REPORT TO THE AER:

COST OF EQUITY ISSUES

2016 ELECTRICITY AND GAS DETERMINATIONS

By Graham Partington and Stephen Satchell

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Author's Credentials

This report has been prepared by Associate Professor Graham Partington and Professor Stephen Satchell. We are senior finance academics who have published several books and many research papers in finance and we have extensive consulting experience, particularly with respect to the cost of capital and valuation. Our *curriculum vitae* can be found in Appendix 2.

We have read "Expert witnesses in proceedings in the Federal Court of Australia" which are attached as Appendix 3. This report has been prepared in accordance with those guidelines. An expert witness compliance declaration can be found following the reference list at the end of our report.

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The context of the report

The AER has approached us with a request for advice in relation to the cost of equity. The full terms of reference are attached as Appendix 1.

The context for the advice is given by the AER as follows:

"The AER is currently considering proposals by VIC DNSPs, ActewAGL, AGN, APTNT, and AusNet Services (TNSP). All of these service providers proposed the AER depart from its rate of return guideline.

The AER seeks expert advice to inform its decisions on the rate of return, in particular the return on equity component for:

Final decisions for the VIC DNSPs, ActewAGL, AGN, and APTNT; and Draft decision for AusNet Services (TNSP)"

The specific questions to be addressed are as follows:

"Part A.

A. Having reviewed the relevant material, provide a report setting out an overall view, with reasons, whether any matters in the relevant material would cause the consultant to:
    - advise the AER to change the manner in which it estimates return on equity from that applied in its recent decisions, and/or
    - alter, or add to, any of the findings in the reports set out in Table 1 (in the Relevant Material section below)

   for the purpose of estimating the forward-looking return on equity of a regulated 'pure-play' Australian energy[1] network[2] business, which is the return that is just sufficient to induce investors to invest in the business.[3]

   The AER, without intending to directly or by implication provide a view of the relative importance of the expert reports and relevant material wishes to highlight the reports listed in items A1 to A4 below. While the authors of those reports have expressed

[1] Being a gas or electricity business.
[2] Being a transmission or distribution network.
[3] Given a 60:40 debt to equity ratio.

numerous views, under A1 to A4, some of their specific views are noted. These issues must be specifically addressed in the consultant's report. This is not intended to restrict the consultant in any way or direct his review. In addition to these, the consultant should review and address all relevant issues that support its overall conclusion.

The consultant is also required to respond to any criticisms levelled against positions/findings in previous advice to the AER.

A1. Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016. In this report, Frontier Economics (among other things):

i. Considered the AER's comparator set of Australian energy network firms is too small and produces unreliable equity beta estimates. It considered the comparator set should be widened to include international energy firms and other Australian infrastructure firms.

ii. Calculated equity beta estimates for the nine firms in the AER's comparator set, as well as a set of eight Australian infrastructure firms and a set of 56 US energy firms. It considered (based on a number of tests) that the additional firms are statistically similar to the AER's comparator set; and broadening the comparator set produces equity beta estimates with improved statistical properties.

iii. Recommended the equity beta estimate of 0.82 it proposed in its June 2013 report. This equity beta estimate is based on a comparator set of 9 Australian and 56 US energy firms, with the Australian firms given 24% weight and the US firms given 76% weight.[4]

A2. Frontier Economics, *The relationship between government bond yields and the market risk premium*, January 2016. In this report, Frontier Economics (among other things):

i. Considered that the decline in government bond yields since the AER's December 2013 Rate of Return Guideline has not caused a commensurate reduction in the required return on equity, which has remained relatively stable.

ii. Considered the prevailing market conditions are currently materially dissimilar to the average historical conditions. Considered that a technique that estimates the MRP by subtracting the average government bond yield from the average market return would not produce a reasonable estimate of the prevailing MRP in these conditions.

[4] SFG, *Regression-based estimates of risk parameters for the benchmark firm*, June 2013, p. 16.

iii. Recommended applying an approach of estimating a risk premium that is commensurate with the prevailing conditions in the market by using DGM and Wright approach estimates of market risk premium.

iv. Considered that analysts' forecasts of earnings per share (market capitalisation weighted average) increasing from 2015 to 2017 is inconsistent with the proposition that firms might (on average) be borrowing in an unsustainable manner to temporarily maintain dividends at their current levels.

v. Considered that potential upward bias in analyst forecasts of dividends (an input into the AER's DGM) does not have a material impact, is unlikely to have materially changed since the December 2013, and is not relevant as the implied discount rate from analysts' dividend forecasts is useful information.

A3. Frontier Economics, *The required return on equity under a foundation model approach*, January 2016. In this report, Frontier Economics (among other things):

i. Considered that the AER's 0.7 equity beta estimate applied in its SLCAPM foundation model should be adjusted (using the return on equity from the Black CAPM and Fama-French model) to correct for low beta and book value biases.

ii. Considered that the AER and its advisers quote selectively from reports that they discuss.

A4. HoustonKemp, *The cost of equity: Response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks*, January 2016. In this report, HoustonKemp (among other things):

i. Noted that the AER's own advisers have found evidence against the SLCAPM, and responded to Partington and Satchell's previous comments in a number of areas, including:
    a. Criticisms of the Black CAPM, including estimates of the zero beta return and the use of work by Beaulieu, Dufour and Khalaf (2012)
    b. Partington's estimation of the market return being similar to NERA and SFG's approach of estimating zero beta return
    c. Partington's view that there is little evidence in the data for mean reversion in betas and concludes that the use of the SLCAPM will not generate downwardly biased estimates of the cost of equity for a benchmark efficient firm.
    d. The use of works by Ray, Savin and Tiwari (2009) and Da, Guo and Jagannathan (2012)
    e. The argument against using the FF3M (being under revision after the development of the FF5M) can also apply to the SLCAPM

f. Criticisms of the FF3M and the use of works by Kan, Robotti and Shanken (2013)

g. Partington and Satchell's suggestion that less weight should be assigned to independent expert reports written by firms who write many reports and more weight should be placed on firms that write few reports.

ii. Conducted a regression analysis to model the relationship between the MRP chosen by independent experts and the 10 year CGS yield. The results indicated that as the 10 year CGS yield falls (rises) experts' estimates of the return required on the market portfolio also fall (rise). The results also indicated that there is a tendency for experts to use a risk free rate that exceeds the CGS yield when the CGS yield is low.

iii. Responded to the AER statement that the results of NERA (2015b) appear counter-initiative."

Introduction

The list of questions above represents an extensive and quite diverse list of questions. As a consequence, responses to individual questions cannot be conveniently summarised in the introduction. However, we use the questions as headings and sub-headings in this document so that readers can readily navigate to our response for any specific question.

Having addressed the questions above and having reviewed the relevant submissions our advice to the AER is that: In response to the submissions there is no substantive basis to change the manner in which the AER estimates the return on equity from that applied in its recent decisions. We also conclude on the basis of the material that we have reviewed that we would not make any substantive alteration to the findings in prior reports by Partington and co-authors, or those reports of Handley, referred to in Table 3 of the terms of reference (see Appendix 1).

In the submissions by the regulated businesses there is much discussion of the Black (zero beta) CAPM and claims of biased estimates of regulatory returns. This is an issue that recurs throughout our report as we respond to the specific questions from the AER. Here we make the general point that the required adjustment to returns, in response to the issues raised, is not necessarily upwards.

There is also much discussion by the regulated businesses of "low beta bias" which although widely used is a somewhat misleading term. The gist of all of this discussion is not that estimates of beta are biased, but that low beta funds have tended to outperform the CAPM benchmark. The

consequence of this is not necessarily that the CAPM gives a downward biased estimate of required returns. One interpretation is that low beta stocks have positive alphas, where alpha measures the abnormal component of risk adjusted returns.[5] Since the benchmark for alpha is zero, the so called low beta bias can also be characterised as upward bias in alpha. Realised returns would then be equal to the equilibrium required return plus alpha and plus a random error that would normally be assumed to have a zero mean. As consequence, one perfectly sensible adjustment would be to subtract alpha from realised returns in order to provide an empirical measure of the required rate of return. Depending on the magnitude of alpha the AER's CAPM estimate of the required return might be above or below the resulting empirical measure.

Where multiple asset pricing models are used, the Queensland Council of Social Services (QCOSS, 2015) expressed a concern about the risk of cherry picking. In response to this expression of concern Partington (2015) made the following statement:

Even with the best will in the world, there is a natural inclination to select the parameters that favour self-interest as being the truth, so there is a natural tendency towards cherry picking. As a test of this we propose the following hypothesis: Where a choice of parameters are available, the regulated businesses will tend to select the values resulting in a higher rate of return and those groups representing users will tend to select the values resulting in a lower rate of return. This hypothesis is well supported by the submissions that we have been asked to review.

As an on-going test we are carrying this hypothesis forward across our reports. Reviewing current submissions by both the regulated businesses and user groups the hypothesis continues to be well supported.[6] In this context an advantage of the SLCAPM is that it is a parsimonious model. The required input is confined to one variable and two parameters, one of which is taken to be the return on government debt and so is directly observable. Parsimony and observability reduces opportunities for cherry picking and also provides the opportunity for a relatively transparent implementation.

[5] For practitioners' views on whether the extra return on low beta stocks is an anomaly giving the opportunity for outperformance (alpha) see Steward (2012).

[6] While one consumer group submission accepts that: '…the rate of return guideline must be seen in its entirety and not being "cherry picked" for elements which favour one stakeholder over another.' They nonetheless …'highlight that there are elements of the guideline which are biased in favour of the networks.' ECCSA (2016, p.33) and go on to describe factors leading to an overstatement of the regulated return.

We note that the SLCAPM being the standard version of the Capital Asset Pricing Model is commonly abbreviated to CAPM. In this report we use the terms interchangeably.

A1. Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016.

Is re-levering equity betas desirable or always necessary?

As we have previously stated in Partington and Satchell (2015b): "We agree with Frontier (2015a) that utilities tend to be low risk assets and so have low asset betas. We also agree that the addition of leverage increases the equity beta above the asset beta…" Consequently we agree with Frontier (2016a) that leverage increases equity betas, but we wonder why they felt the need to belabour the point with multiple quotations, when the point is hardly in dispute. The relevant question is how much should the leverage adjustment to beta be?

As Partington and co-authors have repeatedly pointed out there are alternative approaches to re-levering. Consequently there are alternative re-levering formulas to choose from (more than half a dozen). Depending on which re-levering formula you choose, it is very easy to get a difference of 0.2, or substantially more, in the re-levered beta. Such differences could readily change the conclusions of Frontier's (2016a) analysis. We particularly note that assuming that the debt beta is zero will result in an upward bias in re-levered equity betas. If reliance is to be placed on the re-levering process then the sensitivity of any analysis to alternative re-levering formulas should be investigated by the AER.

Differences in tax-rates and tax systems will result in different leverage effects in the USA and Australia and this should be taken into account when re-levering beta. Unfortunately, this takes us back to the problem of which re-levering formula we choose to use. In short re-levering equity betas is problematic.

We have also previously pointed out that re-levering and its attendant problems are unnecessary for the purposes of benchmark checks on the regulated return. The raw beta estimates can be used directly to estimate the plain vanilla WACC (see Partington 2015). The AER's estimate of WACC can thus be compared to estimates of WACC based on the raw betas of firms considered to be appropriate comparators without any need for re-levering.

Considered the AER's comparator set of Australian energy network firms is too small and produces unreliable equity beta estimates. It considered the comparator set should be widened to include international energy firms and other Australian infrastructure firms.

Adding comparators and improvements in estimates

We consider that, in principle, extending the sample size is a good idea. The addition of *relevant* data should improve accuracy. The critical issue is how appropriate are the additional firms selected as comparators and how much improvement is obtained.

Considerable caution in reaching conclusions about beta needs to be exercised when the comparators are drawn from overseas countries. This is because of differences in industry structure, technology, the nature of competition, the economic environment and regulatory and tax systems.

