REVIEW OF SUBMISSIONS ON THE MARKET-WIDE WACC PARAMETERS FOR AURIZON NETWORK'S 2017 DAU

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CONTENTS

EXECUTIVE SUMMARY

The QCA has recently issued a Draft Decision on Aurizon Network's 2017 DAU, for the regulatory period from 1 July 2017 to 30 June 2021 (UT5 period). In response, numerous submissions have been received. This report has reviewed new arguments in relation to the market-wide WACC parameters (the risk-free rate, market risk premium, and gamma). Much of the analysis offered in these submissions (which are principally by Frontier) involves repetition of previous arguments that have already been addressed by me, but for which Frontier offers no comments. Amongst the new arguments, I agree with the following points.

Firstly, in respect of MRP surveys conducted by Fernandez and KPMG, I agree with Frontier's point that the associated responses provided from the respondents on risk-free rates strongly suggests that their MRP estimates were intended to apply to at least a ten-year term. However, it does not follow from this that the survey respondents do vary their MRP estimates according to the term of the asset being valued. Furthermore, even if these survey responses were adjusted in the same fashion as the QCA does for the independent experts, this would only raise the QCA's point estimate based upon all of these surveys from 7.0% to 7.2%, which would not affect the median result across the five approaches examined by the QCA, and raise the mean result by only 0.05%. Accordingly, it would presumably not have affected the QCA's decision.

Secondly, I agree with Frontier's point that the use of financial statement data to estimate distribution rates for credits presumes that all credits distributed by these firms are immediately available for shareholders to redeem, but that this might not occur because some of the immediate recipients are companies and trusts, who in turn would not pass them to the ultimate beneficiaries until they in turn paid a dividend. So, some credits might be trapped or delayed. However, Frontier offers no analysis on the possible effect of this point and the analysis conducted here suggests that the effect would be very small.

Thirdly, for the purposes of estimating the imputation credit distribution rate for the BEE, I accept Frontier's point that there is merit in examining the distribution rates for a set of firms chosen to match the regulated businesses in some way, although there would be considerable

subjectivity in choosing that set. The natural choice would be the set of energy network businesses firms used by the AER to estimate the optimal gearing and beta for the regulated businesses: APA Group, Ausnet Services, DUET Group, Envestra (now Australian Gas Networks), and Spark Infrastructure. Across these five firms, it is possible to estimate the distribution rate for three of them, and the rate is 1 for two of those firms and should be 1 for the third (all over at least the last ten years). This limited evidence supports my earlier conclusion that the appropriate estimate for the distribution rate of the BEE is at least 0.83.

Fourthly, I accept Frontier's point that there are some errors in the earlier analysis conducted by me into the aggregate imputation credit distribution rate for the 20 largest Australian firms over the 2000-2013 period, leading to an estimate of at least 0.83. By contrast, Frontier's analysis over the same period leads to a figure of 0.79. My revised analysis over this period still leads to a figure of at least 0.83. The difference between the last two figures is due to a wide range of errors in Frontier's analysis, comprising omission of some companies without good cause, apparently underestimating dividends by omitting those dividends paid under Dividend Reinvestment Plans, and errors in determining Franking Balances. Furthermore, I have also extended this analysis to 2017, and the effect is to further raise the rate to at least 0.88.

Lastly, I agree with the QRC's point that the MRP should be estimated using the median MRP result across the methodologies considered by the QCA, so as to provide protection against outliers. The effect of doing so would be to produce an MRP estimate of 6.5% rather than 7.0%, for MRPs defined over both four and ten-year terms.

1. Introduction

The QCA (2017) has recently issued a Draft Decision on Aurizon Network's 2017 DAU, for the regulatory period from 1 July 2017 to 30 June 2021 (UT5 period). In response, numerous submissions have been received. This report reviews new arguments in relation to the market-wide WACC parameters: the risk-free rate, market risk premium, and gamma.

2. Risk-Free Rate

Aurizon (2018, pp. 99-100) notes that in February 2017 it proposed an averaging period for the risk-free rate of 20 business days up to and including 30 June 2017, that the QCA (2017, page 67) subsequently proposed doing so, that the risk-free rate was unusually low at this time, that averaging periods closer to the Final Decision have been used in other decisions, and therefore argues that the averaging period here should be changed accordingly. Aurizon's claim that the risk-free rate in the averaging period just before 30 June 2017 was unusually low seems to be true. However, contrary to Aurizon's suggestion, this does not disadvantage Aurizon. Using such a period would give Aurizon the option to hedge its exposure on the risk-free rate component of its cost of debt with interest-rate swap contracts (because the period is predictable) and the NPV = 0 principle would then be satisfied.

To see this, consider a regulatory scenario in which the regulated businesses purchases an asset costing A now (time 0), with a life of one year, financed with borrowing of B and equity investment of D, a revenue or price cap is set now that yields revenues in one year , and there is no opex or taxes. So, the expected revenues will equal the equity investment (along with an allowed rate k_{eR} on it) plus the borrowing (along with an allowed rate k_{dR} on it). Letting the current borrowing rate for one year on this debt be denoted k_{d01} and the current cost of equity on this equity investment be denoted k_{e01}, the present value now of the net cash flows to the equity holders is then as follows

$$S_0 = \frac{E(REV) - B(1 + k_{d01})}{1 + k_{e01}}$$

$$= \frac{D(1 + k_{eR}) + B(1 + k_{dR}) - B(1 + k_{d01})}{1 + k_{e01}}$$

So, if the allowed rate on equity k_{eR} is equal to the current cost of equity k_{e01} and the allowed rate on debt k_{dR} is equal to the current cost of debt k_{d01}, then the value now of the equity S_0 will equal the investment D, and therefore the value now of the regulated business ($S_0 + B$) will be equal to the cost of the assets ($D + B$), and therefore the NPV = 0 principle will be satisfied. A necessary condition for the allowed rate on equity k_{eR} equaling the current cost of equity k_{e01} and the allowed rate on debt k_{dR} equaling the current cost of debt k_{d01} is that the allowed rates are set on the basis of the *current* risk-free rate.

Furthermore, because NPV = 0 holds regardless of the level of the risk-free rate at the beginning of the regulatory cycle, Aurizon would be protected on both its cost of debt and cost of equity. Thus, even if the risk-free rate over this 20 day period just before the beginning of the regulatory cycle were unusually low, and therefore Aurizon's allowed revenues were lowered (via the allowed rates k_{eR} and k_{dR} in the numerator of the last equation), this would reduce Aurizon's borrowing costs (at rate k_{d01} in the last equation) and the cost of equity used to present value the expected cash flows to its equity holders (rate k_{e01} in the last equation), leaving NPV still equal to zero.

Furthermore, by arguing for a different averaging period, with presumably a higher risk-free rate, Aurizon is therefore seeking revenues that will exceed those consistent with the NPV = 0 principle. In terms of the above example, Aurizon's proposal would elevate the rates k_{eR} and k_{dR} in the last equation but would not change the interest rate k_{d01} that the firm pays or the cost of equity k_{e01} used to present value the expected cash flows to equity holders back to now, and therefore the NPV = 0 principle will be violated. For all of these reasons, Aurizon's argument for a new averaging period close to the Final Decision is devoid of merit.

TCI Fund Management (2018, pp. 2-3) argues that, because the risk-free rate was at an unusually low point at the beginning of the regulatory cycle, the QCA should instead consider "the likely level of RFR over the 4-year period of UT5". However, this is a variant on Aurizon's proposal

to change the point in time at which the allowed rates are set and therefore suffers from the same problems: it would prevent the firm from hedging its borrowing costs using interest rate swap contracts, it would violate the NPV = 0 principle, and it would raise revenues relative to those required to satisfy the NPV = 0 principle.

Frontier (2018a, section 2.1) argues that commercial practice is to use the ten-year risk-free rate in valuing equities, and implies that regulators should do likewise in setting the allowed rate of return. This point has been raised previously in Frontier (2017a, section 2.4) and SFG (2014a, section 2). However, as argued in Lally (2015a, section 2.1), the QCA is not engaged in valuing equities but in periodically setting the allowed rate of return in order to cover a business's efficient costs, and this is equivalent to satisfying the NPV = 0 principle. Since the exercises are different, what is appropriate in one case need not be appropriate in the other. Furthermore, as shown in Schmalensee (1989), Lally (2004) and Lally (2007a, 2007b), this regulatory situation implies that the appropriate term of the risk-free rate is that matching the regulatory cycle. This analysis cannot be rebutted by citing commercial practice in an unrelated exercise. Furthermore, as shown in Lally (2013, pp. 23-26), there are good reasons for valuation exercises to use a different risk-free rate. Frontier (2018a) does not respond to the arguments in Lally (2013) or Lally (2015a).

Frontier (2018a, section 2.1) refers to a survey conducted by Incenta (2013), and claims that it supports regulatory use of the (prevailing) ten-year risk-free rate. This repeats the point made in Frontier (2017a, section 2.4). As noted in Lally (2017a, section 2), this report was examined in Lally (2014, pp. 26-28), and the conclusion reached there was that the Incenta survey results do not support the QCA using the prevailing ten-year risk-free rate. In particular, the interviewees were not using the prevailing ten-year risk-free rate themselves, they were in general recommending rates for use in valuing very long-term cash flows, and various responses from these interviewees undercuts the presumption that their views are authoritative (including rationalizing their actions on the basis that it is "standard market practice"). Frontier (2018a) has not responded to any of the points raised in Lally (2014, pp. 26-28).

Frontier (2018a, section 2.2) claims that the current standard regulatory practice in Australasia is to use the ten-year risk-free rate and, in support of this, it refers to the practice of various such regulators. This point repeats that raised in SFG (2014a, section 5). However, Frontier acknowledges that the ERA and the NZCC both use rates matched to the regulatory cycle, as does the QCA. This contrary evidence contradicts Frontier's claim. Furthermore, even if Frontier's claim were true, any proposed procedure must rest upon its inherent merits rather than mere observation of existing practice. Without such an approach, no progress in any area is possible. Moreover, this is an approach that SFG is entirely sympathetic to. For example, SFG (2012) supported the use of a trailing average for the cost of debt despite the fact that this practice was not used by any Australian regulator at the time (and SFG is Frontier's earlier name). Naturally, SFG supported the use of this approach because of its perceived inherent merits. The same principle applies to the QCA's approach to determining the term of the risk-free rate. The methodology must stand or fall on its own merits.

Frontier (2018a, section 2.3) notes that the typical UK regulatory practice is to allow a real risk-free rate that is usually above the ten-year real risk-free rate, and that the typical US regulatory practice is to allow a 30-year risk-free rate. Since these practices are mutually incompatible, and both inconsistent with the use of a ten-year rate, it is not clear which practice Frontier is recommending. Perhaps the point is to demonstrate that the QCA is part of an Australasian group that is the least generous internationally. If so, the same evidence seems to demonstrate that the UK regulators are the most generous, and could just as easily be used to argue that the UK regulators were 'wrong' rather than the QCA. Nothing in this survey approach reveals which approach is the best. As argued in the previous paragraph, any proposed procedure must rest upon its inherent merits rather than mere observation of existing practice, and Frontier offers no rationale for any of these practices. By contrast, the QCA's (2017) approach follows from the fundamental regulatory principle that the NPV of the regulatory cash flows is zero, and the QCA rationalizes it on that same basis.

Frontier (2018a, section 3.2) asserts that the 'risk-free rate term proposition' (that the risk-free rate allowed by the regulator must match the regulatory cycle in order to satisfy the NPV = 0 principle) assumes that the market value of the regulatory assets at the end of the regulatory

cycle is certain, and quotes from both Lally (2012, pp, 10-14) and the QCA (2014, pp. 45-46) in support of that. The same claim has been made in Frontier (2017a, section 3). However, as discussed in Lally (2017, pp. 9-10), Frontier's quotes from both Lally (2012) and the QCA (2014) are drawn from mere examples in which simplifying assumptions including this one are made in order to demonstrate the fundamental point, and both Lally (2012) and the QCA (2014) elsewhere make it quite clear that this certainty assumption does not underlie the 'risk-free rate term proposition'. Frontier (2018a, section 3.2) does not respond to these points.

