# REVIEW OF THE EARWAKER REPORT

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4 December 2018

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## 1. Introduction

In response to the AER's (2018) Draft WACC Guideline, Earwaker (2018) has assessed the AER's estimate of the equity risk premium for its regulated businesses, which is 3.60% comprising an MRP estimate of 6% and an equity beta of 0.60 geared to 60%. This paper reviews Earwaker's analysis, and addresses the question of whether foreign regulators' estimates should be considered by the AER. The ENA (2018a, 2018b) has also made submissions to the AER that relate to the same issues, but those submissions do not add anything to the Earwaker report on these matters.

## 2. Analysis of the Earwaker Report

Earwaker (2018) argues that the AER's equity risk premium of 3.60% is too low because it is less than the corresponding allowances by regulators in the UK, New Zealand, the US, Canada, and virtually all (14/17) European regulators. Apart from the US and Canadian regulators, the remaining 19 regulators provide estimates of both the MRP and the equity beta. Of these 19 cases, only two estimate the MRP at more than the AER's 6%, being New Zealand (Earwaker, 2018, Table 4) and Portugal (Earwaker, 2018, Annex 4). So, the higher estimates for the equity risk premium by other regulators come from the beta estimates, and all of them exceed the AER's estimate of 0.6 with a median value of 0.89 (Earwaker, 2018, Table 2, Table 4, and Annex 4).

There are a number of possible explanations for this situation consistent with the AER's estimate being appropriate. Firstly, many of the beta estimates used by these 19 foreign regulators are estimated in a sufficiently different fashion to the AER's estimate that they raise concerns about the estimates of the former rather than the latter, and there is no merit in replicating inferior estimation methods. In particular, amongst the 17 estimates from the European regulators reported in Earwaker (2018, Annex 4), for which details on the estimation methods appear in CEER (2017, page 66), only four of them are clearly estimated purely from a regression of firm returns on the local market index (Finland, Slovenia, Ireland and Luxembourg). Of the rest, some are clearly not of this type, such as the "bottom up Beta estimate" for Hungary, the use of a

"world index" for Norway, and the use of a Blume beta for Portugal (in which the empirical estimate is pulled towards 1). The rest are ambiguous ("based on consultancy reports"), and could differ from the AER's (best practice) methodology in various other ways. Whatever the "bottom up beta estimate" used by Hungary's regulator is, it is presumably contrary to the best practice of regressing the returns for regulated firms on a local market index, and therefore lacks credibility. The use of a "world index" by Norway's regulator is incompatible with the AER's use of a domestic version of the CAPM, and therefore does not undercut the merits of the AER's estimate. The Blume beta used by Portugal's regulator pulls the empirical estimate towards 1 and therefore biases the estimate (as demonstrated in Lally, 1998). Furthermore, the AER's estimates are generated by an expert econometrician (Henry, 2014), who has considered a wide range of approaches and conducted a wide range of stability and sensitivity tests; it is unlikely that all of these alternative estimates have benefited from similarly expert opinion.

Secondly, there may be differences in regulatory frameworks that explain this situation. Earwaker (2018, Annex 2) investigates and rules out this possibility in respect of Australia versus the UK, but there are a further 18 markets that he does not examine and it is unlikely that the regulatory situations in *each* of these additional 18 markets would closely resemble the Australian situation.

Thirdly, aside from regulation differences, the beta of regulated energy network businesses in Australia relative to the local market index may be lower than for other markets, in which case the AER's lower estimate may be appropriate for Australia. One possibility is differences in market leverage, which will affect the equity beta of a firm holding constant that firm's leverage (Lally, 2002). This effect can be quite significant. For example, invoking equation (1) in Lally (2002), increasing market leverage from 30% to 40% reduces the firm's equity beta by 14%, i.e., from (say) 0.7 to 0.6. Another possible explanation for the AER's results being the lowest is in the industry composition of the market portfolio proxy used in the regression process, and Lally (2004) shows that this can materially affect a firm's beta. Using a common covariance matrix coupled with industry weights for each of five European countries, Lally (2004, Table 3) determines the industry betas in each of the five markets. Examining each of the ten possible pairs of countries, the average absolute difference in betas across the industries is as high as 0.28

for Netherlands-Spain, and averages 0.17 across the ten possible cross-country pairs. Furthermore, ACG (2008, section 4.4) examined the US and Australian markets and concluded that the difference in industry weights would alter the asset beta estimate for an electricity network business by 20% (from say 0.6 to 0.48).