Portfolio beta estimates would generally be the preferred way to estimate an industry beta. We observe from Frontier (2016a) that for the portfolio beta estimates, there is only a modest improvement in the precision of the estimate as comparator groups are added and samples get larger. This can be seen by comparing Frontier's (2016a) Figure 3, Figure 6, and Figure 9, which provide rolling monthly beta estimates and 95% confidence intervals for the AER sample, the AER sample expanded to include regulated Australian infrastructure firms, and the sample of US firms respectively. Comparing the figures in the Frontier (2016a) report is a little difficult as they are drawn at increasingly smaller scales, which creates the misleading impression that the confidence bands are narrowing substantially, when in fact they are not. On the following page we have reproduced the three figures at about the same scale to facilitate comparison. Not only does this show that improvements in the confidence intervals are modest, it also shows that the US betas are less stable that the Australian betas.

Figure 1: Portfolio beta estimates from Frontier

Figure 3: 10-year rolling monthly beta estimates for AER sample (portfolio beta estimates)

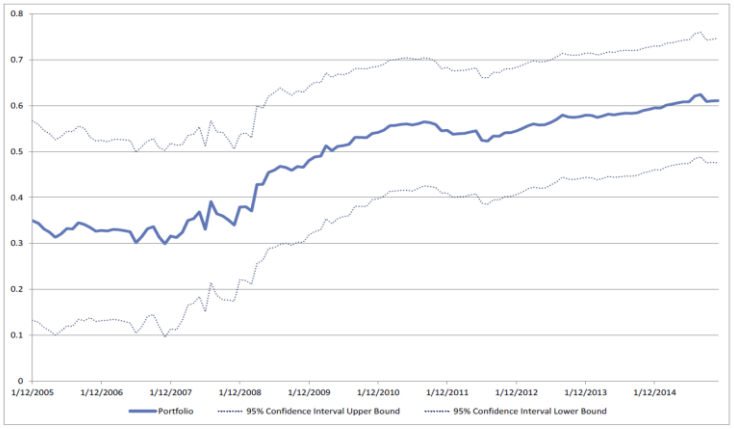


Figure 6: 10-year rolling monthly beta estimates for expanded Australian sample (portfolio beta estimates)

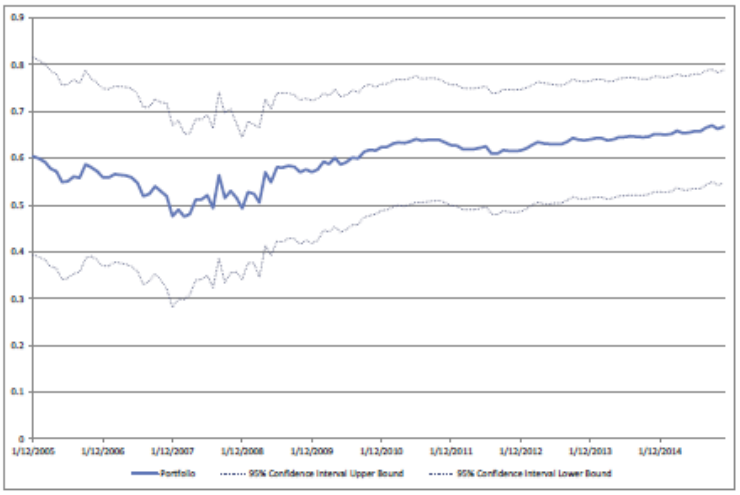
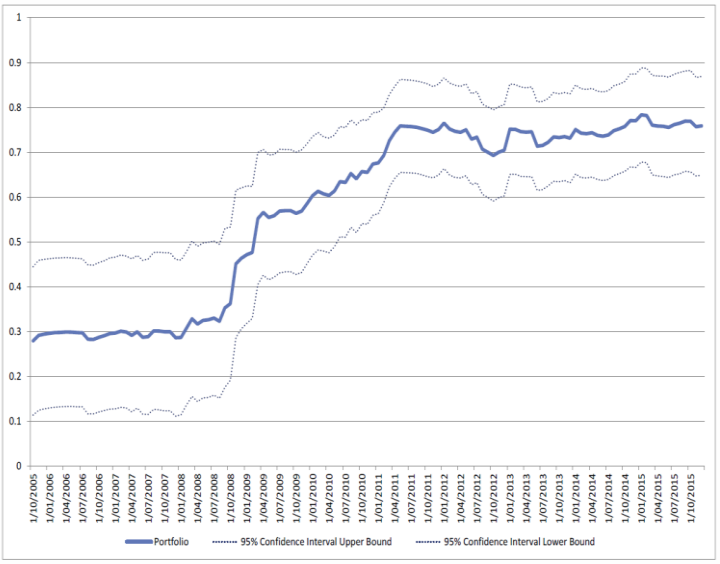


Figure 9: 10-year rolling monthly beta estimates for US utilities sample (portfolio beta estimates)



Source: Frontier (2016a)

Statistical testing of comparators

Frontier (2016a) address the question of appropriate comparators by testing whether the means of the beta estimates for the original AER data set and the additional comparator data-set are equal. They also use the Kolmogorov-Smirnoff (KS) test to compare the distributions for the estimates of beta. Unfortunately, it seems that both tests have been incorrectly applied (we make this claim whilst not having full and explicit details of exactly how they did the calculations, this should have been included in the Frontier report.)

Frontier(2016a) use the Kolmogorov-Smirnov (KS) test which compares two distribution functions, but Frontier's analysis is based on estimated parameters being used as the parameters of the distribution functions. It is known that the critical values of the KS test assume no unknown parameters; that is, they are based on the two empirical distribution functions, and will, consequently, be wrong for the problem being considered by Frontier. Generally, Monte Carlo analysis is necessary.

The second test, as for example in Table 5, is a *t*-test of the equality of means. Suppose for a country, country 1, we have sample estimates of N stock betas. $\hat{\beta}_1, \hat{\beta}_{2,\ldots,}\hat{\beta}_N$ where it is well known that $\hat{\beta}_i \sim N(\beta_i, \sigma_i^2 / \sum_{t=1}^{N} x_{mt}^2)$ This means that $\hat{\beta}_i$ is normally distributed with mean β_i and variance $\sigma_i^2 / \sum_{t=1}^{T} x_{mt}^2$.

Where x_{mt} is the excess return on the market at time *t* and σ_i^2 is the residual variance of asset *i*. If we consider the sample mean of the $\hat{\beta}_i$'s, $\hat{\bar{\beta}} = \frac{\sum \hat{\beta}_i}{N}$ then $\hat{\bar{\beta}} \sim N(\frac{\sum \beta_i}{N}, \frac{\sum \sigma_i^2}{\sum x_{mt}^2})$ (1)

Frontier (2016a), presumably calculate $\hat{\bar{\beta}}$ and also its standard deviations, s = $\left(\frac{\sum_{i=1}^{N}(\hat{\beta}_i - \hat{\bar{\beta}})^2}{N-1}\right)^{\frac{1}{2}}$. Now s^2 can be shown to be biased upwards as an estimate of $\frac{\sum \sigma_i^2}{\sum x_{mt}^2}$; this is due to the fact that, the sample of $\hat{\beta}_i$'s have different means, this upward bias will make the *t*-statistics smaller and we may not reject the null that the two groups are the same even when we should.

To prove the above, let $(\hat{\beta}_i)$ be represented as the vector $\hat{\beta}$, the true values by β and let *i* be a (N x 1) vector of ones. Define M = $I_N - \frac{ii'}{N}$ where I_N is the (N x N) identity matrix and the sample estimator used is $s^2 = \frac{\hat{\beta}' M \hat{\beta}}{(N-1)}$; we note that $\hat{\beta}$= β + V, where V $\sim N(0, D)$ and D is a diagonal matrix

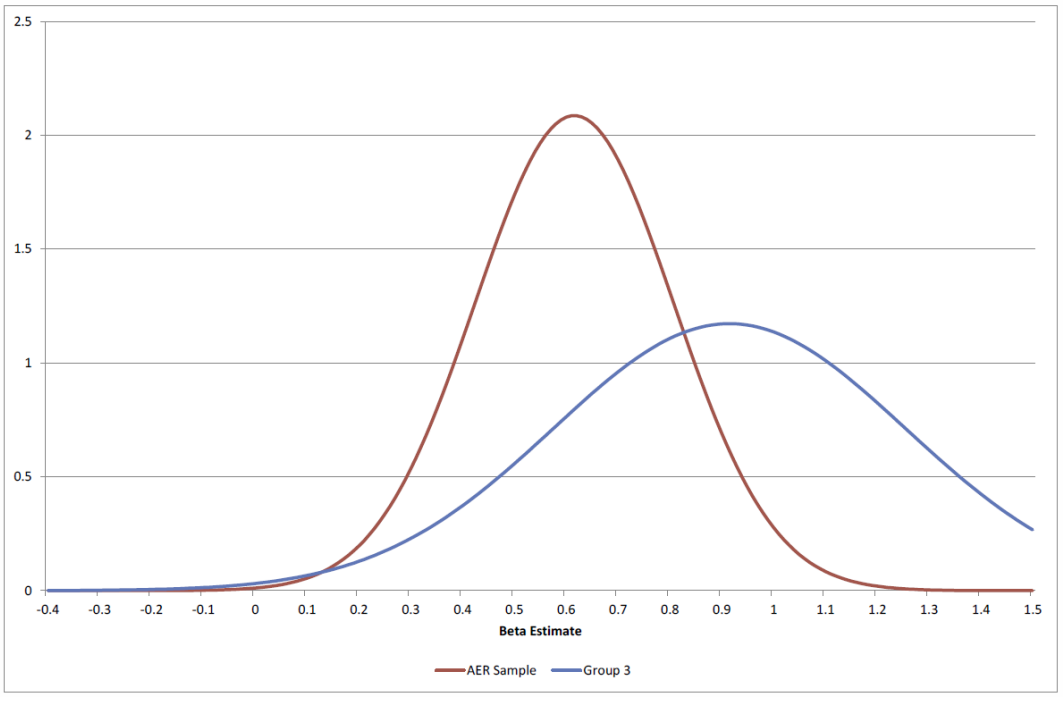
whose ith element is $(\sigma_i^2/\sum r_{mt}^2)$. Now E$(s^2) = \frac{\beta' M \beta}{N-1}$+ tr $\frac{(MD)}{(N-1)}$. Where tr() is the sum of the diagonals of the matrix. The first term is the cross-sectional variance of the true $\beta_i' s$ whilst the second term is approximately the average of variance of the individual estimators i.e. the $\sigma_i^2/\sum r_{mt}^2$, as in equation (1). We see that $\frac{\beta' M \beta}{N-1} \geq 0$ and this leads to upward bias.

Leaving aside the issues of test specification discussed above, the reported critical values for the test statistics suggest that rather small sample sizes were used for the tests. In this case the tests are likely to have low power in detecting significant differences between the comparator groups.

Inappropriate application, or low power, of the tests, is likely to explain why despite the appearance of quite different distributions of beta for the AER sample and other listed Australian Infrastructure firms (see Frontier 2016a, Figure 4 reproduced below) the statistical tests fail to reject the null hypothesis of no difference between the beta estimates for the two groups.

FIGURE 2: Distribution of betas from Frontier

Figure 4: Distributions of 10-year monthly beta estimates for the AER sample (Groups 1 and 2) and other listed Australian infrastructure firms (Group 3)



Source: Frontier (2016a)

Finally and importantly, Frontier misinterpret the results of their own analysis comparing the weekly betas for the US and Australian data. They claim the result is borderline. Whereas, using their reported statistics the null hypothesis of equality in the betas is clearly rejected. There is a significant difference in the betas at the 5% level. Frontier 2016a, Table 11 (reproduced below) shows that the reported *t*-statistic at 2.33 exceeds the reported critical value for *t* of 2.26. Therefore, Frontier's own report shows that there are statistically significant differences in the means for the weekly betas. The mean of the US betas is higher than the mean of the Australian betas.

