.

BHP Billiton, 2015. *Annual Report 2015* (<http://www.bhpbilliton.com/~media/bhp/documents/investors/annual-reports/2015/bhpbillitonannualreport2015.pdf?la=en>).

CBA, 2015. *Annual Report 2015* (<https://www.commbank.com.au/content/dam/commbank/about-us/shareholders/pdfs/annual-reports/cba-annual-report-30%20June-2015.pdf>).

Copeland, T., Weston, J., and Shastri, K., 2005, *Financial Theory and Corporate Policy*, 4th edition, Pearson Addison-Wesley, Boston.

Corrs Chambers Westgarth, 2015. *Notice of Lodgement Australian Competition Tribunal Submissions on Gamma*.

Frontier Economics, 2016. *The Appropriate Use of Tax Statistics when Estimating Gamma*, report prepared for Jemena Electricity Networks (www.aer.gov.au).

Handley, J., 2014. *Advice on the Value of Imputation Credits*, report prepared for the AER (www.aer.gov.au).

_____ 2015a. *Further Advice on the Value of Imputation Credits*, report prepared for the AER (www.aer.gov.au).

_____ 2015b. *Advice on the NERA Report: Estimating Distribution and Redemption Rates from Taxation Statistics*, report prepared for the AER (www.aer.gov.au).

Hathaway, N., 2013, *Imputation Credit Redemption ATO Data 1988-2011: Where Have All The Credits Gone?* (www.aer.gov.au).

Lally, M., 2013. *The Estimation of Gamma*, report prepared for the AER (www.aer.gov.au).

_____ 2014. *Review of Submissions to the QCA on the MRP, Risk-Free Rate and Gamma*, report prepared for the QCA (www.qca.org.au).

_____ 2015a. *Review of Submissions on Gamma*, report prepared for the QCA (www.qca.org.au).

_____ 2015b. *Estimating the Distribution Rate for Imputation Credits*, working paper.

_____ and van Zijl, T., 2003, 'Capital Gains Tax and the Capital Asset Pricing Model', *Accounting and Finance*, vol. 43, pp. 187-210.

Monkhouse, P., 1993, 'The Cost of Equity under the Australian Dividend Imputation System', *Accounting and Finance*, vol. 33 (2), pp. 1-18.

NAB, 2015. *Annual Report* (<http://www.nab.com.au/content/dam/nabrwd/About-Us/shareholder%20centre/documents/annual-financial-report-2015.pdf>).

NERA, 2013, *The Payout Ratio*, report prepared for the ENA (www.aer.gov.au).

_____ 2015. *Estimating Distribution and Redemption Rates from Taxation Statistics*, report prepared for Jemena Gas Networks (www.aer.gov.au).

Officer, R., 1994, 'The Cost of Capital of a Company under an Imputation Tax System', *Accounting and Finance*, vol. 34, pp. 1-17.

Rio Tinto, 2015. *Annual Report* (<http://www.riotinto.com/investors/downloads-16678.aspx>).

SFG, 2014. *An Appropriate Regulatory Estimate of Gamma*, report prepared for Aurizon Ltd (www.qca.org.au).

Telstra, 2015. *Annual Report 2015* (<http://telstra2015ar.interactiveinvestorreports.com/financialreports/downloads/telstra2015ar.pdf>).

United Energy, 2016. *Letter to the AER (26 April 2016)*.

Westpac, 2015. *Full Year 2015 Financial Result* (http://www.westpac.com.au/docs/pdf/aw/ic/Westpac_FY15_financial_results.pdf).