On the question of whether the market value of the regulatory assets at the end of the regulatory cycle must be certain in order for the 'risk-free rate term proposition' (the risk-free rate allowed by the regulator must match the regulatory cycle in order to satisfy the NPV = 0 principle) to be valid, Lally (2017a, section 2) presents two examples that each demonstrate that the certainty assumption is not necessary. Frontier (2018a, section 3.3) objects to the first example. To assess this objection, it is necessary to repeat the example, which was as follows. Fixed assets are purchased now at cost B, their life is two years, all financing is equity, a revenue or price cap is set now that yields revenues in one year and is reset at that point to yield revenues one year later, there are no operating costs or corporate taxes, there are no revenue risks, the allowed depreciation in the first year is 50% of the asset cost, the RAB at time 1 is set to match the replacement cost of the assets at that time (by adding an amount Z to the asset cost net of the first year's depreciation), this amount Z is (as perceived at the current time) a random variable with mean zero and uncorrelated with market returns, the regulator correctly sets revenues at each point, and there is no differential personal tax treatment across different sources of investment income.

In this scenario, in one year's time, the RAB of the asset will be $.5B + Z$, and the regulatory revenues set at that point for receipt one year later will be this RAB plus an allowed rate of return (d_{12}) on it, i.e., $REV_2 = (.5B + Z)(1 + d_{12})$. This amount to be received at time 2 will be known with certainty at time 1. Accordingly, it should be discounted at the one-year risk-free rate prevailing at time 1 (R_{12}). To satisfy the NPV = 0 principle, the regulator should use the same rate in setting these revenues. The revenues are then $(.5B + Z)(1 + R_{12})$ and the value of these revenues at the time they are set is then as follows:

$$V_1 = \frac{(.5B + Z)(1 + R_{12})}{1 + R_{12}} = .5B + Z \qquad (1)$$

Similarly, the regulator sets revenues now (to be received in one year) equal to depreciation (.5*B*) plus an allowed rate of return applied to the initial RAB (Bd_{01}). These revenues are certain now and therefore warrant discounting at the current one-year risk-free rate (R_{01}). The owners of the regulated business will also receive its value in one-year (V_1), which is shown in equation (1) and is not certain at the present time because *Z* is unknown at the present time, consistent with Frontier's scenario of uncertainty about V_1. However, since *Z* is uncorrelated with market returns, the appropriate discount rate on V_1 over the first year will still be the current one-year risk-free rate (R_{01}). Accordingly, the regulator should use the same rate in setting the allowed cost of capital for the first year. The revenues at time 1 from the regulated assets would then be ($.5B + BR_{01}$), and the residual value at that point will be (.5*B* + *Z*) as shown in equation (1). So, the value now of the regulated assets would be as follows:

$$V_0 = \frac{(.5B + BR_{01}) + .5B + E(Z)}{1 + R_{01}} = \frac{B(1 + R_{01})}{1 + R_{01}} = B \qquad (2)$$

So, the NPV = 0 principle ($V_0 = B$) is still satisfied through the regulator using the prevailing one-year risk-free rate at each reset point, despite the fact that V_1 is now uncertain. This contradicts Frontier's claim that the two-year risk-free rate (matching the asset life) must be used by the regulator when V_1 is uncertain.

Frontier's (2018a, section 3.3) objection to this example relates to the discount rates used. In particular, Frontier claims that the QCA invokes discount rates that investors should use rather than the rates actually used by investors, and "..the uncontested evidence clearly shows that the real-world investors set their required return using a ten-year risk-free rate..". In the context of this example, Frontier's view is that the discount rates appearing in the denominators of equations (1) and (2) ought to be the ten-year risk-free rates prevailing at those times rather than the one-year rates, and satisfying the NPV = 0 principle would then require that the allowed rates set by the regulator appearing in the numerators of equations (1) and (2) ought to be the ten-year

risk-free rates prevailing at those times rather than the one-year rates. However, as discussed earlier, the ten-year rates that Frontier claims various market participants are using are rates being used in DCF valuations of companies, and might be considered to be appropriate in *those* circumstances. These market participants were not asked what rates they would use in the scenario presented in this example. Similarly, they were not asked what rate they would use to value an Australian government bond maturing in one year, nor would it be necessary to ask them. An Australian government bond maturing in one year warrants valuing using the prevailing one-year risk-free rate, and any market participant acting otherwise would simply provide arbitrage profits to their peers. Similarly, in equation (1), the correct discount rate is the one-year risk-free rate prevailing at time 1 for exactly the same reason that a Government bond maturing in one year must be valued using the prevailing one-year risk-free rate. So, Frontier's evidence for contesting a hypothetical example bears no relation to the example and, even if it did relate to the example, it would supply evidence on the competence of the survey respondents rather than the appropriate course of action.

In relation to this first example, Frontier (2018a, page 4, page 16) also claims that equation (2) above is circular (i.e., it assumes the result it seeks to prove) because it assumes that the regulator's allowed return in the numerator is equal to the market's required return in the denominator. This is not correct. Frontier is conflating a simplifying assumption made in the derivation of a model (such as the assumption of no transactions costs in the CAPM) with a parameter choice that must be made by a regulator in order to achieve a desired goal, and these are fundamentally different exercises even though both utilize mathematics. The purpose of the regulatory exercise is to find the 'correct' regulatory risk-free rate, defined as the rate that ensures that the NPV = 0 result is obtained. The mathematics of equation (2) above reveals that this regulatory rate must match that used in the discount rate, and therefore match the length of the regulatory cycle. So, an objective exists (NPV = 0) and one seeks a parameter value that achieves it. This kind of exercise is quite different to that involving the derivation of a model such as the CAPM, in which simplifying assumptions are made and the laws of mathematics then produce a result that could be quite surprising to all concerned.

In relation to this first example, Frontier (2018a, page 4) also claims that the NPV = 0 principle "says nothing more than that the discount rate should be the correct one", and again asserts that the correct rate is based on the ten-year risk-free rate because investors use it. The latter point has already been addressed. The former point is a mischaracterization of the NPV = 0 principle, which instead states that the present value of the future cash flows from a regulatory business should be equal to the initial investment, and regulatory use of a risk-free rate matching the regulatory cycle will achieve this. In the course of demonstrating this, a discount rate must be used and naturally the correct rate must be used.

Frontier (2018a, section 3.3) also objects to a second example in Lally (2017, section 2). Again, to assess Frontier's criticism, it is necessary to repeat the example, which was a variant on the first example as follows. Suppose now that Z embodies systematic risk. This has no effect upon equation (1) because the risk relating to Z is resolved over the first year. However, the appropriate discount rate on the payoffs on the regulatory assets at the end of the first year should now be the one-year risk-free rate augmented by a risk premium (p_{01}). This premium is therefore also added by the regulator to its allowed cost of capital in the first year. So, equation (2) becomes:

$$V_0 = \frac{(.5B + BR_{01} + Bp_{01}) + .5B + E(Z)}{1 + R_{01} + p_{01}} = \frac{B(1 + R_{01} + p_{01})}{1 + R_{01} + p_{01}} = B \qquad (3)$$

So, the NPV = 0 principle ($V_0 = B$) is still satisfied through the regulator using the prevailing one-year risk-free rate at each reset point, despite the fact that V_1 is again uncertain. This again contradicts Frontier's claim that the one-year risk-free rate is no longer appropriate when V_1 is uncertain.

In response, Frontier (2018a, section 3.3) argues that there is no place within the QCA's regulatory model to accommodate any such premium. This is not correct. If risk relating to V_1 were systematic, it would be empirically reflected in the beta estimate along with all other sources of systematic risk. Having estimated beta empirically, the QCA does not *additionally*

need to make any allowance for systematic risk relating to V_1, and if it did so it would be double counting.

It should also be noted that, if Frontier's belief (that regulatory use of a risk-free rate matching the regulatory term would be appropriate if V_1 were certain but not otherwise) were true, it would remain true even if the risk associated with V_1 were infinitesimally small, and therefore would violate a "smooth-pasting" requirement in asset pricing and regulation, i.e., very small changes in risk cannot give rise to substantial changes in valuation (due to arbitrage) and hence cannot give rise to substantial changes in the appropriate regulatory decision. Furthermore, the change favoured by Frontier when V_1 has any risk involves switching from the risk-free rate matching the regulatory cycle to a longer-term rate, and this change would be substantial if the two rates were quite different. All of this implies that Frontier's argument cannot be valid. These points were raised in Lally (2017a, section 2) and Frontier (2018a) does not respond to them.

Finally, on this matter, it should be noted that these examples designed to rebut Frontier's claims about risk in V_1 are secondary. The matter has been addressed earlier in Lally (2004), which is concerned with precisely this question and demonstrates that the NPV = 0 principle implies that the appropriate risk-free rate is that matching the regulatory cycle "..even in the presence of cost and volume risks, and risks arising from asset valuation methodologies." (ibid, page 18). These risks are allowed for by adding a risk premium to the discount rate used to value cash flows, and therefore also to the cost of equity allowed by the regulator, not by altering the term for the risk-free rate. Contesting this analysis would require showing some error in it, and Frontier have not done so.

Frontier (2018a, section 4) argues that there is an inconsistency between the QCA's RAB roll-forward, in which the RAB is inflated in accordance with the realized inflation rate whilst an allowance for expected inflation is deducted from its revenue requirement, and the Siegel estimate of the MRP, in which the historical average real return on government bonds is added back to the Ibbotson estimate of the MRP followed by deducting the expected long-run real risk-free rate. In the RAB case, the QCA estimates expected inflation from a geometric average of the RBA's short-term forecasts and the mid-point of the RBA's target band for years beyond its

forecasting period (QCA, 2017, page 50). Implicitly, this involves rejecting use of the "break-even inflation rate" and therefore implicitly rejecting the use of inflation-indexed CGS bonds for determining the real risk-free rate reflected in nominal CGS bonds. By contrast, in determining the Siegel MRP estimate, Frontier claims that the QCA uses inflation-indexed CGS bonds to determine the expected real risk-free rate.

I acknowledge that there is a difference in approach here by the QCA, but there is good reason for the QCA doing so. The "break-even" approach to estimating inflation may be subject to significant biases arising primarily from the presence of compensation for inflation risk within nominal but not inflation-indexed CGS yields and higher compensation for illiquidity within inflation-indexed CGS yields relative to nominal CGS yields. Accordingly, I favour the QCA's approach to estimating expected inflation, involving the use of RBA forecasts. Consistency might then suggest that the QCA should avoid using inflation-indexed CGS bonds for estimating the expected real risk-free rate over the period for which the Siegel estimator is determined (1958-2017), and therefore use the yields on nominal bonds net of RBA inflation forecasts for that period. However, for most of that period, there were no RBA forecasts with which to implement that approach, and even if there were such forecasts would be quite unreliable until 1993 when the inflation rate stabilised. Two options then remain: averaging over inflation-indexed CGS yields for the period in which they were available (from 1987), and averaging over ex-post real returns on nominal bonds over long periods in which inflation was stable. The QCA examines evidence of both types and the results are similar, which supports use of those results to estimate the expected long-run real return on the nominal bonds.

Frontier (2018a, section 5) observes (correctly) that the four-year risk-free rate (used by the QCA to match the regulatory cycle) is more volatile than the ten-year rate, which increases price volatility to customers. This is true but use of the ten-year rate also increases the average price paid by customers because the ten-year rate is on average higher than the four-year rate. Furthermore, relative to the impact of fluctuations in petrol prices or mortgage interest rates on the average consumer, the fluctuations in prices for regulated services occasioned by regulatory use of the four-year rate rather than the ten-year rate would be trivial.

Frontier (2018a, section 5) also argues that these greater price fluctuations from use of the four-year rate rather than the ten-year rate increase the volatility of returns received by investors and therefore inhibit capital investment. This is not correct. Investment will be forthcoming if the NPV of the investment is at least zero rather than if returns volatility is low, and is the basis of the NPV = 0 principle. Furthermore, whatever impact that the greater volatility of four-year government bond rates relative to ten-year rates has on investor behavior, it will induce changes in the relative rates so that both markets clear, and the four-year rate used by the QCA is then a market rate that fully compensates investors for all features of its return distribution.