TABLE 1: Do sample betas differ?

Table 11: T-test for equality of means between AER sample and US utilities sample

Statistic	Estimate (Monthly)	Estimate (Weekly)
t-statistic	1.11	2.33
p-value	0.28	0.05
t-critical	2.14	2.26

Source: Frontier (2016a)

Calculated equity beta estimates for the nine firms in the AER's comparator set, as well as a set of eight Australian infrastructure firms and a set of 56 US energy firms. It considered (based on a number of tests) that the additional firms are statistically similar to the AER's comparator set; and broadening the comparator set produces equity beta estimates with improved statistical properties.

As explained above, the case that the samples are homogeneous has not been made. Also as explained above, for the portfolio estimates of beta, any improvements in the precision of the estimates appear to be modest as are any improvements in stability. Since portfolio estimates would be our preferred way to estimate an industry beta, we conclude that the improved statistical properties are modest and come at the cost of potentially biased estimates from comparators that may be inappropriate. Indeed on the basis of Frontier's analysis of the means for weekly betas the US comparators are inappropriate, and in the time series of rolling portfolio beta estimates the US betas appear to be less stable than the Australian betas.

Recommended the equity beta estimate of 0.82 it proposed in its June 2013 report. This equity beta estimate is based on a comparator set of 9 Australian and 56 US energy firms, with the Australian firms given 24% weight and the US firms given 76% weight.

Again, the previously discussed failings make this conclusion hard to sustain. Furthermore, the use of 24% by weight of Australian data and 76% by weight of US data to compute an Australian beta seems intuitively inappropriate. Frontier's (2016a, p20) own statement is: "We do not suggest that these expanded comparator sets should be used instead of the domestic comparators or even that they should each receive the same weight as the domestic comparators." We suggest that most readers would interpret this statement to imply overseas comparators getting less weight than domestic comparators not over three times the weight.

If it could be compellingly demonstrated that the comparator groups were indeed identically distributed, one might entertain building a portfolio to estimate beta. To our mind, an interesting unresolved research question is how best to do this. The notion that Beta is a measure independent of the index used, and hence can be aggregated across different countries troubles us. The usual way this would be addressed is to build a global CAPM and compute betas with respect to a world portfolio, or regard the USA and Australia as a single region and define a new market portfolio based on the capitalisation weighted aggregate of the two markets. This procedure would have some theoretical validity, but might well reduce the estimated betas substantially. We note, however, that this would run counter to the AER's preferred approach of using a domestic rather than international CAPM.

A2. Frontier Economics, *The relationship between government bond yields and the market risk premium*, January 2016.

Considered that the decline in government bond yields since the AER's December 2013 Rate of Return Guideline has not caused a commensurate reduction in the required return on equity, which has remained relatively stable.

Changes in the risk free rate and the MRP

Rearranging the CAPM tells us that the expected rate of return for a benchmark efficient entity $E(R_i)$ with a beta coefficient of β_i an expected market return of $E(R_m)$and a risk free rate of return R_f, is given by:

$$E(R_i) = (1 - \beta_i)R_f + E(R_m) \quad (1)$$

Thus a fall in R_f, if the expected return on the market is unchanged, will reduce the required return as long as the business' beta $\beta_i$is less than 1. There seems to be widespread agreement that β_i is less than one for the regulated businesses. *Ceteris paribus* a fall in the measure of the risk free rate, the 10 year bond yield reduces the regulated return.

If the objective is to "talk up" $E(R_i)$, then there is no alternative but to argue that that $E(R_m)$ is going to increase. However, this is a difficult argument to sustain and even the Wright approach only claims a constant real return on the market,[7] not that the market return rises as interest rates fall. The logical outcome, therefore, is that as interest rates fall so must the regulated return. The extent of the reduction then hinges on what happens to the market risk premium. The regulated businesses naturally prefer the argument that the market risk premium rises one for one with the fall in interest rates as this minimises the reduction in regulated returns. The AER decisions hold the risk premium nearly constant (although upward adjustments of 0.5% have been made). As result the regulated return tends to fall 1 for 1 with falls in the risk free rate.

We begin by stating our position that it seems likely that the risk premium changes over time. It is also entirely possible that the risk premium sometimes changes at the same time as interest

[7] That is the nominal rate less inflation is constant.

rates change, but that change may either be in the same direction as the interest rates, or in the opposite direction. At any point in time, there are three possibilities for the market risk premium, it may remain unchanged, it may go down, or it may increase. There is no compelling reason for an interest rate decrease to automatically be associated with an increase in the market risk premium.

Our sympathies lie with the view that the tendency has been for the market risk premium to fall over time as diversification and risk management has got easier and cheaper, as individuals and populations have got wealthier and as volatility in equity markets has tended to be lower (although there have been relatively short periods of extreme volatility) and this is consistent with lower average realised risk premiums in equity markets from the 1970's onwards. We are also sympathetic to the view that the twentieth century was the American century and that Australia has been the lucky country. In other words investors in these two countries have on average been the beneficiaries of pleasant surprises over a century or so. As a consequence it seems plausible that the returns they received were higher than the equilibrium returns that they expected. There are also the arguments that survivorship bias inflates the historic returns record and also that investors' underestimated inflation and so accepted ex-ante interest rates that were too low. The consequence of interest rates that were too low is that the realised risk premium provides an upward biased estimate of the equilibrium risk premium. As a result of the foregoing factors, we consider it more likely than not that the historic equity risk premium in both Australia and the US overstates the current forward looking equity risk premium.

Let us now consider the proposition advanced by Frontier (2016b), that a rise in the market risk premium offsets the fall in the risk free rate. The first thing to say is that this is not a generally accepted proposition, whereas it is generally accepted that as interest rates rise equity prices tend to fall and vice versa. This latter proposition is consistent with accepted theory and experience.

The two propositions are inconsistent. If changes in the risk free rate are offset one for one by changes in the risk premium and interest rates rise, then the market risk premium falls by a corresponding amount, leaving the required return unchanged. Given an unchanged cash flow the value of equity is also unchanged. The consequence is that *ceteris paribus* the price of equities would be independent of the interest rate. This is a proposition that we find difficult to swallow

and without compelling theoretical support and compelling empirical evidence we would place little weight on this approach.

The next prop to Frontier's (2016b) case is the results of application of the dividend growth model. We have previously written extensively about the problems of the dividend growth model, why upward biased estimates due to overestimates of growth are quite likely for this model and why we have no confidence in the ability of this model to reliably track changes in the market risk premium. We do not consider that our prior arguments have been rebutted by the regulated businesses. Consequently we place little weight on evidence from the dividend growth model about the magnitude of the market risk premium. We return to this point subsequently and we will present results from an alternative dividend growth model, which suggests that the market risk premium has fallen between 2013 and 2015.

What price earnings ratios and earnings yields really reveal

Frontier (2016b) seek additional support from selected opinions of financial experts, mixed in with arguments based on earnings yields and price earnings ratios. There is considerable confusion about what the behaviour of price earnings ratio and its inverse the earnings yield really means, even it seems among experts such as Dobbs Koller and Lund (2014) who Frontier quote on p21. The behaviour of the required return on equity cannot be simply inferred from the behaviour of price earnings (PE) ratios, neither can it simply be inferred from the behaviour of the earnings yield (earnings price ratio). The earnings yield (and the PE ratio) is a function of the cost of equity, the growth rate and the dividend payout rate. We can examine this relation with the assistance of the dividend growth model.

We start from the simple Gordon dividend growth model. More complex dividend growth models could be used, but would add little for the purpose of exposition, other than complexity. The key message would be the same, the earnings yield (price earnings ratio) depends on the cost of equity, the rate of growth and the dividend payout ratio (or equivalently 1 minus the retention ratio). To see this we start with the equation for the Gordon model:

$P = \frac{D_1}{r_e - g}$ the next period's dividend can be written as bE_1, which gives:

$P = \frac{bE_1}{r_e - g}$ and dividing both sides with E_1 gives $\frac{P}{E_1} = \frac{b}{r_e - g}$ rearranging gives

the earnings yield $\frac{E_1}{P} = \frac{r_e - g}{b}$.

Where *P* = the share price, *b* = the dividend payout ratio, E_i = Earnings per share in period *i*, *g*= the growth rate and r_e = the required return on equity.

The foregoing equations give the prospective earnings yield and prospective PE ratio, but this is easily converted to a current earnings yield, or current PE ratio, since in Gordon growth model earnings are assumed to grow at the constant rate *g*. Thus, $E_1 = E_0(1+g)$, so $\frac{E_0}{P} = \frac{r_e - g}{b} \times \frac{1}{1+g}$. For example, if the growth rate were 2%, the cost of equity was 7% and the dividend payout ratio was 50%, then the prospective earnings yield would be 10% and the current earnings yield would be 9.8%

Having established that the earnings yield is not at all the same thing as the cost of equity, but rather is a consequence of interactions between the cost of equity r_e, the growth rate *g* and the dividend payout ratio *b*, it is clear that inferences about the cost of equity based on plots of earnings yields or PE ratios are highly suspect. In particular, just because the earning yield stays flat, or even rises, when interest rates are falling, does not mean that we can infer that the market risk premium has risen. If there has also been a reduction in the growth rate *g*, or a decline in the payout ratio *b*, the earnings yield can remain relatively flat, or rise, even though the cost of equity is going down. For example, continuing the earlier example if the growth rate drops to 1% and the cost of equity comes down to 6% then the prospective earnings yield remains at 10%, while if the growth rate drops to 1% and the cost of equity drops to 6.5% then the prospective earnings yield rises to 11%

So what is the likely story over recent history? In the environment of the last few of years it seems very likely that expectations of growth have been depressed. Current low interest rates are the RBA's attempt to try and stimulate flagging growth and flagging investment. Reduced expectations of growth would push the earnings yield up, so if the expectations of the payout ratio have not changed, a relatively flat earnings yield implies that the cost of equity has come down. This latter is what we normally expect to happen if interest rates are low.

What is happening to the expectations of the payout ratio is less clear. In the short run, due to the stickiness of dividends, when profits are depressed payout ratios tend to rise as companies hold their dividends at the pre-existing levels, or even try to keep increasing them. In the long run

the payout ratios are expected to converge to the firm's long run target payout ratio. Whether firms, or investors, are revising these targets is unknown. However, changes in target payout ratios by firms tend to be infrequent events. On balance, therefore, it is likely that changes in the payout ratio are likely to be a second order effect in explaining changes in the earnings yield. In our opinion reductions in the growth rate that are offset by reductions in the cost of equity are the most likely explanations for earnings yields not falling as interest rates fall.

For PE ratios, as the growth rate comes down the PE ratio falls, *ceteris paribus*. If the PE ratio instead remains relatively flat, as growth falls the likely explanation is that the cost of equity has come down.

Expert opinions

Individual expert opinions are just that, opinions of one person, not fact. While the pronouncements such as those of the governor of the Reserve Bank deserve serious consideration, neither the governor, nor the Reserve bank, are infallible. It is understandable for the governor to be seeking an explanation for the limited success of the RBA's monetary policy in stimulating investment. One possible explanation, as advanced by the governor, is that required returns have not fallen and this may be a more attractive explanation to a central banker than other alternatives, for example expectations of an extended period of poor economic performance and low growth.

Frontier (2016b) presents a range of quotations selected to support their argument. We view each quoted opinion as akin to a survey with a sample size of one and there is very likely to be sample selection bias and cross correlation in what is quoted. We expect that if the AER trawled the Internet they could also find a range of expert quotations to support the opposite position. Thus, we prefer to rely on more systematic evidence about experts' opinions. With respect to Australia we are aware of two such sources of recent evidence.