Fourthly, even where the methodology used to estimate beta is the same and the true betas of energy network businesses in these different markets are equal, the difference in estimates here may be due to the AER using a longer estimation period than for other regulators. Earwaker (2018, pp. 11-12) raises this possibility. Consistent with this, Wright et al (2019, page 49) notes that UK regulators use the most recent 2-5 year period whilst the AER (2018, page 243) uses data for the longest available period (back to 1992 for some companies). Earwaker (2018, pp. 11-12) favours the shorter period used by the UK regulator apparently on the grounds that the resulting beta estimate better reflects the current situation. Expressed more formally, he favours the shorter period because bias is less. However, the standard error of the estimate will be higher from using the shorter period, this is unfavourable and it may not offset the lessening of bias. This is a standard problem in statistics and the usual criterion is to minimize the Mean Squared Error (MSE) of the estimator (Ferguson, 1967, page 11).[1] Letting $\hat{T}$ denote an estimator and $T$ the true value of the parameter being estimated, the MSE of the estimator is as follows:

$$\begin{aligned} MSE &= E\left[\hat{T} - T\right]^2 \\ &= E\left[\hat{T} - E(\hat{T}) + E(\hat{T}) - T\right]^2 \\ &= E\left[\hat{T} - E(\hat{T})\right]^2 + \left[E(\hat{T}) - T\right]^2 \end{aligned} \qquad (1)$$

where the first term in the last equation is the variance of the estimator and the second term is the square of the bias. Furthermore, letting $\sigma^2$ denote the variance of the residual around the regression line and $R$ the rate of return on the market return (the independent variable in the regression yielding an estimate of beta), the variance in the beta estimate is as follows (Johnston, 1960, page 21):

[1] The MSE is the average over the squared differences between the estimated value and the true value.

$$E[\hat{T} - E(\hat{T})]^2 = \frac{\sigma^2}{\sum(R - \bar{R})^2} \quad (2)$$

So, as the length of the estimation period increases and hence the sample size increases (for a fixed frequency at which returns are observed, such as monthly), the denominator will increase and the variance of the estimator will therefore fall. Furthermore, the denominator will increase in proportion and the ratio in inverse proportion so long as the returns data are independent and identically distributed. By contrast, the squared bias in equation (1) will grow with the length of the estimation period because the data is increasingly less current. Empirically investigating this issue, in order to determine the optimal estimation period, is problematic because the true value for beta (and hence the bias) is unobservable. Furthermore, at least some sources of bias will be transitory, such as those arising from transitory fluctuations in market leverage and the industry weights in the market portfolio. Such fluctuations could reasonably be ignored by regulators, because the errors would tend to offset over time. This reduces the bias component within the MSE in equation (1) and therefore minimising the MSE would likely be best achieved with a longer sample period in order to minimise the variance of the estimator. Interestingly, the only evidence offered by Earwaker (2018) on this question of the optimal estimation period is a report by Wright et al (2018), commissioned by the UK regulators; the authors find empirical evidence of transitory fluctuations in beta, leading three of the four authors to favour using the longest available data series to estimate beta, leading to significantly lower estimates of it (ibid, pp. 51-53). The same result is present in the Australian data used by the AER (2018, page 31). This contradicts Earwaker's view and supports the AER's approach. This evidence is particularly important because it is the only empirical evidence referred to by Earwaker.

Lastly, and again even where the methodology used to estimate beta is the same and the true betas of energy network businesses in these different markets are equal, the difference in estimates here may be due to the AER using a longer data collection frequency than for other regulators. Consistent with this possibility, the AER (2018, page 251) uses weekly and monthly data whilst the UK regulators use daily, weekly, and monthly data (Wright et al, 2018, page 49). Furthermore, Wright et al (2018, pp. 51-53) find empirical evidence of transitory fluctuations in beta, leading three of the four authors to favour using the longest data collection frequency to

estimate beta, leading to significantly lower estimates of it. Again, this is more compatible with the AER's approach than that of UK regulators and it is the only empirical evidence referred to by Earwaker (2018).

In addition to his views on beta, Earwaker (2018, section 5.1) also expresses views on the MRP. In particular, he characterises the AER's view as being that the MRP is fixed even as the risk-free rate moves up and down over the economic cycle, he disagrees with this, and attributes the same view to the UK regulators. Earwaker's views here are not relevant to his belief that the AER's allowed equity risk premium is too low, because the AER's estimate of the MRP is above virtually all of the other regulators to whom he refers. Furthermore, his characterisation of the AER's views is wrong; the AER's (2018, page 204) view is that "while the MRP may vary over time there is no estimable inverse relationship between the MRP and the risk free rate." So, Earwaker has set up a straw man and then knocked it down.