3. Market Risk Premium

Frontier (2018b, section 2.2) asserts that, despite switching to an MRP defined relative to the four-year risk-free rate rather than to the ten-year rate used in the Market Parameters Decision (QCA, 2014), the QCA has not in substance changed its MRP estimate. In support of this claim, Frontier notes that adding the QCA's former MRP estimate of 6.5% (defined relative to the ten-year risk-free rate) to the current ten-year risk-free rate of 2.4% yields a market cost of equity of 8.9%, as does adding the QCA's current MRP estimate of 7.0% (defined relative to the four-year risk-free rate) to the current four-year risk-free rate of 1.9%. However, Frontier is conflating claims concerning the market cost of equity with those concerning the MRP, and the concern here is solely with the latter. Had the current margin between the four and ten-year risk-free rates been other than 0.5%, the two market costs of equity would not have been equal but that would no more have disproved Frontier's point than the current differential proves it. To assess whether the QCA's current MRP estimate defined relative to the four-year risk-free rate is in substance the same as its previous estimates of 6.5% defined relative to the ten-year risk-free rate, it is necessary to strip out the effect of the change in definition. Table 1 below shows the QCA's estimates of the MRP for the five different methodologies examined, in the Market Parameters Decision (QCA, 2014, page 23), the DBCT Decision (QCA, 2016, section 4.7), the UT5 Draft Decision (QCA, 2017, page 83), and reconstruction of the latter numbers to reflect the use of a ten-year risk-free rate (because the 2014 and 2016 QCA Decisions defined the MRP

relative to the ten-year risk-free rate).[1] Since the QCA (2017, pp. 83-84) refers to the simple mean, the median, and a weighted mean (with indicative weights of 15%, 25%, 20%, 25% and 15% respectively on the five methodologies shown in Table 1) in forming its conclusion, the table shows all three statistics for the last two columns (with the weighted mean in brackets) and the first two statistics for the 2014 and 2016 Decisions.[2]

Table 1: MRP Estimates

	2014 (10)	2016 (10)	2017 (10)	2017 (4)
Siegel	5.5	5.5	5.6	5.9
Ibbotson	6.5	6.4	6.3	6.6
Surveys	6.2	6.4	6.8	7.0
Cornell	6.9	7.0	6.4	6.4
Wright	n/a	9.2	9.0	9.5
Mean	6.3	6.3	6.8 (6.7)	7.1 (7.0)
Median	6.35	6.4	6.4	6.6
Decision	6.5	6.5	?	7.0

The issue here is whether the QCA would have estimated the MRP at 6.5% in 2017 had it defined it relative to the ten-year risk-free rate rather than the four-year risk-free rate. If it had done so, the increase to 7.0% would be purely due to the change in definition, as claimed by Frontier. In respect of the three statistics considered by the QCA in its 2017 Decision, one of

[1] In respect of the survey-based estimates, the midpoint of the range (arising from considering estimates 'with and without' allowance for imputation credits) is used (consistent with the QCA). In respect of the 2017 (10) estimates, the Cornell estimate is the same as in the 2017 (4) estimates for the reasons given by the QCA (2017, page 477). In addition, the Ibbotson and Siegel estimates are lower than the 2017 (4) estimates because the historical average risk-free rate differential is 0.34% (ibid, pp. 476-477). In addition, the 2017 (10) survey based estimate is lower than for the 2017 (4) estimate because one component in this approach (the MRP estimate from the Independent Expert Reports) is reduced by 0.34% (ibid, page 482). Finally, the 2017 (10) Wright estimate is lower than in the 2017 (4) estimate due to the current risk-free rate differential of 0.53% (ibid, page 477).

[2] The mean and median for the 2016 Decision are determined using only the results for the first four methodologies because the QCA (2016, footnote 199) places "very low weight" on the Wright approach despite reporting its estimate of the MRP using this approach.

them (the simple mean) supports an MRP of 7.0% if rounded to the nearest 0.5% whilst the other two do not. So, it is unclear how the QCA would have acted in 2017 if it were defining the MRP relative to the ten-year rate and rounding to the nearest 0.5%. Furthermore, the QCA might be estimating the MRP to the nearest 0.25% and if so would presumably have estimated the MRP at 6.75% in 2017 had it defined it relative to the ten-year risk-free rate. In this case, the increase in its MRP estimate from 2014/2016 to 2017 would be partly due to the change in definition and partly real. All of this undercuts Frontier's claim that the QCA has not changed its MRP estimate after allowing for the change in its definition.

My own view is that the MRP should be estimated from the median across the five methodologies, in accordance with the usual rationale of providing protection against the impact of outliers. As shown in Table 1, this supports an MRP estimate of 6.5% for both a four-year and a ten-year MRP, when rounding to the nearest 0.5% or even the nearest 0.25%.

Frontier (2018b, section 2.3) also argues that the QCA ought to have in substance raised its MRP estimate. In support of this, it notes that the QCA (2017, page 84) has observed that the estimates from four of the five methods examined by it have increased since the DBCT Decision. It also notes the QCA's (2017, page 82) observation that the current risk-free rate is low and the "plausible (negative) correlation between the risk-free rate and the MRP." It also provides some evidence that the MRP has increased, most particularly evidence on the negative correlation between the MRP and the risk-free rate. However, all of this evidence is premised upon the QCA not having in substance increased its MRP estimate, and this premise may not be true as demonstrated above. Furthermore the QCA's observation that the MRP estimates for four of its five methods had increased since the DBCT Decision is a reference to its current estimates defined relative to the four-year risk-free rate (see Table 1, columns 2 and 4). The appropriate comparison should be with the current estimates defined relative to the ten-year risk-free rate. In this case, the MRP estimates have increased in only two of the five cases (see Table 1, columns 2 and 3). Thus, Frontier's evidence does not support an increase in the MRP estimate. Furthermore, the QCA's belief that there is a "plausible (negative) correlation between the risk-free rate and the MRP" was made before a detailed inspection of the results from five methods, and it is the results from those five methods that have (properly) guided the QCA rather than its

view on this correlation question. Furthermore, the evidence provided by Frontier on the negative correlation between the MRP and the risk-free rate involves mere estimates of the MRP and therefore the evidence inherits all of the limitations in estimating the MRP through that methodology (which is the Cornell approach). Accordingly, the most one could expect of this correlation evidence is that the QCA estimated the MRP using this Cornell methodology (as well as other approaches), and the QCA has done so but the latest estimate from the Cornell methodology is less than at the time of the DBCT Decision (see Table 1). Thus, none of this evidence supports the QCA acting any differently to what it has done.

Frontier (2018b, section 2.4.1) argues that, in relation to survey evidence from KPMG (2017), the MRP estimate is defined relative to the ten-year rather than the four-year risk-free rate, and therefore the QCA ought to have adjusted it but has not done so. In support of its claim that the KPMG survey respondents were defining their MRP estimates relative to the ten-year risk-free rate, Frontier notes that the vast majority of the respondents used the ten-year government bond yield as their risk-free rate benchmark with or without adjustment (KPMG, 2017, pp. 10-11). Prima facie, this argument is reasonable. However, the set of questions posed by KPMG includes one asking respondents whether they adjust their risk-free rate to reflect the life of the asset being valued when this life is finite, but no such question is raised in respect of the MRP. This implies that KPMG considers that the MRP is invariant to the term of the asset being valued, and therefore that the MRP estimates are equally good for any term. If KPMG believes this, it is plausible that many of the survey respondents share this view. Nevertheless, I note that the QCA (2017, page 477) presumes that the independent experts estimates of the MRP are defined relative to the ten-year risk-free rate, and believes that they are highly likely to be Ibbotson-type estimates (because they are typically 6.0%), and therefore adjusts them to MRP estimates defined relative to the four-year risk-free rate using the historical differential between four and ten-year risk-free rates. If this reasoning is valid, and I concur with it, it would seem to apply equally to the KPMG survey (because most of their respondents also use an MRP of 6.0%). This would boost the QCA's estimate of the MRP estimate from surveys from 7.0% to 7.1%. This does not affect the median result across the five approaches examined by the QCA, and raises the mean by only 0.025%. Accordingly, it would presumably not have affected the QCA's decision.

Frontier (2018b, section 2.4.1) also argues that, in relation to survey evidence from Fernandez et al (2017), the MRP estimate is defined relative to the ten-year rather than the four-year risk-free rate, and therefore the QCA ought to have adjusted it but has not done so. In support of this, Frontier claims that the Fernandez et al (2017) survey sets the ten-year government bond yield as the risk-free rate and that survey respondents were adopting a risk-free rate even higher than the ten-year rate. However, Frontier's claim that the survey *sets* the ten-year government bond yield as the risk-free rate is not correct; the survey questionnaire simply asks respondents what risk-free rate they use (Fernandez et al, 2017, Exhibit 1). By contrast, in respect of Frontier's claim that survey respondents use risk-free rates that are at least the ten-year rate, this is true in the four markets for which this analysis was performed (ibid, Table 8). Although these markets did not include Australia, it could reasonably be suspected that the same result would hold for the Australian respondents, particularly since the KPMG (2017) survey finds the same result. I therefore offer similar comments here as for the KPMG survey. Firstly, survey respondents may use the same MRP regardless of the term of the asset being valued, and therefore no adjustment for the term of the MRP may be required. Secondly, the QCA (2017, page 477) presumes that the independent experts estimates of the MRP are defined relative to the ten-year risk-free rate, and believes that they are highly likely to be Ibbotson-type estimates (because they are typically 6.0%), and therefore adjusts them to MRP estimates defined relative to the four-year risk-free rate using the historical differential between four and ten-year risk-free rates. If this reasoning is valid, and I concur with it, it might be applied to the Fernandez survey (but the argument for doing so is much weaker than for the KPMG survey because most of the Fernandez respondents are clearly not using an MRP estimate of 6.0%). In conjunction with applying the same approach to the KPMG survey, this would boost the QCA's estimate of the MRP estimate from surveys from 7.0% to 7.2%. Thirdly, this would not affect the median result across the five approaches examined by the QCA, and would raise the mean by only 0.05%. Accordingly, it would presumably not have affected the QCA's decision.

Frontier (2018b, section 2.4.2) notes that the QCA (2017, pp. 489-490) uses the Cornell-type estimate of the ten-year MRP also for the four-year MRP, without correction for the current differential in the risk-free rates (of 0.53%), and asserts that such an adjustment must be made.

However, the QCA (2017, pp. 489-490) provides the rationale for not doing so by reference to the analysis in Lally (2015b, Appendix). Frontier offers no comment on this analysis, and simply queries why the QCA "would deduct the ten-year yield when the objective is to estimate the MRP relative to the four-year yield." However the objective is to estimate the MRP for the next four years, and properly doing so would involve estimating the market cost of equity over the next four years following by deducting the current four-year risk-free rate. Furthermore, it is not feasible to estimate the market cost of equity over the next four years, and instead the QCA has estimated it over the next ten years. If the QCA were to deduct the four-year risk-free rate from this estimate of the ten-year market cost of equity, as proposed by Frontier, it would involve mismatching the term for the market cost of equity with the term for the risk-free rate. In such a situation, the analysis in Lally (2015b, Appendix) suggests that the best (but imperfect) Cornell-type estimate of the MRP over *four* years is obtained by deducting the ten-year risk-free rate from the estimate for the ten-year market cost of equity. Naturally, that estimate would be appropriate for estimating the MRP over the next ten years. So, this estimate using data applicable to the next ten years naturally serves as the appropriate estimate for the MRP over the next ten years, and also provides a better estimator for the MRP over the next four years than the approach proposed by Frontier.

Frontier (2018b, section 3.2) argues that the Siegel approach should not be used because it is not used by anyone else. This claim has been made previously by SFG (2014b, section 4), and addressed in Lally (2015a, section 2.4). In particular, Lally notes that the New Zealand Commerce Commission does use the methodology, and the Wright methodology (widely used in the UK and favoured by Frontier themselves) is motivated by the same underlying concern over the inflation shock in the 20th century. Furthermore, methodology choices must stand or fall on their own merits rather than by counting heads. Frontier (2018b) does not respond to these points.