One systematic study is the report by HoustonKemp (2016) based on 23 firms doing independent expert valuations, which we analyse in more detail at A4 below. Contrary to the interpretations of Frontier (2016b) and HoustonKemp, what HoustonKemp actually find is that there is no relation between the risk premium that experts use and the return on ten year bonds. What the expert reports actually show is that post 2010 about half the expert reports use a rate higher than the

government bond rate as their proxy for the risk free rate. This is what drives the results in HoustonKemp's report, rather than an increase in the risk premium that the experts were using.

Averaged across firms of experts the market risk premium was 6.38%. That is 38 basis points above the 6% commonly used in practice. It is an open question whether the difference between the 6.38% average and the 6% standard is statistically significant. Since HoustonKemp did not provide statistics for the distribution of the market risk premium across expert firms, we cannot tell what drives their result. For example, is any increase pervasive across expert firms, or is the result like the result for interest rates with a roughly even split between increases and no change? Without statistical testing and details of the distribution it is difficult to conclude on the strength of any evidence for an increase in the risk premium, but it seems clear that the increase, if any, is not large.

The other study is by KPMG (2015) who survey valuation practices in Australia for 29 firms, covering the big 4 accounting firms, investment banks, boutique valuation firms, large corporates and infrastructure funds. Their headline result is "Australian market risk premium steady at 6%" (p19), which was the risk premium used by nearly 80% of the respondents to their survey.[8]

In other KPMG surveys, for the US and UK, the most commonly used risk premium was 5%. This latter result is interesting as these markets have had much more severe interest rate reductions than Australia (with the bank rate in the UK at 0.5% and the US Federal funds rate at 0.25% to 0.5%) and yet the KPMG results suggest that since 2013 there has been a reduction in the use of risk premiums above 5% for both the UK and the USA.

KPMG's results also suggest that since 2013 there has been a reduction in the use of risk premiums above 6% in Australia. So the evidence from this study is that in valuation practice risk premiums have, if anything, been coming down since 2013. We caution however about overweighting the evidence that risk premiums have come down and we note that there is no testing for the statistical significance of the changes. The evidence, however, is clearly incompatible with the proposition that risk premiums are rising.

[8] Fernandez (2015) who regularly conducts surveys of market risk premiums around the world also reports a 6.0% risk premium for Australia.

KPMG also report that 88% of their respondents generally used the 10 year government bond rate as their proxy for the risk free rate. Relative to the HoustonKemp (2016) report, the KPMG result gives a much higher percentage of observations where the 10 year government bond rate is the usual choice. Direct comparison, however, is difficult as HoustonKemp give their results based on the number of reports, not based on the number of firms.

Considered the prevailing market conditions are currently materially dissimilar to the average historical conditions. Considered that a technique that estimates the MRP by subtracting the average government bond yield from the average market return would not produce a reasonable estimate of the prevailing MRP in these conditions.

Are interest rates abnormally low in Australia?

We begin by making a comment about the supposed abnormality of the current conditions. We agree that interest rates in the USA and UK are abnormally low. However, in Australia, while current interest rates may seem very low to those whose memory of interest rates only extends back for forty-five years, the low interest rates we are currently experiencing are not so unusual. Indeed over the majority of the history for which the MRP has been calculated relatively low interest rates have prevailed.

In 1949/50 bond yields were at the previous low point relative to current rates. The yield on 2 year government bonds was 2.08% (current yield 1.96%) and 10 year government bond yields were 3.19% (current yield 2.60%). Below is a plot of government bond yields from 1883 to 2010 as presented in Figure 2 of Brailsford et.al (2010). Clearly high yields were only a feature of the post 1970 era and thus it is lower interest rates that have been most common in computing the long run market risk premium. It is also clear that there have been extended periods of low interest rates. For 30 years prior to 1913 interest rates were below 4% and reached a low point of 3%. While for 18 of the 19 years from1933 to 1951 interest rates were again below 4% and for 11 years of that period stayed in the range 3.1% to 3.3%.

FIGURE 3: Historic bond returns from Brailsford *et al*

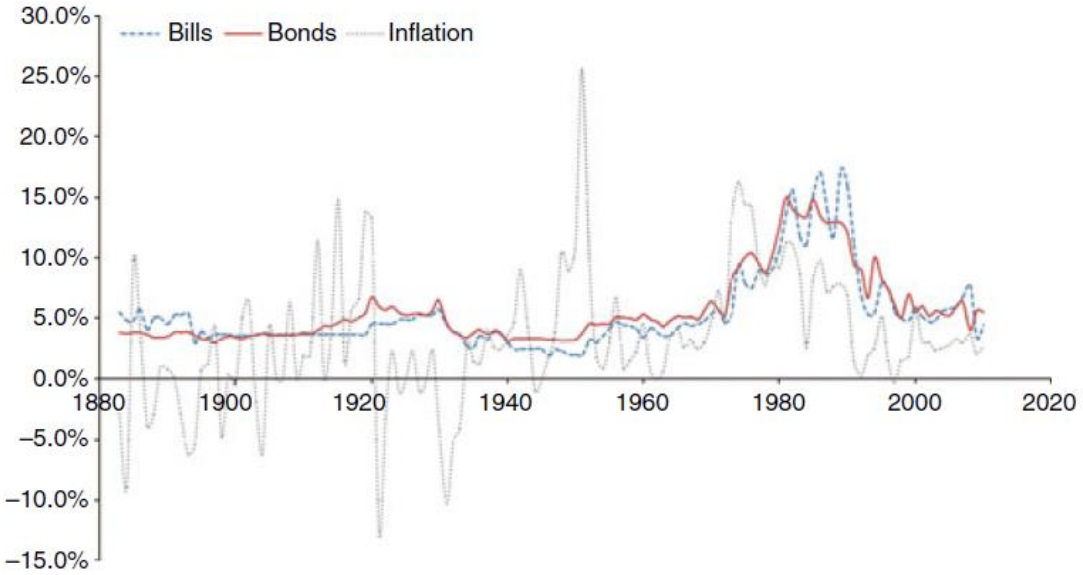


Figure 2 Historic bill and bond returns.

Source: Brailsford *et. al.* (2011)

We also can get some sense of the history of Australian interest rates from interest rates on mortgages. These rates are given below in Figure 8 from Small (2007). It can be seen in this figure that for 40 years before 1970 mortgage rates varied from roughly 4% to 6%, and for about 20 of those years they were settled at just above 4%. Small observes, "The longer record of mortgages in Australia, that in the case of NSW reach back to 1852, show that before 1970, mortgage interest rates have typically been within 0.5% of 5% except for very short excursions above or below that range." (p8). In other words prior to 1970 mortgage rates were quite similar to the rates we observe today.

FIGURE 4: Mortgage rates from Small

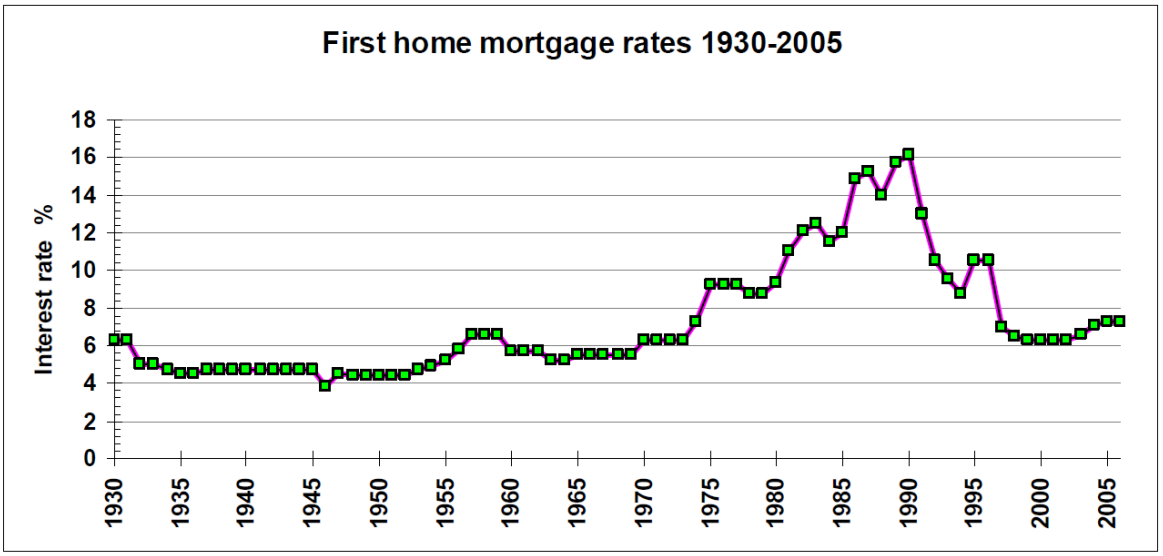


Figure 8: First home mortgage rates. Source: Commonwealth Bank of Australia

Source: Small (2007)

We recognise that institutional arrangements were very different fifty or more years ago and there were more direct government controls affecting both bond yields and mortgage interest rates. Nonetheless, that fact remains that the calculation of the long run historic MRP for the majority of observations has been calculated relative to low interest rates. Furthermore, we observe that the predominance of low interest rates was not a uniquely Australian phenomenon, but was shared with other developed countries. For example, from the start of the 1930s until the beginning of the 1950s, very low interest rates predominated in the UK.

The conclusion we reach is that a low interest rate environment over extended periods has been a common experience in Australia and elsewhere. Current 10 year Australian bond yields are 40 basis points below the previous minimum, so we have struck a new minimum. However, we do not consider that the magnitude of current interest rates is so dissimilar to the past as to invalidate the historic MRP informing an estimate of the current MRP. [9] We also observe that in

[9] The context is somewhat different, but Frontier (2016b) observe in relation to the DGM estimate of the market return " We note that even this significant bias in dividend forecasts results in only 30 basis point differential in the estimate of the required return on the market, which is economically small." p40.

Brailsford *et. al.* (2012) the arithmetic average risk premium (in excess of bonds) computed over 128 years from 1883 to 2010, a period over which low interest rates were in the majority, is exactly the same at 6.1% as the estimate over the 53 years from 1958 to 2010, where high interest rates were a dominant feature.

The historic MRP

We do not claim that computing the historic MRP is a panacea for all the problems of estimating the equilibrium expected market risk premium. However, the estimation process is relatively straightforward and transparent and alternative estimates of the historic MRP are generally not very different, except for estimates over short time periods.

The realised MRP is expected to be quite volatile over short periods. Whilst, we can reduce the effect of volatility by extending the sample, using longer and longer time series to estimate the MRP brings its own problems. There is always the problem that the economy may have changed dramatically over a long period, say from agriculture to mining, and these changes in the composition of the market portfolio can change the distribution of market returns. There is also the issue that as we go back a long way in time the number of firms in the market shrinks dramatically and we also have incomplete data.

There is no satisfactory way round such problems. If we use estimates of the realised market risk premium from more recent history the resulting risk premiums have a higher standard error. The average risk premium from more recent history tends to be lower than the long run historic average, consistent with our view (expressed above) that the risk premium has probably fallen over time, but because of high standard errors we consider this to be weak evidence.

We note that while the standard errors increase as the estimation period shortens, the variation in the mean is not that large. For example, using 128 years of data Brailsford et.al. (2012) compute an arithmetic mean return for the MRP relative to bonds at 6.1%, while using only 23 years of recent data covering the imputation tax system they estimate a mean MRP of 5%. Using the 53 years of recent of data, which they consider to be the period when the data are of good quality, they estimate a mean MRP of 6.1%.

The regulated businesses naturally argue for a higher risk premium and while we cannot absolutely rule out a risk premium higher than the historic risk premium, in our opinion it is very

unlikely. For the reasons that we have advanced earlier it is our view that the market risk premium is more likely to have gone down than to have gone up. However, it is also our opinion that currently the strength of the evidence is not sufficient to recommend a move down from the value used in common practice, which is 6%.

Recommended applying an approach of estimating a risk premium that is commensurate with the prevailing conditions in the market by using DGM and Wright approach estimates of market risk premium.