Consistent with his belief that the MRP is inversely related to the risk-free rate, Earwaker (ibid) favours some weight on the Wright methodology. I agree with the AER that there is no clear evidence that the MRP is inversely related to the risk-free rate. However, I consider that the proposition of an inverse relationship is plausible because the market risk premium is compensation for bearing equity risk (Merton, 1980), equity risk (volatility) seems to be greatest in depressed economic conditions (French et al, 1987, Figure 1a), and the risk free rate also tends to be lowest in depressed economic conditions (due inter alia to countercyclical interventions by central banks). Nevertheless, the significant issue for regulatory purposes is the *strength* of this relationship and especially its strength in respect of the risk free rate and the MRP applicable now to the next regulatory cycle (of five years). Market volatility (and therefore the market risk premium) might be high today but volatility (and hence the MRP) tends to rapidly subside to normal levels (French et al, 1987, Figure 1a) and the MRP for the next five years *might* not then be greatly increased by a temporary upsurge in volatility. In view of all this, I agree with some weight being placed upon the Wright methodology consistent with my previously expressed views (Lally, 2017, page 38).

## 3. Recourse to Foreign Regulators' Estimates

This review of Earwaker's report raises the general question of whether estimates of the cost of equity by foreign regulators should be considered by the AER. My view is that the estimates of foreign regulators should be considered by the AER. If they differ materially from the AER's, the sources of the difference should be identified. This may involve differences in methodology and/or data. Doing this might reveal methodologies and/or data sets not previously considered by the AER and which might warrant use by the AER. In respect of the difference in beta estimates, I do not see anything in the methodology or data sets of these foreign regulators that warrants any change in the AER's estimate, and a good deal in it that reinforces the merits of the AER's approach. By contrast, in respect of the MRP, many of these foreign regulators draw upon historical average returns in their markets, as does the AER for Australia. Furthermore, Lally and Randal (2015) show that most of the cross-country variation in MRP estimates using historical average returns is noise, and therefore the cross-country average is a useful estimator of the MRP in *every* market. So, the AER should place some weight upon this estimator, which draws upon data used by foreign regulators.

## 4. Conclusions

My principal conclusions on Earwaker's report are as follows. Firstly, although the AER's equity risk premium for energy network businesses seems to be less than most other regulators surveyed by Earwaker, the source of this lies in a lower estimate for the equity beta rather than the MRP.

Secondly, there are a number of possible explanations for the AER's equity beta estimate being lower than for other regulators other than the AER's estimate being too low. In particular, many of the beta estimates used by these foreign regulators are estimated in a sufficiently different fashion to the AER's estimate that they cast doubt on the merits of these other estimates rather than the AER's estimate. There may also be differences in regulatory frameworks that explain this situation, and Earwaker investigates and rules out this possibility only in respect of one foreign market. In addition, aside from regulation differences, the true beta of regulated energy

network businesses in Australia relative to the local market index may be lower than for other markets, in which case the AER's lower estimate may be appropriate. In addition, even where the methodology for estimating beta is the same and even if the true betas of energy network businesses in these different markets are equal, the difference in beta estimates here may be due to the AER using a longer estimation period and data collection frequency than for other regulators, and empirical evidence cited by Earwaker suggests that the AER's approach is superior in both respects.

Thirdly, in respect of the MRP, Earwaker considers that the MRP is inversely related to the risk-free rate and, consistent with this, favours some weight on the Wright methodology. As with the AER, I do not think that there is any clear evidence that the MRP is inversely related to the risk-free rate. However, I consider that the proposition of an inverse relationship is plausible and therefore favour some weight being placed on the Wright methodology, consistent with my previously expressed views.

Finally, this review of Earwaker's report raises the general question of whether estimates of the cost of equity by foreign regulators should be considered by the AER. The methodology and data drawn upon by foreign regulators should be considered, as opposed to their estimates, because this might reveal methodologies and data sets not previously considered by the AER and which might warrant use by the AER. Whilst no cases of this type are apparent in respect of beta, a case does arise from MRP estimates by foreign regulators involving historical average returns in each of their markets; since most of the cross-country variation in MRP estimates using historical average returns is noise, the cross-country average is a useful estimator of the MRP in every market and use of that estimator by the AER would involve using data that individual foreign regulators have used parts of.

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