Frontier (2018b, section 3.2) also argues that the Siegel methodology should not be used because there is no objective standard for assessing which unexpected historical events warrant adjustment for. This claim has been made previously by Frontier (2017b, section 4.3.3) and addressed in Lally (2017a, section 3). In particular, Lally argues that the inflation shock

motivating the Siegel methodology is one of a set of events that would likely have significantly lowered the MRP during the period over which the estimate was based, that no clear contrary case is apparent, that the inflation shock is amenable to quantification, and therefore warrants doing so. Frontier does not respond to any of these points.

Frontier (2018b, section 3.2) also argues that the Siegel methodology should not be used because the data required to implement the approach is not available. This claim (relating to the absence of data on inflation-indexed bonds prior to 1987 in order to estimate the expected real risk-free rate averaged over the period from 1958) has been previously presented by Frontier (2017b, section 4.3.3) and addressed in Lally (2017a, section 3). In particular, Lally argues that the average realised real return of 3.5% on conventional government bonds over a long period (1883-1939) during which inflation was low (averaging 0.9%) compensates for the lack of data on inflation-indexed bonds prior to 1987. Frontier does not respond to this point.

Frontier (2018b, section 3.2) also argues that the Siegel methodology should not be used because it is based on the (invalid) prediction by Siegel that high real government bond yields in the 1980s would persist. This claim has been made previously by SFG (2014b, paras 80-83) and addressed in Lally (2015a, section 2.4). In particular, Lally argues that SFG's characterisation of a prediction made by Siegel (1992, 1999) is not correct, and that the actual prediction made by Siegel has been vindicated. Frontier does not respond to this point.

Frontier (2018b, section 3.2) also alludes to the question of whether the inflation shock that motivated the Siegel approach was of sufficiently long duration to warrant the special treatment accorded to it by the QCA, notes the QCA's response that the high inflation period was of particularly long duration (50 years), and argues that despite this the inflation cannot have been unexpected for the entire period of 50 years. The latter point is undoubtedly true, but attempting to determine what part of this period was characterized by 'surprises' would not be useful even if it were successful. As noted by Lally (2017a, section 3), Australia's experience from 1883-2013 can be divided into a low inflation era (1883-1939), a high inflation era (1940-1990), and a second low inflation era (1991-2013) with average inflation rates of 0.9%, 6.4% and 2.5% respectively. The corresponding average real yields on ten-year government bonds were 3.5%,

0.7% and 3.5%. So, in the high inflation era, real yields on government bonds were markedly below that from the earlier period (highly suggestive of ten-year inflation forecasts having been too low in this high inflation era) and with little 'compensation' in the subsequent low inflation era (due to ten-year inflation forecasts being too high). The effect of this would have been to significantly raise the Ibbotson MRP estimate, and this remains true regardless of when during the high inflation period (1940-1990) investors had ceased to be surprised by the inflation shock. Equivalently expressed, it is not the length of the high inflation period per se that is important or the proportion of it in which investors continued to be surprised but the evidence just referred to that strongly suggests that the Ibbotson estimate has been significantly raised by this phenomenon. Furthermore, it is unlikely that investors quickly adjusted to the new high inflation regime; had they done so, the average real return on ten-year government bonds over the 1940-1990 period would not have been so much lower than in the preceding 56 years and the following 23 years (0.7% versus 3.5% and 3.5% respectively).

Frontier (2018b, section 3.2) also argues that, because the Ibbotson and Siegel approaches presume that the MRP is constant whilst the Wright approach presumes that the real cost of equity is constant, and that the QCA concluded that there was "no significant difference between the two (approaches)", it was unreasonable for the QCA to assign much more weight to the Ibbotson and Siegel approaches than the Wright approach (40% versus 15%). This is a misrepresentation of the QCA's analysis. The QCA (2017, pp. 491-493) explained why it did not place equal weight on these two approaches, most particularly that the empirical evidence favoured the Ibbotson and Siegel approaches over the Wright approach (the estimated MRP was only half as variable over time as the estimated cost of equity), but that it had not tested for statistical significance because the sample size was too small (four independent observations). Furthermore, Frontier does not contest the QCA's empirical evidence on the relative volatility of the estimated MRP and the estimated cost of equity. Furthermore, since the QCA apparently chooses its MRP estimate to the nearest 0.5% (its decisions to date having been 6.0%, 6.5% and 7.0%), its latest decision would be invariant to a wide range of alternative weights on the results from these approaches. For example, equal weighting over all five approaches (which I consider to be reasonable) yields a mean of 7.1%, which would round to 7.0% as at present. Since Frontier does not propose an alternative set of weights that would produce a mean at least equal

to 7.25% (and hence rounded to 7.5%), there is no apparent practical significance to Frontier's objection to the QCA's weights.

Frontier (2018b, section 3.3) notes that the QCA estimates the MRP from survey data as the midpoint of the estimates excluding imputation credits (6.6%) and including them (7.4%), and argues that the QCA ought to have used the latter figure consistent with its estimates using other methods and the need for an estimate inclusive of imputation credits. However, in describing certain results as "excluding imputation credits", the QCA presumably means that these results are without explicit inclusion of imputation credits because the QCA (2014, pp. 65-66) clearly acknowledges that survey results without *explicit* inclusion of the credits might nevertheless include them. Thus the QCA's figures of 6.6% and 7.4% should be interpreted as lower and upper bounds on the appropriate MRP estimate inclusive of the credits, and this would support the QCA's use of the midpoint. I agree with this approach, and would even favour a figure below the midpoint. As argued in Lally (2017a, page 18), the full adjustment for imputation credits would only be warranted if *none* of the survey respondents allowed for the imputation credits *and* all of their MRP estimates were based upon the Cornell or similar approach. By contrast, if all of the survey respondents did allow for the credits, no adjustment for the imputation credits would be warranted. Alternatively, if none of the survey respondents allowed for the credits, but all of their MRP estimates were based upon the Ibbotson, Siegel or Wright approaches, the appropriate adjustment for the credits would be closer to zero than to the QCA's upper bound because these MRP estimation methods use long-term historical data and only a portion of that data is drawn from the period in which imputation prevailed. Thus, if even a substantial minority of survey respondents did allow for credits in their estimates (say, at least 30%) and even a substantial minority of those who did not do so use historical data rather than the Cornell approach (say, at least 30%), the appropriate adjustment for the credits will be closer to zero than to the QCA's upper bound.[3] Frontier (2018b, section 3.3) does not respond to these points.

[3] The same result would arise if a majority of survey respondents did allow for credits in their estimates, regardless of how the other respondents estimated the MRP.

Frontier (2018b, section 3.3) also claims that these survey respondents are using a risk-free rate materially above the prevailing government bond yield and therefore an MRP above that reported by the respondents should be used if it is combined within the CAPM with the prevailing government bond yield. This argument has been raised previously by Frontier (2017b, section 6) and SFG (2014b, section 5), and addressed in Lally (2015a, pp. 28-29). In particular, the QCA is involved in a regulatory exercise that requires resetting the cost of capital every four years and therefore need only be concerned with the prevailing rate for the next four years. By contrast, most of these survey respondents are presumably offering cost of capital estimates for conducting DCFs for businesses with infinite-life cash flows and therefore would be interested in the prevailing term structure of discount rates (including risk-free rates) for terms out to infinity. Since observed risk-free rates exist only out to ten years, these valuers would have to speculate upon the rest of the term structure, and then invoke an average rate if they used only one rate (as they do). Since the term structure for risk-free rates is currently markedly upward sloping, the term structure beyond the four-year term invoked by the QCA will be in excess of this regulatory rate and therefore the average rate invoked by the valuers over the entire term structure would be in excess of both the prevailing four-year rate invoked by the QCA and the prevailing ten-year rate. Frontier (2018b) does not respond to those points.

Frontier (2018b, section 3.3) notes concerns expressed by the QCA (2017, page 483) about the sample size of the Fernandez et al (2017) survey, asserts that this "leads the QCA to place equal weight on the KPMG survey", and argues that these concerns about the sample size (23) are unwarranted because the sample size was comparable with sample sizes for corresponding surveys in the 2009-2013 period preceding the Market Parameters Decision (QCA, 2014a). This is a misrepresentation of the QCA's (2017, page 483) concerns about the Fernandez survey, which were much more extensive. In particular, the QCA noted that the 2017 survey result of 7.6% was well in excess of any previous Fernandez survey-based estimate for Australia (5.1% to 6.0% for 2011-2017) and exceeded results for all other developed markets (Western Europe, North America, Japan, and Australasia) over the period 2010-2017 except for some results for Portugal, which (unlike Australia) suffered a very severe economic and financial crisis during this period (requiring bailouts by the IMF and the EU). The QCA referred to concerns about the sample size only after mentioning these points, and therefore presumably did not consider the

sample size to be the primary concern. Furthermore, I share that view, and in my own analysis of this matter (Lally, 2017a, pp. 19-20) listed a further two concerns with the survey.

Frontier (2018b, section 3.3) notes Lally's (2017a, page 20) suggestion that the Fernandez (2017) median Australian MRP estimate for 2017 of 7.6% may be a computational error, typo, or the result of transcription errors, but claims to be "unaware of any evidence to support this conjecture, nor any reason why the current survey may be more susceptible to such errors than previous surveys by the same author." However, Lally (2017a, pp. 19-20) provides an extensive list of reasons in support of this conjecture. Firstly, this figure of 7.6% is well in excess of any previous Fernandez survey-based estimate for Australia (5.1% to 6.0%). Secondly, across the developed markets (Western Europe, North America, Japan, and Australasia) and over the period 2010-2017, this figure of 7.6% is exceeded only by some Fernandez results for Portugal, which (unlike Australia) suffered a very severe economic and financial crisis during this period (requiring bailouts by the IMF and the EU). Thirdly, the figure of 7.6% exceeds all Fernandez results in this period for both Spain and Ireland, which both (unlike Australia) experienced very severe economic and financial crises during this period (requiring bailouts by the EU). Fourthly, whilst there was a general tendency for the 2017 survey results for each country to lie above the range of previous results for that country, the median excess across these markets is only 0.4% whilst the corresponding figure for Australia is 1.6% and is exceeded in this respect only by Switzerland. Finally, the sample size for Australia in 2017 (26) was only one third that of the previous year (87), it is the smallest sample size across all of these markets for the years 2015-2017 (sample sizes in earlier years are not reported), and this sample size is not satisfactorily large in any absolute sense. Frontier (2018b, section 3.3) does not respond to any of these points. In respect of Frontier's claim that there is no reason why the current survey may be more susceptible to errors than previous surveys by the same author, the five points listed above also constitute evidence on this question because previous Fernandez survey results for Australia were not afflicted by these problems.

Frontier (2018b, section 3.4) alludes to its previous objections to the QCA estimating its expected long-run growth rate in DPS at less than that for real GDP. Frontier's objections have been previously detailed in Frontier (2017b, section 5.2.2) and earlier in SFG (2014c, section

3.3). These points were addressed in Lally (2015a, page 22), i.e., the deduction is logically necessary (or else the earnings share of GDP either goes to zero or exceeds 100%), empirical analysis is therefore required merely to estimate the size of the deduction, the empirical evidence cited by Frontier has been for too short a period to provide a reliable estimate, it does not provide a reliable estimate for the long-run (because it shows EPS growing faster than GDP, which is not indefinitely sustainable), and longer term evidence reveals that EPS does grow slower than GDP. Frontier (2018b) is aware of the Lally (2015a) paper because they cite it in an earlier report (Frontier, 2016a), but does not respond to these arguments there or in their current paper.

Frontier (2018b, section 3.4) also alludes to its previous objections to the QCA using two discount rates in its Cornell methodology, one from the tenth year set equal to the long-run estimate and the other determined through the Cornell methodology. These points were raised in Frontier (2017b, section 5.2.3), and addressed in Lally (2017a, pp. 16-18). Frontier (2018b, section 3.4) does not respond to these points.