Difficulties with the DGM

The DGM does have some merit in relation to estimating the cost of equity. It has a solid theoretical basis and has had practical use in estimating the cost of equity. The popularity of the DGM for estimating the cost of equity waned once the CAPM was developed, but it has continued to have some use in practice and in regulation. However, for the reasons discussed below we would give DGM estimates a relatively small weight in relation to determination of the MRP.

The DGM can be used in different ways. It can be used directly, for example estimating the cost of equity as equal to the dividend yield plus a growth rate and this is how the model was used before it was supplanted by the CAPM. The DGM can also be used indirectly to derive an implied cost of capital from analysts' forecasts of earnings and dividends and a long run growth forecast. Although it is common to talk of the DGM, there are several variants of the model, such as the three stage dividend growth model, the H model, the Gordon growth model and the Gordon and Gordon model. Depending on which variant of the DGM you pick you can get quite different estimates of the cost of equity and the risk premium.

We have previously pointed out the problems of determining the market risk premium using the dividend growth model (DGM) and in particular the problem of using the DGM to track changes in the MRP. This is because of sluggish adjustment in DGM estimates to changing expectations of growth. Even if this were the only problem it would be sufficient for us to conclude that it is unlikely that the DGM will give you "a risk premium that is commensurate with the prevailing conditions in the market". There are also other problems in the DGM estimates that we have previously discussed at length. Consequently, we only mention some of these problems here and fairly briefly.

Other problems in the DGM include the problem of upward bias created by the use of analysts' forecasts, which are themselves known to be upward biased. There is also a problem of upward bias in the estimate of the long term growth rate, by for example failing to allow for the investment of the additional capital required to support the growth.

Proponents of the dividend growth model seem to live in a world of perpetual optimism. It always seems to be the assumption that firms are currently experiencing above average (supernormal) growth before moving towards the long run rate. Clearly all firms at all times cannot be operating at above the long run rate. This is impossible and it seems rather unlikely in current conditions that the market is offering a supernormal growth rate.

A further problem, in estimating the DGM implied market risk premium, is that the sample is not chosen as a representative sample of the market, but rather it is a sample selected on the criterion that the stock pays dividends. The sample selection is also restricted to stocks for which analysts' forecasts are available. Thus, the sample is selected in such a way that it may not even be a representative sample of dividend paying stocks. The extent of the bias that this causes and its direction is uncertain, but it does make the DGM less reliable as an MRP estimate for the whole market. There are also serious issues of aggregation in moving from application of the DGM at the individual firm level to application at the level of the market.[10]

Alternative DGM estimates

As a consequence of our discussion above it would be no surprise to find estimates from the DGM that tell a completely different story to that told by Frontier (2016b). This is illustrated by the plot (see Figure 5 below) from Fenebris (2016) of the DGM implied risk premium for the Australian market. The plot covers the period from January 2012 to February 2016. Fenebris is a web service that provides implied market risk premiums for markets around the world. According to this DGM analysis, the implied DGM risk premium has fallen since 2012. This is in contrast to Frontier's (2016b) claim, which is that the risk premium has risen as interest rates have fallen.

The implied market risk premium is about 6.25% at the start of 2012, but falls substantially over 2013 to about 4% for much of 2014, and then makes a partial recovery by February 2016 to end up with a risk premium at 5.32% and an implied market return of 7.72%. In our opinion these

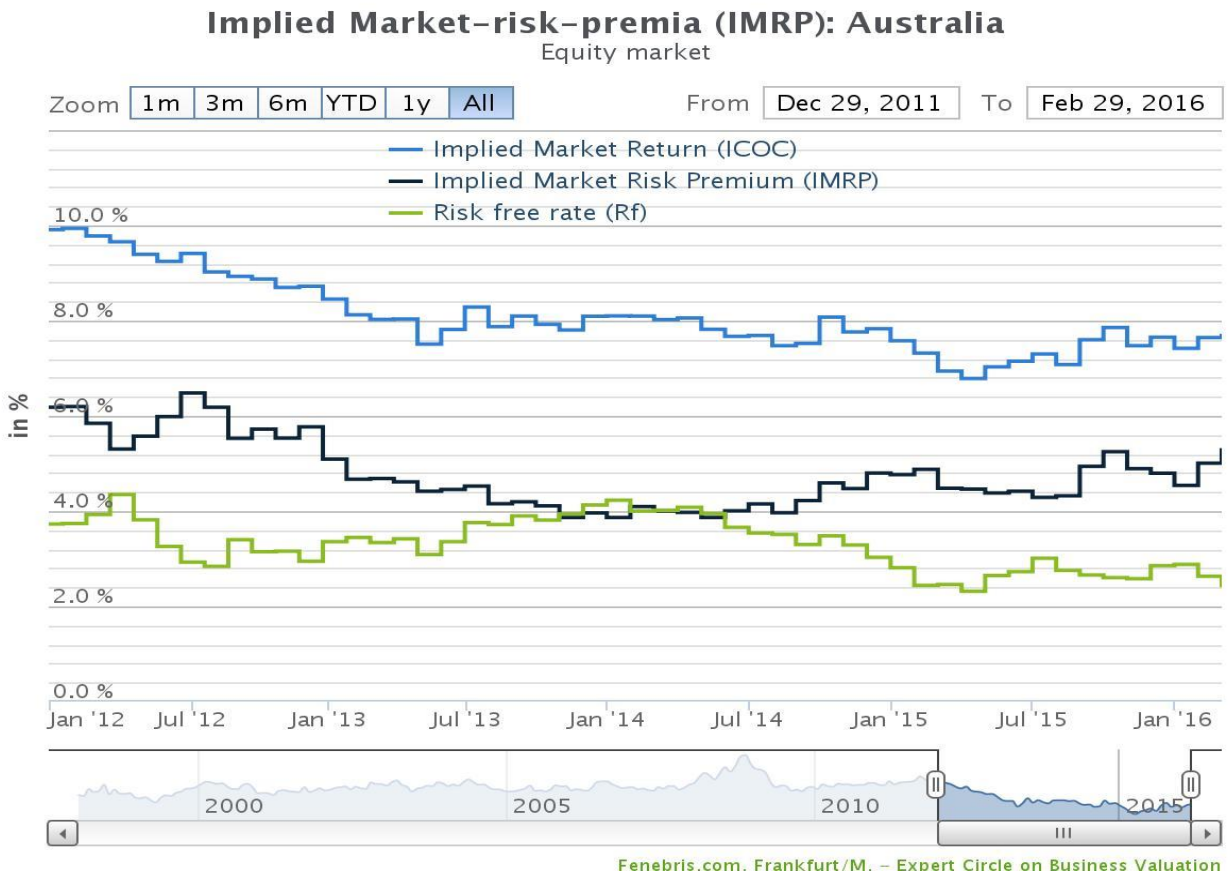
[10] For example, firms are likely to have different expected growth rates and different periods of supernormal growth.

latter values are quite plausible, but we would give this evidence relatively little weight, because the Fenebris analysis has not suddenly solved all the problems with the DGM.

So why is it that an objective, arm's length, estimate of the implied MRP using the DGM results in a much lower estimate of the market risk premium relative to the AER's DGM estimate? A key reason is differences in the assumption about growth rates. In the Fenebris analysis the long-run growth rate in earnings and dividends are constrained to be equal to the rate of growth in book value. The resulting growth rate is known as the internal growth rate, because it provides an estimate of the growth rate that the firm can sustain without raising additional funds.

The lesson here is that the implied market risk premium you get from the DGM can vary substantially depending on what you assume about growth rates. In this case the MRP is not only substantially lower, it reverses the story that Frontier (2016b) is promoting about rising risk premiums.

Figure 5: Australian implied market risk premium from Fenebris



In the light of the foregoing discussion, we think it very unlikely that the DGM will track short run changes in the market risk premium. It is our opinion that the AER should place a relatively small weight on MRP estimates from the DGM. We recommend that the AER should consider the average of the estimate over a substantial number of years, as year by year estimates are likely to be unreliable, and should also consider the consequences of alternative assumptions about the long term growth rate. By alternative assumptions, we do not simply mean that growth rates of different magnitudes should be considered, we also mean that the consequence of alternative assumptions for the period beyond the explicit dividend forecasts should be considered. For example, the AER should consider the assumption of the Gordon and Gordon model where, rather than assuming a long term growth rate, the assumption is that beyond some time horizon *t* investments have an NPV of zero.

Weakness in the Wright approach

Unlike the DGM, the Wright approach does not have the benefit of well accepted theory. Indeed there seems to be no theory advanced by the regulated businesses in support of the Wright approach. We have also seen no evidence that the Wright approach is used in practice. However, the Wright approach has been used in regulation, for example in the UK. In our opinion this is probably a mistake. We do however understand that in the UK, with the bank rate at 0.5%, regulators might feel under pressure to do something in response to abnormally low interest rates.

Provided the volatility of inflation rates is low the Wright approach will provide a relatively stable estimate of the market rate of return, since under the Wright approach it is assumed that the market rate of return is constant in real terms. This stability might be attractive to regulators, but will be inconsistent with efficient investment if the Wright approach is wrong. The stability will also disappear if inflation becomes volatile.

Not only is there no well accepted theoretical support for the Wright approach, but it also runs contrary to the well accepted view that asset prices are inversely related to interest rates. *Ceteris paribus*, under the Wright approach the price of shares is insensitive to interest rate changes. This has the interesting implication that there is relatively little point in hedging interest rate risk per se. A key objective for an entity hedging interest rates is to protect the value of assets and equity

against interest rate movements, but under the Wright approach there is an inbuilt hedge. Interest rates go up, but this is offset by a decline in the market risk premium.

There is also a practical issue in implementing the Wright approach. The Wright approach needs an estimate of expected inflation in order to form a forward looking estimate on of the nominal return on the market. This provides an extra parameter to estimate that could easily be a source of contention and also estimation error, just like the growth rate in the DGM. Over recent history the volatility of inflation has been relatively low with the implication that inflation has been relatively easy to forecast. However, a longer slice of history shows that inflation is at times volatile and difficult to forecast. It quite possible that inflation may contain surprises going forward creating estimation difficulties for the Wright approach. If inflation is volatile the stability in the rate of return under the Wright approach also disappears.

We are unconvinced by the Wright approach. It is not widely accepted and does not seem to be much used, if at all, in practice. We recommend that the AER gives it little weight.

Considered that analysts' forecasts of earnings per share (market capitalisation weighted average) increasing from 2015 to 2017 is inconsistent with the proposition that firms might (on average) be borrowing in an unsustainable manner to temporarily maintain dividends at their current levels.

It is entirely feasible for analysts' forecasts for earnings per share to be increasing while at the same time firms are financing the payment of dividends. Even though analyst's earnings forecasts are increasing, financing can create a growth rate of dividends that is not sustainable and financing may be necessary to maintain dividends at their current level. This can be seen by examining the cash flow identity for firms, which is given by:

Investment + dividends = earnings + net debt issues + net share issues

Rearranging gives: Dividends = earnings – investment + net debt issues + net share issues

Inspection of this latter equation shows, that even if earnings are increasing, as long as earnings minus investment is less than dividends, then dividends have to be financed by debt or equity issues. Even without the cash flow identity it is clear that a substantial fraction of dividends are financed with share issues, since that is the point of dividend reinvestment plans.

Faith in analysts' forecasts of earnings and dividends should be tempered by the understanding, that as forecasters, analysts are contaminated by their employment since their function is not just to inform clients, but also to encourage trading. The evidence is that analysts' forecasts are biased upwards as we move beyond horizons of a month or so, see for example, Brown et.al. (2002). for evidence of overoptimistic dividend forecasts in Australia.

Considered that potential upward bias in analyst forecasts of dividends (an input into the AER's DGM) does not have a material impact, is unlikely to have materially changed since the December 2013, and is not relevant as the implied discount rate from analysts' dividend forecasts is useful information.

Whether the extent of analysts' upward bias has materially changed since December 2013 is unknown. It is plausible that when the economy is depressed the incentive for upward bias in order to generate trades might be higher, but we will only know the extent of any bias with the benefit of hindsight.

Frontier (2016b) gives the results for a 5% upward bias and a 10% upward bias in analysts' forecasts as 30 basis points and 65 basis points respectively. These are not large effects, but a difference of 30 or 65 basis points in the rate of return is a difference that would matter to investors and the regulated businesses, so it is not a difference that is trivial. However, it is also a difference that is quite small relative to the widely varying estimates that can be obtained from the DGM. So whether or not, after deducting the bias, the DGM implied risk premium is above or below the AERs 6.5% MRP, depends on which DGM estimate you use. For example, with the Fenebris (2016) 5.32% MRP estimate and a 65 basis point upward bias, the implied MRP after correction for bias is only 4.67%. Our conclusion is that we cannot reliably determine the MRP from the DGM, but whatever the implied MRP estimate from the DGM it is likely to be upward biased.

As to whether knowledge of the discount rates that analysts are using is useful, in our opinion evidence of what discount rates are used in practice is useful. Whether that information is the output from an analysis of the discount rate implied by the DGM is an entirely different question. First, it must be presumed that the analysts are using the DGM as their valuation model and in the same form as the particular version of the DGM used to derive the implied discount rate. Second, all the input to the model needs to come from the analysts. Typically, however, the long

run growth rate, as in the AER's DGM, does not come from the analysts. Since the conditions that we outline are unlikely to hold, we conclude that the implied discount rate from a DGM is unlikely to give you the discount rate that analysts are using.

A3. Frontier Economics, *The required return on equity under a foundation model approach*, January 2016.

Considered that the AER's 0.7 equity beta estimate applied in its SLCAPM foundation model should be adjusted (using the return on equity from the Black CAPM and Fama-French model) to correct for low beta and book value biases.

Mixing models and weights

The multi model approach advocated by Frontier (2016c) involves the consideration of a number of models and allocating them weights in estimating the regulated return. Some of our arguments against this approach have been presented in previous reports and weaknesses in the use of the Black and Fama-French models are also discussed under AI and A4 in this report. These weaknesses also mitigate against using the Black and Fama-French models to adjust the equity beta estimate. While we have previously made the case against giving these models significant weight in a regulatory setting some points bear repeating, as below. We also include some more technical discussion of issues in using the zero beta (Black) CAPM.

One reason why regulators should be wary of the Fama-French approach is that there is considerable possible variation in the ways these factors can be constructed, which is one of the reasons that these factors are favoured by the financial sector; they can be customised. Also, there is no theory attached to such a model; this has the implication that we do not really know if these factors represent risks, alpha opportunities, or behavioural anomalies. By contrast, the CAPM is a simple but self-contained theory of equilibrium pricing; the single factor, the market, is clearly identifiable as a risk factor and this makes it much harder to manipulate once we agree upon the market portfolio and the choice of riskless asset.

Is it possible to manipulate the Fama-French model? Clearly, it is, we cannot only vary the number of factors by adding or not adding momentum or other factor choices such as liquidity, or moving to Fama and French's new five factor model, but we can also vary the way the factors are defined. For example, there are many possible ways of defining a value factor, this gives us a large number of regressions to choose from, thereby allowing us to choose the one that is most favourable to our argument.

It is surprising that the one model used extensively in practice (SLCAPM) to estimate the cost of equity receives a substantially smaller weight In Frontier's analysis, at 12.5%, than any of the other models, which have weights ranging from 25% to 37.5%. Applying the smallest weight to the model that gives the lowest regulated return would obviously be attractive to the regulated businesses, but it is not well justified.

The zero beta/Black CAPM

It seems appropriate to re-examine the underpinnings of the zero-beta CAPM as these are behind the justifications for adopting this model with its implicit higher cost of capital. To do this we shall re-examine 3 important sources; Black (1972), Brennan (1971) and Grundy (2010). We include the latter because it well-argued and is the perhaps the most persuasive of the many attempts to justify the use of this model. We shall address the Brennan paper first. The Brennan model allows different borrowing and lending rates and investors are unconstrained with regard to short-selling, in all other respects, the assumptions are the classical CAPM framework. The analysis defines two "Markowitz" portfolios, one for lending and one for borrowing and the market portfolio (in terms of equity) could be either of these, or as is more likely some combination of the two. The weights of the combination depends upon the cross-sectional distribution of borrowers/lenders in the riskless asset. This is an interesting problem but unsuitable for regulatory use as we cannot be certain what the properties of the market portfolio actually are (as opposed to the CAPM where there is a single Markowitz portfolio).

Assuming that the market portfolio lies between the two Markowitz portfolios only tells us that the mean of the zero-beta portfolio should lie between the borrowing and lending rate. It is hard to see how this leads to a flattening of the SML since this needs to be relative to something which is not defined by the model. However, it does tell us that the zero-beta premium is at most equal to the spread between borrowing and lending.

Turning to the second paper, the original Black (1972) model there is a single Markowitz portfolio. Black obtains this result by assuming (p.446):

"Let us start by assuming that investors may take long or short positions of any size in any risky asset, but that there is no riskless asset and that no borrowing or lending at the riskless rate of interest is allowed. This assumption is not realistic, since restrictions on short selling are at least as stringent as restrictions on borrowing."

We would agree that this is unrealistic and further argue that the assumption of no riskless asset, is for practical purposes denied by the existence of T bills and 10 year government bonds. Black (1972) goes on to consider the case previously analysed by Vasichek (1971) where there is a riskless asset and investors can take long and short positions in risky assets but are not allowed to short the riskless asset. The assumption that we can go long and short in all assets except the risk free asset which we can only go long in, seems somewhat contrived.

This brings us to work of Grundy (2010). Grundy uses a much more persuasive argument which is based on the idea that, since we do not know if the cap-weighted "market" index is the true market, we should treat it as an efficient portfolio and then apply the zero-beta CAPM, as might appear to be appropriate. However, this leads us back to the large and difficult area of testing for mean variance efficiency, see Brieure (2012) and Levy and Roll (2012) for recent papers is this area.

Furthermore, whilst we can estimate the mean of the zero-beta portfolio with all the problems that have been discussed in previous reports, what has not been discussed to the same degree is the actual nature of the zero-beta portfolio. From mean variance (MV) mathematics if m is the efficient portfolio and z is the zero-beta portfolio, and Ω is the (N x N) covariance matrix, z is defined by the condition:

$$m'\Omega z=0 \qquad (2)$$

To see the sets of numbers that are thrown up by equation 2, assume the "market" has two assets with weights (w,1-w), 0<w<1 and $\Omega = \begin{pmatrix} \sigma_1^2 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 \end{pmatrix}$.

Let the zero-beta portfolio be (a, 1-a).

If we simplify the analysis by setting $\sigma_1 = \sigma_2$, condition (2) gives us:

$$a = \frac{-1 + w(\rho - 1)}{(1 - 2w)(1 - p)}$$

Plausible values for *w* and ρ might be that *w* = 0.6, $\rho = 0.4$ but these would give us values of a = -5.33. Thus, in this simple example to "construct" your zero-beta portfolio, with say a net investment of $100m, you would need to invest $633m in asset 2 and short $533 m in asset 1.

Such extreme positions seem unreasonable and in practice establishing and maintaining the short position over an extended period would be very difficult and costly. It is also worth noting that Merton (1972, footnote 9) mentions with respect to the zero beta portfolio "…it is misleading to allow as one of the mutual funds a portfolio that no investor would hold as his optimal portfolio."

In the example above there are only two assets so all portfolios will be MV efficient. The large long and short positions are not an odd case; we would expect large long and short positions in more realistic cases. Intuitively this arises because the vast majority of assets in head-line indices are positively correlated, see for example Buda (2010). Then if *m* typically has positive elements as well, it must be the case that *z* must have some negative elements to satisfy $m'\Omega z = 0$. Finally whether the zero-beta CAPM leads to a higher or lower cost of capital relative to the market depends upon the position of the efficient market proxy portfolio relative to the efficient market portfolio.

A very important problem with the mean of the zero-beta rate (v_2) is its non-existence under normality.

It can be shown that:

$$v_2 = \frac{\beta\Pi - \alpha}{\gamma\Pi - \beta}$$

Where for our returns $R_t \overset{iid}{\sim} N(\mu, \Omega)$.

$$\beta = \mu'\Omega^{-1}i$$

where i = (1…1) an N x 1 vector of ones. $\gamma = i'\Omega^{-1}i$ and $\alpha = \mu'\Omega^{-1}\mu$. The term Π is the expected rate of return of the mean-variance efficient portfolio used in place of the market portfolio (we call this the proxy portfolio). Now v_2 becomes infinite if $\gamma\Pi = \beta$ or $\Pi = \beta/\gamma$ where it turns out that β/γ is the mean of the minimum variance (MV) portfolio so that it would seem that, as long as $\Pi > \beta/\gamma$ the problem will go away. Unfortunately even if $\Pi > \beta/\gamma$ it does not mean that estimates of $\hat{\gamma}$, $\hat{\Pi}$ and $\hat{\beta}$ may not take values such that $\hat{\gamma}\hat{\Pi} = \hat{\beta}$ for some realisation. What this says that at times when the proxy portfolio has low returns relative to the MV portfolio is the time when $\hat{v}_2$ can be very large which may explain some of the very large numbers being provided by consultants to the regulated businesses.

It is also a consequence of MV mathematics that if the efficient portfolio is above the minimum variance portfolio then the zero beta portfolio must be below it. Another explanation for the very high average value of the zero-beta portfolio may well be that in some periods the proxy efficient portfolio is inefficient. A proof of the above result is in Merton (1972)

Considered that the AER and its advisers quote selectively from reports that they discuss.

The Frontier (2016c) report comments that some of AER's advisors have been quoting the submissions in a selective way, the implication being that these selectively chosen quotations misinterpret the position presented in the reports. We have read Frontier (2016c) to find where this argument has been developed or evidence presented, but it seems to be mainly based on assertion. Indeed the Frontier (2016c) assertion could levelled at the consultants to the regulated businesses. For example, in discussion of Kan, Robotti and Shanken (2013) the consultants to the regulated businesses avoid discussion of the negative results with respect to the Fama and French model. However, assertion of selective quotation by the businesses' consultants is not an issue that we wish to pursue, because it seems to us that this is not a productive issue to debate.

By definition any quotation of other than the whole work involves selection, but we reject the implication of selectively quoting in order to mislead the reader. Indeed one of the pleasant features of providing reports for the AER is that there is no pressure from the client to support a particular position, this is in sharp contrast to our experience in similar work with commercial clients.

A4. HoustonKemp, *The cost of equity: Response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks*, January 2016.

Reading the HoustonKemp (2016) report one might be led to believe that the *single* criterion for selecting an asset pricing model is how well it forecasts subsequent realised returns. For reasons we discuss subsequently, this is not a view we endorse. It would be unwise to use the ability to forecast subsequent realised returns as the sole criterion for selecting an asset pricing model. Forecasting stock returns and determining equilibrium expected returns (asset pricing) are two different tasks. For example, adding a momentum factor to the Fama and French three factor (FF3) model improves the power of the model to forecast returns, but the regulated businesses while arguing for the FF3 model do not suggest that momentum determines the cost of capital for long term projects. Since momentum is short lived it is not appropriate as a determinant of equilibrium expected returns in the long term.

The essence of the HoustonKemp (2016) report, with respect to their analysis of realised returns, can be boiled down to two main points. First that their best forecast of realised returns is to assume that in the cross-section all stocks have the same return and by implication that they all have the same cost of capital. The second point is that the HoustonKemp implementation of the Black CAPM gives much the same result as assuming that returns across stocks are all the same. In our opinion assuming all stocks have the same cost of capital is not plausible and is likely to impart a significant upward bias to the regulated return. Therefore, accepting HoustonKemp's proposition as a basis of determining the rate of return for regulated businesses is likely to deliver substantial monopoly profits to the owners of the regulated business and is unlikely to achieve the efficiency objectives of regulation.