Frontier (2018b, section 3.4) claims that, in the QCA's two discount rate version of the Cornell approach in which the long-run market cost of equity was set equal to the sum of a long-run MRP estimate and a long-run risk-free rate estimate (using data from July 1993 for the latter), the estimate for the latter has not been updated. However, the QCA (2017, footnote 1538, footnote 1550) states clearly that it has been updated. The source of Frontier's misunderstanding may be its belief that this long-run risk-free rate is the average yield on inflation-indexed bonds from July 1993 coupled with expected inflation of 2.5% using the Fisher relation, whereas the QCA (2017, pp. 485-487) states that it is the average yield on ten-year government bonds.

QRC (2018, section 5.3) notes that the QCA's survey results range from 6.6% to 7.4% depending upon the treatment of imputation credits, notes that Lally (2017b, page 38) favours an estimate from the lower half of this range, and then concludes in favour of 6.6% on the basis of this advice. However, Lally's advice would imply a figure in the 6.6% - 7.0% range rather than 6.6%.

QRC (2018, section 5.3) notes that the Wright estimate of the MRP is an outlier amongst the results from the five approaches considered by the QCA (see last column of Table 1 above), and then argues that it "should be given limited weight in any averaging of estimates from the five approaches". QRC then notes that the median and mode of these results (subject to the survey result being 6.6%) are both 6.6%, and concludes in favour of 6.5%. By contrast, the mean is 7.0%. Clearly, QRC favours the median over the mean (as do I), but this does not involve giving lower weight to the Wright estimate; the median of 6.6% results from giving equal weight to all five methods. The QRC is confusing a preference for the median, which gives more protection against outliers than the mean, with the down weighting of an observation. To illustrate this point, and using the results in the last column of Table 1 above, if the weight on the Wright method were reduced to 10% and the weights on the Siegel and Cornell methods were each raised by 5%, the median observation would fall to 6.4%.

4. Gamma

Frontier (2018c, section 2.2) asserts that the equity ownership approach to estimating the utilization rate assumes that domestic and foreign investors hold identical portfolios of Australian stocks. No evidence is offered in support of this claim and it is not correct. Within the Officer (1994) model, the utilization rate is a weighted average over the utilization rates of individual investors in the Australian market (as demonstrated by Lally and van Zijl, 2003). Since the Officer model assumes that national equity markets are fully segregated then the only investors in the model would be local investors. Since all of these investors can fully utilize the credits, U would then be 1. However, since national equity markets are not fully segregated, many investors in the Australian market are foreigners. In an effort to recognize this empirical reality, the QCA has elected to instead define U as a weighted average over the utilization rates of all investors in the Australian market, both foreign and local investors, which involves only a subtle change in the interpretation of the definition. Since local investors can use the credits and foreigners cannot, this implies that U is equal to the proportion of Australian equities owned by local investors. Accordingly, one should use ABS information to estimate this proportion. Nothing in this process assumes that domestic and foreign investors hold identical portfolios of Australian stocks. In fact, given that local investors can use the credits and foreigners cannot,

one would expect that the Australian stocks held by local investors would be tilted towards those with high imputation credits.

Frontier (2018c, section 2.2) asserts that the equity ownership approach to estimating the utilization rate assumes that domestic investors can fully utilize the credits, and this is inconsistent with the 45 day rule. This is correct. However, as argued in Lally (2016, page 19), it is implausible that there is any material group of Australian investors who hold Australian stocks for less than 45 days around an ex-dividend date, because the penalty from doing so would be large (loss of the imputation credits) and the disadvantage from simply expanding their ownership period enough to avoid the 45 day rule would seem to be small. Furthermore, any overestimate of U that results from ignoring such investors is likely to be dwarfed by the *underestimate* of U that results from assuming that no foreign investors can use the credits (which is unlikely to be true given the incentives that such investors would have to circumvent the legislation and the track record of successful efforts in circumventing legislation more generally).

Frontier (2018c, section 2.4) argues that the "best" estimate of gamma is obtained from the ATO data using company tax collected and credits redeemed, because these two figures are "100% reliable", and cites Hathaway (2014, 2017) in support of this. Furthermore, Frontier states that they have updated Hathaway's (2014) estimate of gamma, using data from 2010-2015, and the result is 0.31. However, the AER's (2018a, Table 2) most recent estimate of gamma using this ATO data is 0.35. In addition to this empirical issue, there are five more fundamental difficulties with Frontier's argument.[4] 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 presumably have to use the ATO data if gamma were estimated from the ATO data, and the unreliability of the ATO data in estimating the credits distributed (and hence the utilization rate) would then be problematic. On this point, Hathaway (2017, page 2) accepts that the ATO data on credits distributed are problematic: "I have trouble deciding which one of these two items is the culprit for this lack of reconciliation". Furthermore, the AER

[4] Frontier (2017c, section 4.2) has previously raised this argument, it has been critiqued by Lally (2017a, pp. 25-26), and Frontier (2018c) does not respond to the critique. A more extensive critique is presented here.

sought clarification from the ATO on this matter and, in a note summarizing the information it received from the ATO, the AER (2018b) identified a number of points at which Hathaway's FAB data are wrong, but they did not conclusively determine that the problem lay there and concluded that "there are certain limitations in relying on taxation data as an analytical tool in the calculation of imputation credits."

Secondly, such an approach necessarily uses 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). Furthermore, the ATO can only supply data on credits redeemed for all companies (Handley, 2014, pp. 38-39). So, in using ATO data, one is bound to use all companies, and this would involve estimating the credit distribution rate for all firms. Furthermore, as discussed in Lally (2016, section 2.3), the inclusion of unlisted firms would be inappropriate because they seem to have markedly lower distribution rates than listed firms, there are good reasons for this, and the privately-owned regulated businesses in Australia are typically listed firms or subsidiaries of listed firms (see Appendix 1). Thus, using ATO data to estimate the distribution rate in the course of using ATO data to estimate gamma would underestimate the distribution rate for the regulated businesses.

Thirdly, Hathaway's (2017, page 1) claim that the ATO data used to estimate gamma are "100% reliable as they are figures that relate directly to ATO tax collections" is contradicted by the ATO (as reported by the AER, 2018b, page 2). In particular, the ATO claims that the company tax figure used by Hathaway includes payments by non-resident companies that do not generate franking credits, and therefore should have been excluded by Hathaway. So, Hathaway's figure for company tax may be right in the sense that such a figure was collected by the ATO but is not relevant for the present purposes because it includes payments that did not generate imputation credits. Ironically, in the very note in which he asserts that the company tax and credits redeemed figures are "100% reliable", Hathaway (2017, page 3) acknowledges that his logic for analyzing the ATO data might be at fault.

Fourthly, even if the ATO (as reported by the AER, 2018b) had not suggested that Hathaway was using the wrong figure for company tax, the fact that the ATO data offers two conflicting estimates of the credits distributed and neither Hathaway nor the ATO can reconcile this discrepancy (as noted above) ought to make any observer sceptical about anything drawn from the ATO database. Had the ATO data offered only one estimate of the credits distributed, observers would presumably have judged it to be reliable. It has been judged unreliable simply because the ATO data permitted two approaches to be adopted. If the ATO data permitted two approaches to estimating the company tax payments or to the credits redeemed, they too might be in conflict.

Finally, even the ATO (2018) has advised that "the Taxation Statistics data should not be used for detailed time series analysis of the imputation system".

Frontier (2018c, section 2.5.1) argues that the use of financial statement data by Lally (2014, Table 2) to estimate distribution rates for credits presumes that all credits distributed by these firms are immediately available for shareholders to redeem, but that this might not occur because some of the immediate recipients are companies and trusts, who in turn would not pass them to the ultimate beneficiaries until these intermediaries in turn paid a dividend. So, some credits might be trapped or delayed. This is possible. However, delay per se in distributing the credits is not relevant for the present purposes. If all of the credits that are released from the companies that ultimately generated them (the "source companies") were released to intermediaries and did not reach their ultimate users for (say) two years, the credits received by the ultimate users within a particular year would be those released by the "source companies" to the intermediaries two years previously and the distribution rate to ultimate users within a year would be the same as the distribution rate by the "source companies" to the intermediaries in the same year except to the extent that the distributions to intermediaries was growing over time. So, if this growth rate were (say) 5% per year and the delay in transmitting the credits from the "source companies" to the ultimate beneficiaries was two years, the credits received by the ultimate beneficiaries within a particular year would be 90% of those distributed by the "source companies" to intermediaries in the same year, as follows:

$$\frac{Credits\ received\ by\ ultimate\ users\ in\ yr\ t}{Credits\ released\ by\ source\ companies\ in\ yr\ t} = \frac{1}{(1.05)^2} = .90$$

Furthermore, the extent to which shares in Australian companies are owned by other companies and trusts is minor. In particular, in respect of the analysis by the AER (2018a, Table 3) of the ownership of Australian listed equity, their underlying analysis estimates the listed equity value at $1,761b of which $534b is held by the "Rest of World". Of the remaining $1,227b held by Australian entities, only $125b is held by companies (10%). Furthermore, they do not record trusts as a category. So, if 10% of shares were held by intermediaries, they delayed the pass through of the credits to the ultimate beneficiaries by two years, and the growth rate in dividends were 5% per year, the credits received by the ultimate users in a particular year would be 99% of those released by the source companies in the same year as follows:

$$\frac{Credits\ received\ by\ ultimate\ users\ in\ yr\ t}{Credits\ released\ by\ source\ companies\ in\ yr\ t} = \frac{1 + 9(1.05)^2}{10(1.05)^2} = 0.99$$

Similarly, even if the intermediaries constituted 30% of the owners of shares and the delay were three years, the credits received by the ultimate beneficiaries in a particular year would still be 96% of those released by the source companies in the same year. Thus, the impact of delays in the transmission of credits from the source companies to the ultimate users would seem to be immaterial.

This leaves the issue of whether credits are trapped in the intermediaries and therefore never passed on to the ultimate users. A reasonable assumption is that the intermediaries distribute the same proportion of credits received as the source companies, and the best estimate for both is the figure of 83% in Lally (2015c, Table 1). So, if intermediaries constitute 10% of the owners of shares, the proportion of credits distributed by the source companies that reached the ultimate users would be 82%:

$$0.83[0.9 + 0.1(0.83)] = 0.82$$

The shortfall from 83% in the absence of intermediaries is therefore only 1%. Even if the intermediaries constituted 20% of the shareholders in the source companies, the distribution rate would still be 80% compared to 83% without the effect of the intermediaries. All of this strongly suggests that the presence of intermediaries who might delay or trap the passing on of the credits to the ultimate users does not materially reduce the distribution rate defined as credits received by the ultimate users within a year as a proportion of those released by the source companies in the same year.

Frontier (2018c, section 2.5.1) also argues that the 20 firms examined by Lally (2014, Table 2) have on average large foreign revenues, this is not a feature of the businesses that are being regulated (pure plays operating only within Australia), and this would have induced an overestimate by Lally. No empirical evidence is provided for the alleged overestimation. This claim has been made previously by Frontier (2016b, section 2.3). In response, Lally (2016, section 2.3) shows that 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. Lally (2016, section 2.3) also provides an explanation for this. Frontier (2018c, section 2.5.1) offers no response to this analysis. Furthermore, consistent with this inverse relationship, removal of the firms with the highest proportion of profits from foreign operations from the 20 examined by Lally (which ought to be welcomed by Frontier) would *raise* the distribution rate. In particular, removing the two firms with the highest such proportion in Lally (2016, Table 2) from the set of 20 firms examined (being BHP and Rio Tinto) would raise the aggregate distribution rate from 83% in Lally (2015c, Table 1) to 92%. This reinforces the point that the appropriate estimate for the distribution rate of a firm without foreign operations is *more* than 83% (and the analysis in the Appendix, which extends the data till 2017, raises the figures of 83% and 92% to 88% and 95% respectively).