Noted that the AER's own advisers have found evidence against the SLCAPM.

Houston and Kemp (2016a) use quotations from our prior work suggesting problems with the CAPM. We should put these quotations in context. With respect to the CAPM's performance in forecasting realised returns, we have previously acknowledged that a substantial body of academic opinion takes the evidence to be against the CAPM. However, we have also pointed out (see for example, Partington and Satchell 2015a and 2015b) that there is well regarded research

which shows that there are substantial methodological and statistical problems associated with asset pricing tests, for example, that results depend on how the portfolios used in the tests are formed.

We have further pointed out that Levy and Roll (2012) use an alternative to the standard tests and conclude that: "*…in contrast to the widely held belief, the CAPM cannot be empirically rejected."* More recently, Dan and Qiao (2015) argue that changes in firm's leverage ratios lead to substantial time variation in betas and that this causes the poor empirical performance of the CAPM, but that unlevered betas can better explain the cross-section of unlevered returns. These papers do not use the same empirical implementation as the AER, but they illustrate that the debate about how to conduct asset pricing tests including tests of the CAPM is still evolving.

These papers also illustrate that the tide of academic opinion is divided about the evidence from realised returns, both for and against the CAPM. In short there is ongoing debate about how asset pricing tests should be conducted, what test statistics are appropriate, and what such tests actually mean. Consequently, strong claims about the empirical performance of asset pricing models should be taken with a big dose of salt, including those made by HoustonKemp (2016).

Consultants evidence and the zero beta CAPM

Our opinion on the analysis of realised returns, in the context of asset pricing models, is that the result you get is influenced by what you do, sometimes very substantially. The results in HoustonKemp (2016) illustrate this. An estimate of the zero beta premium[11] that is equal to, or greater than, the market risk premium is risible when viewed in the context of the underlying theory. HoustonKemp's argument is that the underlying theory is irrelevant, their analysis of the data gives the number they report, and implicitly that it is indisputably correct. We do not agree.

There is no tabular reporting of the numerical values of the zero beta premium in the HoustonKemp (2016) report, but their Figure 4 suggests that recursive estimates settle down to around eight or nine percent. Like the HoustonKemp report, the NERA (February 2015) is authored by Wheatley and Table 4.1 reports a zero beta premium of 10.75%. SFG also uses data to estimate the zero beta premium and estimates a different and much smaller number at 3.4%. Why this large difference? The explanation that has been offered is that the portfolios used in the estimation process were constructed differently. Large differences in the zero beta premium were obtained because of

[11] The zero beta premium is defined as the difference between the return on the zero beta portfolio and the return on a risk free asset.

differences in what the consultants to the regulated businesses chose to do. Large differences can also arise because of the intrinsic instability of the estimate, referred to above

HoustonKemp are arguing that there is no objective standard and no theoretical guidance on the magnitude of the zero beta premium, but rather that what we must rely on is what comes out of empirical analysis of the data. Since what comes out of the data varies very substantially depending on what consultants to the regulated businesses choose to do, this hardly seems to be a suitable basis for regulation. The more so since, as we subsequently discuss, what comes out of the data as an estimate of the zero beta premium has relatively large standard errors, or to put it another way rather low accuracy.

The SLCAPM is based on a theoretical model of equilibrium expected returns. Equilibrium expected returns are what we want to measure when determining the cost of capital. Like the SLCAPM, the zero beta CAPM has the advantage of being an equilibrium model, but relative to the SLCAPM it has the disadvantage that the return on the zero beta portfolio cannot be directly observed it has to be estimated. As we have repeatedly pointed out this presents substantial problems and the model does not have significant use in practice

As we have said before Partington and Satchell (2015b, p21) "…the CAPM has passed an important test. That test is the test of time. While academics are still debating the merits of the different asset pricing models, how they should be tested and what the appropriate test statistics are, the users of models have made up their mind about which model to use when estimating the cost of capital. The SLCAPM has had several decades of widespread practical use in estimating the cost of capital. None of the other models have passed the same test." This contrasts with the HoustonKemp's (2016a) zero beta CAPM with no track record of use in practice, and in our opinion it is a model that is never likely to have significant use in practice.

"Low beta bias" and the AER adjustment

HoustonKemp (2016) raise the issue of low beta bias in the SLCAPM and argue for the use of a zero beta CAPM. We have put the heading low beta bias in quotes, because it is potentially misleading. In the context of HoustonKemp's report it does not mean that beta is downward biased, neither does it necessarily mean that the equilibrium expected returns from the CAPM are downward biased. In the current context, low beta bias means that equilibrium expected returns given by the CAPM for low beta portfolios are lower than the subsequent realised returns

for those portfolios. The interpretation that HoustonKemp makes of this is that the equilibrium expected returns from the CAPM are downward biased, this is a possible explanation, but it is not necessarily the true explanation.

For a number of reasons, including consideration of the theory of the Black CAPM, the AER has adopted the high end value of 0.7 for beta, out of a range from 0.4 to 0.7. HoustonKemp (2016) attempt to determine whether the adjustment is too high or too low by constructing what it calls the AER CAPM. Essentially this involves taking the standard CAPM and adjusting the intercept upward by adding an implied zero beta premium to the risk free rate.

HoustonKemp attempts to derive an implied value for the zero beta premium from the AER's beta estimates. This is accomplished by taking the mid-point of the AER's beta range of 0.55 as the unadjusted beta, weighting it by two thirds and weighting the market beta of 1 by one third in order to get an adjusted beta of 0.7. HoustonKemp argue that this "…implies the AER currently acts as if it believes the zero beta premium should be one third of the value of the *MRP"*. With an MRP of 6.5% this gives an implied zero beta premium of 2.17%.

The foregoing process is somewhat ad-hoc. For example, if the unadjusted beta is taken to be 0.4, then the weighting scheme becomes 50% on the adjusted beta and 50% on the market beta of 1. As a consequence the implied zero beta premium rises to 3.25%. This higher value would reduce the strength of HoustonKemp's (2016a) claims that the AER's adjustment was insufficient. Of course it would also be feasible to set the unadjusted beta to a value above 0.55 and in turn this would imply a zero beta premium of less than 2.17%. This lower zero beta premium would strengthen HoustonKemp's (2016a) argument that the AER's adjustment was too low. The problem of estimating this implied zero beta premium is analogous to the problem of estimating the zero beta return for the zero beta CAPM. There is scope for different estimates and the estimate you get is influenced by what you choose do, but less substantially so than in the zero beta CAPM.

Assuming that an adjustment is required, would an implicit 3.25% adjustment be big enough? Compared to HoustonKemp's (2016a) estimate of the zero beta premium the AER adjustment is substantially smaller. However, compared with the SFG 3.40% estimate of the zero beta premium, a 3.25% AER adjustment is not far off. HoustonKemp's estimate of the AER adjustment at 2.17% is somewhat further off. Does this mean an adjustment of 2.17% is too low? Not necessarily, as

we have previously argued a 3.40% zero beta premium seems unreasonably high, as at the time of its estimation the resulting zero beta return matched the return on speculative debt.[12] Once again we strike the problem of how the reasonableness of the zero beta premium is to be determined. Unless we resort to the underlying theory, how is a judgement to be made? HoustonKemp's answer is, let the data speak, but the data speaks in many tongues and does not provide one unambiguous answer, or even approximately similar answers. Furthermore, the analysis of the data does not put beyond reasonable doubt the issue of whether any adjustment is necessary at all.

Criticisms of the Black CAPM, including estimates of the zero beta return and the use of work by Beaulieu, Dufour and Khalaf (2012)

In our prior reports Satchell and Partington (2015a, 2015 b) we illustrate some technical problems in relation to the estimation of zero beta returns and support our own analysis by reference to Beaulieu, Dufour and Khalaf (2012) who independently demonstrate the unreliable nature of inference in respect to the estimation of the zero beta return (γ). We utilised the following quotation:

"Identification: as β i$\longrightarrow$1, γ becomes weakly identified. Weak identification (WI) strongly affects the distributions of estimators and test statistics, leading to unreliable inference even asymptotically. This should not be taken lightly: reported betas are often close to one (see e.g. Fama and MacBeth, 1973). *Further, even if estimated betas are not close to one, irregularities associated with WI are not at all precluded* [in view of (1) and (2) above]." Beaulieu, Dufour and Khalaf (2012. P.3, emphasis added)

Houston and Kemp (2016) respond to the problems so identified as follows:

"The estimates that we produce of the zero-beta premium use the largest 100 stocks from 1963 to 1973 and the largest 500 stocks from 1974 to 2014 and it is unlikely that all of these stocks have true betas that are close to one." (p.26)

[12] Other than the consultants to the regulated businesses, we doubt there are many, if any, academics, financial experts, or finance industry practitioners, who would advocate calculating the cost of capital by taking the cost of speculative debt as the base return and then adding a CAPM risk premium.

First, as Beaulieu, Dufour and Khalaf (2012) state above, even if the estimated betas are not close to one, this is not a sufficient condition to preclude problems of estimation and inference. Second, Houston and Kemp's (2016) statement above, does not sit easily with their statement in the same report that: "Forecasts that the naïve model and the Black CAPM produce are similar because at each point in time the Black model looks back at past data, sees little relation between mean return and beta and so sets the betas of the 10 portfolios close to one." (p.14). Neither does it sit easily with their claim that the evidence favours a naïve model, "…which sets the beta of every asset to one" (p1).

HoustonKemp (2016) further argue: "Again, like NERA and SFG, we compute an estimate of the zero-beta rate by adding an estimate of the zero-beta premium to the current risk-free rate and so the evidence that Beaulieu, Dufour and Khalaf provide about the instability of estimates of the zero-beta rate is of little relevance to our work." (p26)

The implicit argument in this statement is that any instability in estimates of the zero beta return is due to variation in the risk free rate. Thus eliminating the risk free rate fixes the stability problems in the zero beta rate by transforming it to a zero beta premium. This is a dubious proposition, which we find completely unconvincing.

The regulated businesses repeatedly argue that application of the Black CAPM will help correct "low beta bias". What "low beta bias" actually means is that there is a tendency for low beta stocks to overperform and high beta stocks to underperform relative to the CAPM, but if this is (and there is substantial evidence that it is) the case, this does not necessarily imply anything other than that the stocks have outperformed or underperformed. The SLCAPM can still be used in the usual manner to compute the equilibrium expected return to the asset.

Partington's estimation of the market return being similar to NERA and SFG's approach of estimating zero beta return

Partington and Satchell (2015b) make the point that the current government bond rate is observable, it does not have to be estimated. Whereas the zero beta return has to be estimated, which requires a considerable number of years of data. Consequently the estimate is not current. In response HoustonKemp (2016a, p40) state:

"This argument ignores the fact that both NERA and SFG suggest that an estimate of the zero-beta rate be formed by adding an estimate of the zero-beta premium to the current risk-free rate in exactly the same way that Partington and Satchell argue that one should form an estimate of the mean return to the market – by adding an historical estimate of the *MRP* to the current risk-free rate."

We have not argued that "…one should form an estimate of the mean return to the market – by adding an historical estimate of the *MRP* to the current risk-free rate." What we have argued is that you should add the current risk premium and the current risk free rate to get the current return. However, the current risk premium cannot be observed, it has to be estimated. The historic return on the market is a major source of evidence in determining the value to be used. However in the estimation process judgement is necessary and we have also argued that other evidence, such as that from surveys, can be useful in informing judgements about the current market risk premium. In our opinion, the current market risk premium is likely to be lower than the historic risk premium rather than higher, but we have not yet seen sufficiently strong evidence to recommend lowering the rate that the AER uses.