Frontier (2018c, section 2.5.1) argues that the appropriate firms for estimating the distribution rate for the regulated businesses should match the businesses in their dividend payout rate and in their level of foreign income (zero), rather than being the largest listed firms as used by Lally (2014). This approach conflicts with Frontier's preference for estimating gamma directly using

ATO data (as described above) because such ATO data is for all firms and therefore implicitly estimates the distribution rate using all firms. Furthermore, if a small subset of firms were to be chosen so as to match the regulated businesses in some way, there would be considerable subjectivity in doing so, both over the criteria for selecting them and over the firms that approximately satisfied the criteria, and Frontier do not offer any such set of firms.

Nevertheless, the natural choice would be the set of energy network businesses firms used by the AER (2018c, Table 3) to estimate the optimal gearing and beta for the regulated businesses: APA Group, Ausnet Services, DUET Group, Envestra (now Australian Gas Networks), and Spark Infrastructure. In respect of the APA Group, the distribution rate was 0.84 over the 2007-2017 period[5]. However APA's Franking Account Balance is always positive and yet most of its distributions are unfranked. Prima facie, this is inefficient behavior and therefore its distribution rate should be treated as 1. In respect of Ausnet Services, the Franking Account Balance was smaller in 2017 than in 2007, which implies a distribution rate of 1 for all credits created in that ten-year period. In respect of DUET, the Franking Account Balance for the latest available financial statements (2016) is not disclosed but the dividends paid shortly after balance date were unfranked, implying a zero Franking Account Balance at that time. Accordingly, the distribution rate for all earlier credits generated from company tax payments must be 1. In respect of Envestra, I am unable to locate recent financial statements. Finally, in respect of Spark, recent financial statements do not record either the Franking Account Balance or whether dividends are franked, and therefore the distribution rate cannot be estimated. So, of the three firms for which the distribution rate can be estimated, the rate is 1 for two of those firms and should be 1 for the third (all over at least the last ten years). This limited evidence supports my earlier conclusion that the appropriate estimate for the distribution rate of the benchmark firm is at least 0.83.

Frontier (2018c, section 2.5.2) argues that the equity ownership proportion is an upper bound on the redemption rate for the credits, due to credits not being redeemed that could have been redeemed (caused by the 45 day rule, for example). However, Frontier is implicitly treating the

[5] The Franking Account balances at 30 June 2007 and 30 June 2017 were \$0.1m and \$4.4m respectively, and the only franked dividends paid in that intervening period were \$52m in the 2016-2017 year. These dividends involve distributed credits of \$22.3m and therefore the company tax payments over this ten-year period must have been \$26.6m (\$22.3m + \$4.4m - \$0.1m). The distribution rate is then \$22.3m/\$26.6m = 0.84.

redemption rate as the parameter to be estimated and the equity ownership proportion to be a mere estimator of it and this is not correct. The parameter that is being estimated is the weighted average of the utilization rates of all investors, and the equity ownership proportion is an estimator of it. Clearly, the 45 day rule will induce an upward bias in the estimator relative to the true value for the parameter. However, as argued above, the effect here is very likely to be small and dwarfed by the countervailing possibility that some foreign investors do find ways to use the credits.

Frontier (2018c, section 2.5.2) argues that the ABS data used to estimate the equity ownership proportion are subject to concerns over their accuracy. However, this only matters to the extent that the data is worse than alternatives and Frontier offers no evidence on any alternative sources for equity ownership data or their relative accuracy. Furthermore, the alternative approach promoted by Frontier (the ATO data, involving the use of redemption rate data) is markedly inferior for reasons discussed earlier in this section.

Frontier (2018c, section 2.5.2) notes that the QCA's (2017, page 163) estimate of the equity ownership proportion (for listed equity) over the last 4-5 years is 55% whereas the AER's (2017a, Figure 4.3) estimate is 45%, Frontier attributes this difference to the AER's exclusion of public sector entities, and argues that the QCA should do likewise. However, since the publication of the AER's (2017a) report, the AER (2018a, Table 3) has used revised data from the ABS and the resulting estimates of the equity ownership proportion have increased to about 55% in recent years (and 58% at the latest available quarter of September 2017). This figure excludes public sector entities, as Frontier prefers, but inclusion of them would not materially change the figures (because they add only about 1% to the listed equity held by local investors).

Frontier (2018c, Appendix) argues that there are a number of errors in the analysis in Lally (2014, Table 2) relating to estimating the distribution rate of the largest 20 firms in the ASX over the 2000-2013 period. In particular, Frontier argues that the aggregate rate is 0.79 rather than Lally's figure of 0.84. However, subsequent to Lally (2014), an adding error was corrected by Lally (2015c, Table 1), and referred to in Lally (2016, page 35); this reduced the figure of 0.84 to 0.83. Furthermore, Frontier is aware of this because Frontier (2018c, para 43) alludes to this

amendment. Appendix 2 analyses Frontier's work, relating to the 2000-2013 period, and still yields a figure of 0.83, after making some corrections to the figures in Lally (2015c, Table1), primarily due to inclusion of data from the 2013 Financial Statements in those cases in which such statements were not available at the time the analysis was conducted by Lally in late 2013, and the inclusion of dividends paid by Rio Tinto Plc that were previously incorrectly omitted. The difference between this revised figure of 0.83 and Frontier's figure of 0.79 is due to a wide range of errors in Frontier's analysis, comprising omission of some companies without good cause, apparently underestimating dividends by omitting those dividends paid under Dividend Reinvestment Plans, and errors in determining Franking Balances arising from conflating the Franking Balance with the maximum fully franked dividends that could be paid, incorrectly including the effect of some events after balance date, and the use of annual average rather than year-end exchange rates when converting US$ to A$.

In addition, Appendix 2 extends the analysis up to 2017, and the effect is to raise the distribution rate to 0.88. Furthermore, as discussed in Lally (2016, section 2.3), this figure of 0.88 is a lower bound because it includes companies with foreign operations, such operations are not relevant for estimating the distribution rate of regulated Australian business, and the effect of foreign operations appears to be to depress the distribution rate. For example, deletion of BHP and Rio Tinto (the two firms with the highest proportion of foreign income amongst those examined in Lally, 2016, Table 2) would raise the figure of 0.88 to 0.95.

5. Conclusions

In conclusion, much of the analysis offered in these submissions (which are principally by Frontier) involves repetition of previous arguments that have already been addressed by me, but for which Frontier offers no comments. Amongst the new arguments, I agree with the following five points.

Firstly, in respect of MRP surveys conducted by Fernandez and KPMG, I agree with Frontier's point that the associated responses provided from the respondents on risk-free rates strongly suggests that their MRP estimates were intended to apply to at least a ten-year term. However, it

does not follow from this that the survey respondents do vary their MRP estimates according to the term of the asset being valued. Furthermore, even if these survey responses were adjusted in the same fashion as the QCA does for the independent experts, this would only raise the QCA's point estimate based upon all of these surveys from 7.0% to 7.2%, which would not affect the median result across the five approaches examined by the QCA, and raise the mean result by only 0.05%. Accordingly, it would presumably not have affected the QCA's decision.

Secondly, I agree with Frontier's point that the use of financial statement data to estimate distribution rates for credits presumes that all credits distributed by these firms are immediately available for shareholders to redeem, but that this might not occur because some of the immediate recipients are companies and trusts, who in turn would not pass them to the ultimate beneficiaries until they in turn paid a dividend. So, some credits might be trapped or delayed. However, Frontier offers no analysis on the possible effect of this point and the analysis conducted here suggests that the effect would be very small.

Thirdly, for the purposes of estimating the imputation credit distribution rate for the BEE, I accept Frontier's point that there is merit in examining the distribution rates for a set of firms chosen to match the regulated businesses in some way, although there would be considerable subjectivity in choosing that set. The natural choice would be the set of energy network businesses firms used by the AER to estimate the optimal gearing and beta for the regulated businesses: APA Group, Ausnet Services, DUET Group, Envestra (now Australian Gas Networks), and Spark Infrastructure. Across these five firms, it is possible to estimate the distribution rate for three of them, and the rate is 1 for two of those firms and should be 1 for the third (all over at least the last ten years). This limited evidence supports my earlier conclusion that the appropriate estimate for the distribution rate of the BEE is at least 0.83.

Fourthly, I accept Frontier's point that there are some errors in the earlier analysis conducted by me into the aggregate imputation credit distribution rate for the 20 largest Australian firms over the 2000-2013 period, leading to an estimate of at least 0.83. By contrast, Frontier's analysis over the same period leads to a figure of 0.79. My revised analysis over this period still leads to a figure of at least 0.83. The difference between the last two figures is due to a wide range of

errors in Frontier's analysis, comprising omission of some companies without good cause, apparently underestimating dividends by omitting those dividends paid under DRPs, and errors in determining Franking Balances. Furthermore, I have also extended this analysis to 2017, and the effect is to further raise the rate to at least 0.88.

Lastly, I agree with the QRC's point that the MRP should be estimated using the median MRP result across the methodologies considered by the QCA, so as to provide protection against outliers. The effect of doing so would be to produce an MRP estimate of 6.5% rather than 7.0%, for MRPs defined over both four and ten-year terms.

APPENDIX 1: THE LISTING OF PRIVATELY-OWNED REGULATED BUSINESSES

This Appendix examines the extent to which privately-owned regulated businesses in Australia are listed or owned by listed firms. As noted in Lally (2016, section 2.3), in respect of the QCA, the privately-owned regulated businesses are Aurizon Network (listed in Australia) and DBCT Management (ultimately owned by BIP, which is listed in the US and Canada). In respect of the ERAWA, the privately-owned businesses are the DBP, which is owned by the DUET Group (listed in Australia), the GGP, which is 88% owned by APA (listed in Australia), and the Midwest South West Gas Distribution System, which is owned by ATCO Gas Australia, which in turn is owned by the ATCO Group (listed in Canada).

I also examine the privately-owned businesses that are regulated by the AER. These are enumerated by the AER (2017b, Tables 3.1 – 3.4) along with their owners. Amongst these, those that are entirely or majority privately-owned are as follows:[6]

Ausnet Services: this is listed in Australia.

ElectraNet: This is 33% owned by YTL Power Investments Ltd (which is listed in Malaysia), 20% owned by Hastings (which is owned by Westpac, which is listed in Australia), and the rest publicly-owned.

Directlink (and Murraylink): Both are owned by Energy Infrastructure Investments, which is 50% owned by Marubeni (which is listed in Japan), 30% owned by Osaka Gas (which is listed in Japan), and 20% by the APA Group (which is listed in Australia).

Powercor Australia: This is 51% owned by Cheung Kong Infrastructure (which is listed in Hong Kong) and 49% owned by Spark Infrastructure (which is listed in Australia).

[6] TransGrid is described in the AER (2017b, Table 3.1) as (inter alia) 65% owned by "other private equity". I understand that the actual ownership is 25% by a Canadian Crown Corporation (Quebec Deposit and Investment Fund), 20% by a wholly-owned subsidiary of a sovereign wealth fund (Tawreed Investments Ltd and the Abu Dhabi Investment Authority respectively), and 20% by another wholly-owned subsidiary of a sovereign wealth fund (Wren House Infrastructure Management and the Kuwaiti Investment Authority respectively). Accordingly, TransGrid is excluded from this analysis.

United Energy: This is 66% owned by Cheung Kong Infrastructure (which is listed in Hong Kong) and 34% by publicly-owned entities.

CitiPower (and SA Power Networks): These are both 51% owned by Cheung Kong Infrastructure (which is listed in Hong Kong) and 49% owned by Spark Infrastructure (which is listed in Australia).

Gas transmission businesses: These are all owned by the APA Group, which is listed in Australia.

Central Ranges System: This is owned by the APA Group, which is listed in Australia.

Multinet (and AGN): These are both owned by Cheung Kong Infrastructure (which is listed in Hong Kong).

Allgas Energy: This is 20% owned by the APA Group (which is listed in Australia), 40% by Marubeni (which is listed in Japan), and 40% by Deutsche AWM (whose listing status is unclear).

So, amongst this large sample of privately-owned regulated businesses in Australia, all are listed or at least majority owned by listed businesses.

APPENDIX 2: THE DISTRIBUTION RATES OF COMPANIES

This Appendix provides the data underlying the analysis in Lally (2015c, Table 1), corrected where appropriate (and the principal source of corrections is inclusion of data from the 2013 Financial Statements in those cases in which such statements were not available at the time the analysis was first conducted in late 2013, and the inclusion of dividends paid by Rio Tinto Plc). In addition, these figures are compared to those in Frontier (2018c, Table 7), and explanations offered for the differences. Finally, the analysis is also extended to 2017.

CBA (Parent)

The Franking Balance (FB) for the Parent for 2017 is $1,067m, as reported in the Financial Statements. The FB for the Parent for 2013 is $742m, as reported in the Financial Statements. The FB for 2000 is $450m, as reported in the Financial Statements.[7] This figure for 2000 is for the Group but the figures for the Parent are presumably the same because the dividends are the same. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements (and the Directors' Report for 2001 and 2002), and involving adding together the Interim Dividend for the year in question and the Final Dividend declared in the previous year but paid in the year in question:[8]

$1681m, $1785m, $1892m, $2062m, $2398m, $2645m, $3048m, $3426m, $3691m, $3588m, $4678m, $5096m, $5776m, $6174m, $6744m, $6994m, and $7237m

For the 2000-2013 period, the total multiplied by 3/7 is $17,900m, and represents the total distributions from the Franking Account (*DIST*). The company tax payments to the ATO (*TAX*) are then *DIST* plus the growth in FB, which is $18,191m.

[7] These figures are net of adjustments for tax not yet paid at balance date but payable in respect of profits for the year ending on the balance date in question, and for credits distributed with dividends paid after balance date but declared before balance date. The second of these adjustments could be reversed out but the first cannot (because the extent of these tax payments is not known). Accordingly, no adjustment is made. If the only adjustment were for dividends, the adjustment would be made and this occurs for some companies examined in this Appendix.

[8] There is sometimes ambiguity over whether the final dividend reported in the Dividends Note for a particular year has been paid in that year or merely declared and paid in the following year. If in doubt, I assume the former. The effect of any such errors on the distribution rate for credits would be slight.

Compared to this, Frontier's (2018c, Table 7) *DIST* is less by about 20%, likely due to Frontier mistakenly omitting the dividends under the Dividend Reinvestment Plan (DRP), which are approximately 20% of the total.[9]

For the 2000-2017 period, the figures are *DIST* = $29,535m and *TAX* = $30,152m.

BHP (Group)

The FB for the Group for 2017 is US$10,155m, as reported in the Financial Statements, which is converted at the prevailing exchange rate of 0.77 (US$ per A$1) as reported by the RBA, to yield $13,188m. The FB for the Group for 2013 is US$10,516m, as reported in the Financial Statements, which is converted at the prevailing exchange rate of 0.92 (US$ per A$1) as reported in the Financial Statements, to yield $11,430m. The FB for the Group for 2000 is $24m, as reported in the Financial Statements. The fully franked dividends in $US are as follows, for the years 2001 – 2017 respectively, drawn from the Cash Flow Statements rather than the Dividends Note to the Financial Statements (because the former includes the dividends paid to the minority shareholders, but with checking against the information in the Dividends Note to check for partly franked dividends and any DRPs).

$524m*(26/51), $831m, $868m, $1576m, $1642m, $2126m, $2339m, $3250m, $4969m, $4895m, $5144m, $5933m, $6222m, $6506m, $7052m, $4217m, and $3502m.

The exchange rates used for the conversion (US$ per A$1) are the average over the financial year, as reported in the Accounting Policies Note in the Financial Statements (or the RBA otherwise) as follows:

0.53, 0.52, 0.58, 0.71, 0.75, 0.75, 0.79, 0.90, 0.75, 0.88, 0.99, 1.03, 1.03, 0.92, 0.84, 0.73, and 0.75.

[9] The DRP dividends are estimated from the difference between the (cash) dividends reported in the Cash Flow Statement and the total dividends reported in the Dividends Note.

For the 2000-2013 period, converting at these rates and adding up, the total multiplied by 3/7 is $19,971m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $31,377m.

Compared to this, Frontier (2018c, Table 7) uses the wrong FB 2013 $US figure (by incorrectly including the effect of events after balance date) and converts it at the wrong exchange rate (the average rate for the year rather than the year end rate).

For the 2000-2017 period, the figures are *DIST* = $31,076m and *TAX* = $44,240m.

Westpac (Parent)

The FB for the Parent for 2017 is $1,063m, as reported in the Financial Statements. The FB for the Parent for 2013 is $1,247m, as reported in the Financial Statements. The FB for the Group for 2000 is -$56m, as reported in the Financial Statements, but this is likely to be similar to the figure for the Parent because the dividends are very similar. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements for the years 2000-2013 and otherwise from the Statement of Changes in Equity:

$1017m, $1157m, $1304m, $1474m, $1667m, $1981m, $2270m, $2583m, $2994m, $3700m, $4500m, $4931m, $5568m, $5837m, $5752m, $6129m, and $6301m.

For the 2000-2013 period, the total multiplied by 3/7 is $15,062m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $16,365m.

Compared to this, Frontier (2018c, Table 7) uses the wrong FB figures for both 2000 and 2013 by incorrectly including the effect of events after balance date. In addition, its *DIST* is less by about 15%, likely due to Frontier mistakenly omitting the dividends under the DRP (which are approximately 15% of the total).

For the 2000-2017 period, the figures are *DIST* = $25,356m and *TAX* = $26,475m.

ANZ (Parent)

The FB for the Parent for 2017 is $171m, as reported in the Financial Statements. The FB for the Parent for 2013 is $265m, as reported in the Financial Statements. The FB for the Parent for 2000 is zero, as reported in the Financial Statements. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements:

$995m, $1155m, $1333m, $1598m, $1877m, $2068m, $2363m, $2506m, $2452m, $2667m, $3491m, $3691m, $4082m, $4694m, $4906m, $5001m, and $4609m.

For the 2000-2013 period, the total multiplied by 3/7 is $12,976m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $13,241m.

Compared to this, Frontier's (2018c, Table 7) *DIST* is about 30% less, likely due to Frontier mistakenly omitting the dividends under the DRP (which are approximately 30% of the total).

For the 2000-2017 period, the figures are *DIST* = $21,209m and *TAX* = $21,380m.

NAB (Group)

The FB for the Group for 2017 is $1,115m, as reported in the Financial Statements. The FB for the Group for 2000 is zero, as reported in the Financial Statements. The fully franked dividends for the Group are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements:[10]

$2080m, $2355m - $120m, $2360m - $120m, $2503m, $2586m*0.9, $2661m*0.8, $2788m*0.9, $3124m, $3069m, $3102m, $3490m, $3955m, $4249m, $4553m, $4670m, $5161m, and $5216m.

For the 2000-2013 period, the total multiplied by 3/7 is $15,862m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $16,909m.

[10] In some years, the dividends are only reported for the Parent in the Dividends Note, but the dividends reported in the Cash Flow Statement for the Group and Parent are almost identical, so the figures in the Dividends Note can be extrapolated to the Group.

Compared to this, Frontier's (2018c, Table 7) *DIST* is about 20% less for unknown reasons.

For the 2000-2017 period, the figures are *DIST* = $24,262m and *TAX* = $25,377m.

Telstra (Group)

The FB for the Group for 2017 is $9m, as reported in the Financial Statements. The FB for the Parent for 2013 is -$85m, as reported in the Financial Statements, and this should be similar to the figure for the Group because the dividends are very similar. The FB for the Group for 2000 is $74m, as reported in the Financial Statements. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Cash Flow Statements rather than the Dividends Note to the Financial Statements (because the former includes the dividends paid to the minority shareholders, but with checking against the information in the Dividends Note to ensure all were fully franked and there was no DRP):

$2316m, $2831m, $3345m, $3186m, $4131m, $4970m, $3479m, $3498m, $3517m, $3494m, $3489m, $3491m, $3508m, $3567m, $3700m, $3787m, and $3736m.

For the 2000-2013 period, the total multiplied by 3/7 is $19,395m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $19,236m.

Compared to this, Frontier's (2018c, Table 7) *DIST* is about 10% higher for unknown reasons.

For the 2000-2017 period, the figures are *DIST* = $25,733m and *TAX* = $25,668m.

Woolworths (Group)

The FB for the Group for 2017 is $2,577m, as reported in the Financial Statements. The FB for the Group for 2013 is $1,943m, as reported in the Financial Statements. The FB for the Group for 2000 is $418m, as reported in the Financial Statements. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements:

$500m, $312m, $381m, $428m, $500m, $613m, $788m, $1006m, $1174m, $1349m, $1457m, $1516m, $1597m, $1703m, $1753m, $1471m, and $860m.

For the 2000-2013 period, the total multiplied by 3/7 is $4,980m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $6,505m.

Compared to this, Frontier's (2018c, Table 7) *DIST* is about 25% less and this is likely due to Frontier mistakenly omitting the dividends under the DRP (which are approximately 25% of the total).

For the 2000-2017 period, the figures are *DIST* = $7,460m and *TAX* = $9,619m.

Wesfarmers (Group)

The FB for the Group for 2017 is $786m, as reported in the Financial Statements. The FB for the Group for 2013 is $243m, as reported in the Financial Statements. The FB for the Group for 2000 is zero, as reported in the Financial Statements. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements:

$245m, $459m, $446m, $500m, $546m, $725m, $889m, $997m, $1487m, $1330m, $1562m, $1793m, $1990m, $2164m, $2600m, $2272m, and $2235m.

For the 2000-2013 period, the total multiplied by 3/7 is $5,558m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $5,801m.

Compared to this, Frontier's (2018c, Table 7) *DIST* is about 10% less, and this is likely due to Frontier mistakenly omitting the dividends under the DRP (which are approximately 10% of the total).

For the 2000-2017 period, the figures are *DIST* = $9,531m and *TAX* = $10,317m.

CSL (Group)

The FB for the Group for 2017 is not reported but is presumably zero because the 2017 dividends are unfranked. The FB for the Group for 2013 is not reported but is presumably zero because the 2013 dividends are unfranked. The FB for the Group for 2004 is $20m, being the amount of retained profits that could be distributed as fully franked dividends of $47m (as reported in the Financial Statements) multiplied by 3/7. Earlier Financial Statements could not be located. The fully franked dividends are as follows, for the years 2005 – 2017 respectively, drawn from the Dividends Note to the Financial Statements:

$85m, $58m, zero, $50m, $138m, zero, $27m, $9m, zero, zero, zero, zero, and zero.

For the 2000-2013 period, the total multiplied by 3/7 is $157m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $137m.

Compared to this, Frontier (2018c, Table 7) omits CSL but provides details earlier in its Appendix and therefore the omission appears to be an oversight.

For the 2000-2017 period, the figures are *DIST* = $157m and *TAX* = $137m.

Woodside (Group)

The FB for the Group for 2017 is US$2,032m, as reported in the Financial Statements, which is converted at the prevailing exchange rate of 0.78 (US$ per A$1) as reported by the RBA, to yield $2,605m. The FB for the Group for 2013 is US$2,545m, as reported in the Financial Statements, which is converted at the prevailing exchange rate of 0.895 (US$ per A$1) as reported by the RBA, to yield $2,844m. The FB for the Group for 2000 is $173m, as reported in the Financial Statements. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements (with the dividends for 2009 – 2017 reported in $US and converted at the average exchange rate over the year shown in brackets below as US$ per A$1 from the RBA):

$560m, $446m, $413m, $347m, $447m, $713m, $847m, $929m, US$574m (0.79), US$773m (0.92), US$866m (1.03), US$979m (1.04), US$1738m (0.97), US$1764m (0.90), US$1730m (0.75), US$640m (0.74), and US$826m (0.77).

For the 2000-2013 period, the total multiplied by 3/7 is $4,218m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $6,888m.

Compared to this, Frontier (2018c, Table 7) uses the wrong exchange rate to convert the FB US$ 2013 figure (using a rate used by BHP, despite the fact that the year ends of these two companies differ by six months). In addition, Frontier's *DIST* is about 15% less, and this is likely due to Frontier mistakenly omitting the dividends under the DRP (which are about 15% of the total).

For the 2000-2017 period, the figures are *DIST* = $6,877m and *TAX* = $9,309m.

Rio Tinto (Group)

The FB for the Group for 2017 is US$5,014m, comprising the retained earnings that could be distributed as fully franked dividends of US$8,542m (which is net of the outflow of credits on the final dividend declared in financial year 2017 of US$3,158m but paid in the next financial year) plus that dividend, as reported in the Financial Statements, multiplied by 3/7. Converting at the exchange rate of US0.78 per A$1 as reported in the Financial Statements yields $6,428m. The FB for the Group for 2013 is US$6,987m, comprising the retained earnings that could be distributed as fully franked dividends of US$14,298m (which is net of the outflow of credits on the final dividend declared in financial year 2013 of US$2,005m but paid in the next financial year) plus that dividend, as reported in the Financial Statements, multiplied by 3/7. Converting at the exchange rate of US0.89 per A$1 as reported in the Financial Statements yields $7,850m. The FB for the Group for 2000 is $445m, comprising the retained earnings that could be distributed as fully franked dividends of zero (which is net of the outflow of credits on the final dividend declared in financial year 2000 of $1,038m but paid in the next financial year) plus that dividend, as reported in the Financial Statements, multiplied by 3/7. The fully franked dividends in $US are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements:

$812m, $826m, $882m, $1062m, $1143m, $2573m, $1507m, $1933m, $876m, $1754m, $2236m, $3038m, $3322m, $3710m, $4076m, $2725m, and $4250m.

The exchange rates for the conversion (US$ per A$1) are the average over the financial year, as reported in the Exchange Rates Note in the Financial Statements:

0.52, 0.54, 0.65, 0.73, 0.76, 0.75, 0.84, 0.86, 0.79, 0.92, 1.03, 1.04, 0.97, 0.90, 0.75, 0.74, and 0.77.

For the 2000-2013 period, converting at these rates and adding up, the total multiplied by 3/7 is $11,320m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $18,725m.

Compared to this, Frontier (2018c, Table 7) uses the wrong FB figures in both 2000 and 2013 in $US (by incorrectly including the effect of events after balance date) and converts the 2013 figure at the wrong exchange rate (the average rate over the year rather than the year end rate). In addition, Frontier's *DIST* is about 10% too high for unknown reasons.

For the 2000-2017 period, the figures are *DIST* = $19,358m and *TAX* = $25,342m.

Westfield (Parent)

The FB for the Parent for 2017 is $4m, as reported in the Financial Statements. The FB for the Parent for 2013 is $83m, as reported in the Financial Statements. The FB for the Parent for 2000 is $25m, as reported in the Financial Statements. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements:

$47m, $55m, $56m, $82m, $185m, $71m, $64m*0.6, $194m, $195m*0.6, 0, $115m, 0, 0, $164m, 0, 0, and 0.

For the 2000-2013 period, the total multiplied by 3/7 is $411m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $469m.

Compared to this, Frontier (2018c, Appendix) excludes the company on the grounds of a merger having occurred in 2004. However, even if this were relevant, Frontier could have included the company using data from 2004. The effect of doing so, and therefore deleting the first four years' dividends above and replacing FB 2000 by FB 2004 ($2m instead of 0) would be inconsequential.

For the 2000-2017 period, the figures are *DIST* = $481m and *TAX* = $461m.

Macquarie (Group)

The FB for the Group for 2017 is $199m, as reported in the Financial Statements. The FB for the Group for 2013 is $297m, as reported in the Financial Statements. The FB for the Group for 2008 is $133m, as reported in the Financial Statements. Earlier Financial Statements could not be located. The fully franked dividends are as follows, for the years 2009 – 2017 respectively, and drawn from the Dividends Note to the Financial Statements:

$880m, $122m*0.6, 0, 0, 0, $1159*0.4, $931m*0.4, $1208m*0.4, and ($816m*0.4 + $646m*0.45).

For the 2000-2013 period, the total multiplied by 3/7 is $408m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $572m.

Compared to this, Frontier (2018c, Appendix) excludes the company on the grounds that it did not exist until 2008. This is not valid grounds for excluding the company, with data used from 2008.

For the 2000-2017 period, the figures are *DIST* = $1,238m and *TAX* = $1,304m.

Origin Energy (Group)

The FB for the Group for 2017 is zero, as reported in the Financial Statements. The FB for the Group for 2013 is zero, as reported in the Financial Statements. The FB for the Group for 2000

is zero, as reported in the Financial Statements. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements:

$23m, $34m, $13m, $53m, $94m, $134m, $158, $201m, $554m, $439m, $442m, $538m, 546m, 0, 0, 0, and 0.

For the 2000-2013 period, the total multiplied by 3/7 is $1,384m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $1,384m.

Compared to this, Frontier's (2018c, Table 7) *DIST* is about 10% less for unknown reasons.

For the 2000-2017 period, the figures are *DIST* = $1,384m and *TAX* = $1,384m.

Suncorp (Group)

The FB for the Group for 2017 is $456m, as reported in the Financial Statements. The FB for the Group for 2013 is $551m, as reported in the Financial Statements. The FB for the Group for 2000 is $70m, being the amount of retained profits that could be distributed as fully franked dividends of $136m (as reported in the Financial Statements) multiplied by 0.34/0.66. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements:

$229m, $300m, $305m, $335m, $458m, $920m, $573m, $993m, $729m, $440m, $444m, $511m, $769m, $1088m, $1386m, $1025m, and $911m.

For the 2000-2013 period, the total multiplied by 3/7 is $3,002m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $3,483m.

Compared to this, Frontier's (2018c, Table 7) FB for 2000 is $136m, which is the retained profits that could be distributed as fully franked dividends rather than the FB. In addition, Frontier's

DIST is about 15% less, and this is likely due to Frontier mistakenly omitting the dividends under the DRP (which are approximately 15% of the total).[11]

For the 2000-2017 period, the figures are *DIST* = $4,892m and *TAX* = $5,278m.

QBE (Group)

The FB for the Group for 2017 is $199m, as reported in the Financial Statements. The FB for the Group for 2013 is $272m, as reported in the Financial Statements. The FB for the Group for 2000 is -$8m, as reported in the Financial Statements. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements (with the dividends for 2010 – 2013 reported in $US and converted at the average exchange rate over the year shown below as US$ per A$1 from the RBA):

$19m, $37m, $34m, $126m, $241m, $344m, $566m, $396m, $255m, US$217m (0.92), US$139m (1.03), US$146m (1.04), US$349m (0.97), $342m, $574m, ($288m*0.5 + $411m), and ($302m*0.3 + $453m*0.5).

For the 2000-2013 period, the total multiplied by 3/7 is $1,238m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $1,518m.

Compared to this, Frontier's (2018c, Table 7) *DIST* is about 30% smaller for unknown reasons.

For the 2000-2017 period, the figures are *DIST* = $2,004m and *TAX* = $2,211m.

Brambles (Group)

The FB for the Group for 2017 is US$57m, as reported in the Financial Statements, and converting at the balance date exchange rate of US0.77 per A$1 (from the RBA) yields $74m. The FB for the Group for 2013 is US$72m, as reported in the Financial Statements, and converting at the balance date exchange rate of US0.92 per A$1 (from the RBA) yields $78m. The FB for the Group for 2006 is US$139m, as reported in the Financial Statements, and

[11] The data for Suncorp shown in Frontier (2018c, Table 7) is actually for QBE, and vice versa.

converting at the balance date exchange rate of US0.74 per A$1 (from the RBA) yields $188m. Earlier Financial Statements could not be located. The fully franked dividends in $US are as follows, for the years 2007 – 2017 respectively, drawn from the Dividends Note to the Financial Statements:

$356m, $66m, $34m, $65m, $75m, $80m, $128m, $118m, $108m, $90m, and $87m.

The exchange rates for the conversion (US$ per A$1) are the averages over each of the financial years (from the RBA):

0.79, 0.90, 0.75, 0.88, 0.99, 1.03, 1.03, 0.92, 0.84, 0.73, and 0.75.

For the 2000-2013 period, converting at these rates and adding up, the total multiplied by 3/7 is $1,261m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $1,252m.

Compared to this, Frontier's (2018c, Table 7) *DIST* is about 20% smaller, despite obtaining data back to 2000, and is likely to be due to mistakenly omitting the dividends under the DRP (which are about 20% of the total).

For the 2000-2017 period, the figures are *DIST* = $2,021m and *TAX* = $1,907m.

Santos (Group)

The FB for the Group for 2017 is US$399m, as reported in the Financial Statements, and converting at the balance date exchange rate of US0.78 per A$1 (from the RBA) yields $511m. The FB for the Group for 2013 is $845m, as reported in the Financial Statements. The FB for the Group for 2000 is $360m, as reported in the Financial Statements. The fully franked dividends are as follows, for the years 2001 – 2017 respectively, drawn from the Dividends Note to the Financial Statements (with the dividends for 2016 reported in $US and converted at the average exchange rate over the year shown below as US$ per A$1 from the RBA):

$180m, $200m, $198m, $213m, $243m, $268m, $269m, $286m, $327m, $350m, $263m, $285m, $289m, $341m, $298m, US$66m (0.74), and 0.

For the 2000-2013 period, the total multiplied by 3/7 is $1,445m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $1,929m.

Compared to this, Frontier's (2018c, Table 7) *DIST* is about 10% less, for unknown reasons.

For the 2000-2017 period, the figures are *DIST* = $1,756m and *TAX* = $1,908m.

AMP (Group)

The FB for the Group for 2017 is $275m, as reported in the Financial Statements. The FB for the Group for 2013 is $196m, as reported in the Financial Statements. The FB for the Group for 2002 is $80m, as reported in the Financial Statements. Earlier Financial Statements could not be located. The fully franked dividends are as follows, for the years 2003 – 2017 respectively, drawn from the Dividends Note to the Financial Statements:

$51m, $322m, $392m, $556m, $685m, $765m, $412m, $351m, $315m, $399m, $475m, $710m*0.7, ($399m*0.8 + $414m*0.85), $828m*0.9, and $837m*0.9.

For the 2000-2013 period, the total multiplied by 3/7 is $2,024m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $2,140m.

Compared to this, Frontier's (2018c, Table 7) *DIST* is about 15% less, and likely to be due to mistakenly omitting the dividends under the DRP.

For the 2000-2017 period, the figures are *DIST* = $3,167m and *TAX* = $3,361m.

Amcor (Group)

The FB for the Group for 2016 is zero, as reported in the Financial Statements (the 2017 Statements could not be located). The FB for the Group for 2013 is zero, as reported in the

Financial Statements. The FB for the Group for 2000 is not reported in the Financial Statements but is presumably zero because the 2001 dividends are not fully franked. The fully franked dividends are as follows, for the years 2001 – 2016 respectively, drawn from the Dividends Note to the Financial Statements:

$88m, $103m, $120m, $106m, $98m, $55m, $23m, 0, 0, 0, 0, 0, 0, 0, 0, and 0.

For the 2000-2013 period, the total multiplied by 3/7 is $254m (*DIST*). The *TAX* is then *DIST* plus the growth in FB, which is $254m.

This matches Frontier's (2018c, Table 7).

For the 2000-2017 period, the figures are *DIST* = $254m and *TAX* = $254m.

Aggregate

For the 2000-2013 period, aggregating over the values for *DIST* and *TAX* for these 20 companies, the results are $137,962m and $165,415m respectively, implying an aggregate distribution rate of 0.834.

For the 2000-2017 period, aggregating over the values for *DIST* and *TAX* for these 20 companies, the results are $216,344m and $244,677m respectively, implying an aggregate distribution rate of 0.884.

Considering the period from 2013-2017, *DIST* grew by $78,382m while *TAX* grew by $79,262m, yielding an aggregate distribution rate over this period of $78,382m/$79,262m = 0.99. Consequently, the distribution rate over the entire period from 2000 grew from 0.834 to 0.884. Furthermore, the higher distribution rate in the last four years is not skewed by the result for one firm; amongst the seven firms with the largest distributions (the four banks, BHP, Rio Tinto, and Telstra, which account for 81% of distributions over the entire period), the lowest distribution rate for the last four years is 0.86.

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