Observability and estimation error

We emphasise that because the current yield on a government bond is directly observable, not only is it current, but also estimation error is not a substantive issue. In contrast, as reported by the consultants to the regulated businesses, not only are the zero beta premium estimates not current, the standard errors of the estimates are substantial. HoustonKemp (2016) does not provide standard errors for the zero beta premium in its report, but past reports with standard errors of the zero beta premium can be found in NERA (February 2015) and from NERA (June 2013).[13] The estimate from NERA (February 2015) Table 4.1 is that the zero beta premium is 10.75% which has a 95% confidence interval from 5.03% to 16.47%, which admits a substantial range of possibilities. NERA's (June 2013) Table 5.3 (reproduced below) reports standard errors and also provides evidence on the stability of zero beta premiums. It is evident that there is substantial variation in the estimates and the standard errors are large relative to the estimated zero beta premiums.

[13] Houston and Kemp (2016), NERA (February, 2015) and NERA (June 2013) all have Wheatly as author or co-author.

In the worst case with respect to precision, which is the portfolio estimate for the 1974 to 1993 period, the estimate of the zero beta premium is 17.68% and the 95% confidence interval ranges from negative at -1.88% to positive at 37.22%. Other cases are not so extreme but the range of possibilities is still substantial. The portfolio estimate from 1994 to 2012 estimates the zero beta premium as 10.03%, with a 95% confidence interval of 0.63% to 19.43%. With such large confidence intervals, it is not surprising that the hypothesis of no difference between the estimates across different time periods cannot be rejected. Rather than taking comfort that this is evidence on the stability of the zero beta premium, we conclude that poor estimates with low precision give rise to tests with very low power to detect significant differences.

Table 5.3
Stability tests that use estimates of the zero-beta premium

	Portfolios			Securities		
	1974-1993	1994-2012	Difference	1974-1993	1994-2012	Difference
Estimate	17.68	10.03	7.65	12.99	9.00	4.00
Std. error	(9.78)	(4.70)	(10.85)	(5.31)	(4.25)	(6.80)
P-value	[0.09]	[0.05]	[0.49]	[0.02]	[0.05]	[0.56]

Source: NERA (June 2013)

Partington's view that there is little evidence in the data for mean reversion in betas and concludes that the use of the SLCAPM will not generate downwardly biased estimates of the cost of equity for a benchmark efficient firm.

There are two uses of the term of low beta bias. One, that has been the topic of many submissions by the regulated businesses, is that ex-post realised returns for low beta portfolios are higher than the expected returns from the SLCAPM given the beta of the portfolio. This has been discussed in the section above headed "low beta bias" and in the discussion of the Black model. A second type of low beta bias is that estimates of beta that are low may be downwardly biased estimates of the true beta due to measurement error. Reversal of this measurement error over time would give rise to mean reversion as later estimates of the original downwardly biased betas drift up towards one. In our prior work we have concluded that there is little evidence of mean reversion

with respect to the betas for energy utilities.[14] The appropriate conclusion is that the estimates of utility betas are not downward biased. In turn, therefore, this will not be a source of downward bias in estimates of the cost of equity for utilities.

The use of works by Ray, Savin and Tiwari (2009) and Da, Guo and Jagannathan (2012)

The discussion presented by Houston and Kemp (2016) contains nothing new and largely consists of quotations drawn, from previous reports. The issue relating to Da Guo and Jaganathan (2012) was dealt with in Partington and Satchell (2015b). The Da Guo and Jaganathan (2012) paper helps explain the continued use of the SLCAPM, despite the academic attack that the CAPM had received. The paper also explains how the CAPM could be appropriate for evaluating projects even if equity returns do not confirm to the CAPM. We agree that the betas estimated in Da Guo and Jaganathan (2012) are not estimated in the same way as AER's estimates of beta. However, we do not with agree the argument that the results of Da Guo and Jaganathan (2012) are irrelevant to the AER's use of the SL-CAPM in estimating estimate the cost of capital. The Da Guo and Jaganathan (2012) paper goes to the question of the continuing use of the SLCAPM in practice and why evidence from equity returns should not necessarily be considered as evidence against the CAPM in determining the required return for projects.

The paper by Ray, Savin and Tiwari (2009) was originally cited to show how statistical inference can be erroneous and that therefore tests of asset pricing models should be interpreted with caution. In particular, that the statistical significance of past results could be subject to material misstatement resulting in unreliable inference. It seems quite possible that the bootstrap simulations that NERA (2015b) undertake result in more reliable inference, but as our earlier discussion shows we are completely unconvinced about the superiority of NERA's/Huston Kemp's zero beta CAPM over the SLCAPM.

[14] We note that Frontier (2016) do not use the Vasicek adjustment for mean reversions. This is because in prior work for the regulated businesses SFG (2013) found that the Vasichek adjustment had minimal impact for both US and Australian firms.

The argument against using the FF3M (being under revision after the development of the FF5M) can also apply to the SLCAPM

It is true that there has been and continues to be considerable debate about the SLCAPM and that there have been attempts to extend the model, such as the development of the intertemporal CAPM. Nonetheless the SLCAPM still has widespread acceptance. Despite the hullabaloo and in some cases premature heralding of the death of the CAPM, the SLCAPM remains the premier model used to estimate the cost of capital in practice, by both industry and regulators. It is also widely agreed that the SLCAPM is a model of equilibrium expected returns. Indeed, so well is the SLCAPM established as the standard model that in most contexts people will just write CAPM rather than SLCAPM. None of this can be said of the Fama and French three factor model (FF3).

Other than as a benchmark for investment styles, where it is often supplemented by a momentum factor, FF3 is a model that that is still to gain acceptance in the world of practice. It is also being increasingly questioned, not just in terms of the changes that Fama and French themselves are making, but also in terms of whether the model factors have explanatory power other than in portfolios sorted on size and momentum. Let us suppose an implementation of the FF3 model delivered a lower cost of capital for the regulated businesses (we note that this is feasible).[15] In this case we hypothesise that the regulated businesses would be arguing against the use of FF3 by the AER. Our opinion is that whether FF3 yields a higher or lower cost of capital, it should not be used by the AER. The model has not established itself in the role of estimating the cost of capital, it is increasingly being challenged and currently it is in a state of flux with Fama and French having moved on to a new model.

Criticisms of the FF3M and the use of works by Kan, Robotti and Shanken (2013)

We stand by our observations that in Kan, Robotti and Shanken (2013) the results of the asset pricing tests in general, and tests of the FF3 model in particular, depend upon the characteristics used in sorting stocks into portfolios. This is consistent with Lewellen, Nagel, and Shanken (2010) who show that factors correlated with the characteristics used to sort stocks into portfolios have explanatory power for portfolio returns. Thus in Kan, Robotti and Shanken (2013) using tests

[15] For example, the results of Jagadeesh and Noh (2013) are that the SMB factor is not priced and the HML factor has a negative premium, so relying on these results (which we do not advocate) a lower regulated rate of return would be the likely outcome.

based on size and book to market sorts for portfolios the FF3 model ranks second to the ICAPM, but when portfolios are sorted on size and beta the performance of FF3 degrades. Indeed in multiple model comparisons the FF3 model is rejected in tests using size and beta sorted portfolios as is the SLCAPM. Further the book to market (HML) factor is not significant with an unconstrained zero beta rate of return. This is hardly an endorsement of the FF3 model as HoustonKemp (2016) imply.

We also make it very clear in our prior report that we do not take the results of Kan, Robotti and Shanken (2013) to be an empirical endorsement of the SL-CAPM. As we state Partington and Satchell (2015b, p24) "We are not suggesting that these results are an endorsement of the CAPM, but rather that they highlight the difficulties of all attempts to fit asset pricing models to realised returns, including the work of NERA."

Partington and Satchell's suggestion that less weight should be assigned to independent expert reports written by firms who write many reports and more weight should be placed on firms that write few reports.

What we actually say is: "The problem in practice is that we don't know what weighting should be given to each expert firm and the reality, if we use each report as an observation, is that we weight each firm according to the number of reports they write." We are concerned about the problem of dependence in expert's reports, particularly when reports are written by the same firm, and we are concerned about the biased estimates that can result from an incorrect weighting of reports. Our position on this was clearly explained in our last report as follows, Partington and Satchell (2015b, p33):

"The problem of dependence in the magnitude of estimates can be illustrated as follows, suppose the true risk free rate is 4.5% and the true market risk premium is 7%. Further suppose that there are 100 reports supplied by two experts. Expert one writes seventy of the reports and expert two writes 30. Expert one adopts 5% and 8% for the risk free rate and the market risk premium respectively and expert 2 adopts 4% and 6%.

Treating the reports as representing 100 observations gives an estimate of the mean risk free rate as 4.7% and an estimate of the mean market risk premium as 7.4%. In forming these estimates the views of expert 1 get a 70% weight and the views of expert 2 get a 30% weight. However, if

the two experts are equally good in their judgement the estimates should be equally weighted, in which case the estimate gives the true values of 4.5% for the risk free rate and 7% for the market risk premium. The problem in practice is that we don't know what weighting should be given to each expert firm and the reality, if we use each report as an observation, is that we weight each firm according to the number of reports they write. This turns out to be important in the current context, because two firms write more than 40% of the reports that use a substantially increased risk free rate." Furthermore, if we then construct the standard error based on 100 observations rather than two observations we form an erroneous belief in the accuracy of our estimates.

The results of the analysis of independent expert's reports are largely driven by the use of a substantially increased risk free rate by some experts. Visual inspection of Figure 7 in Houston and Kemp (2016a) suggest there were substantial increases in the risk free rate above the government bond rate in roughly half the reports written post 2010. However, taking the period from 2008 to 2015 HoustonKemp (p59) show that reports substantially increasing the risk free rate above the government bond rate are in the minority.[16] On the evidence of Partington and Satchell (2015b) and Houston and Kemp (2016a) about 40% of the reports that substantially increase the risk free rate were written by two firms. The question is, should that 40% of reports be weighted as though they were all independent observations, or should they be weighted as two reports? Given the split of expert opinions on whether the risk free rate should be increased or not and given uncertainty over the appropriate weighting of observations, we consider that the case for an increase in the risk free rate is quite weak.

Conducted a regression analysis to model the relationship between the MRP chosen by independent experts and the 10 year CGS yield. The results indicated that as the 10 year CGS yield falls (rises) experts' estimates of the return required on the market portfolio also fall (rise). The results also indicated that there is a tendency for experts to use a risk free rate that exceeds the CGS yield when the CGS yield is low.

As we previously pointed out the result of NERA's (2015) report was that there was no relation between the government bond yield and the market risk premium used in expert reports. The

[16] HoustonKemp's analysis of counts by report from 2008 to 2015 reveal a less than even balance. The ratio of reports that make a 50 basis point upward adjustment to those that do not is 48/147. That is, about a 25% (48/195) of the total number of reports make a substantial upward adjustment. By expert firm the ratio is higher at 14/19 or equivalently about 42% (14/33) of the total make an upward adjustment.

more recent HoustonKemp (2016) report now finds that the relation between the government bond yield and the risk premium used in experts reports is significant in some cases, but only when the NERA or Ernst & Young adjusted estimates of the market risk premium are used and the results are not significant even in these cases for the random effects models and the effect where it is significant is small. We conclude that this evidence is quite weak, the more so when the problem of biased parameters introduced by potentially incorrect weighting is considered.

The key point about the results in the NERA (2015a) report and the HoustonKemp (2016) report is that they are driven, not by the experts' risk premium, but rather by increases in the risk free rate that are made in some expert reports. The supposed evidence about changes in the risk premium is derived from an implied market risk premium. The implied market risk premium is computed by adding the expert's risk free rate to the expert's market risk premium to get the expert's market return (eg. 3.0%+6% = 9%). An implied market risk premium is then computed by subtracting the government bond yield (eg. 9%-2.5% = 6.5%). Any difference between the market risk premium so implied and the expert's market risk premium is entirely a result of differences between the government bond yield and the expert's risk free rate (eg.6.5%-6% = 3%-2.5%= 0.5%). The substantive story is about the risk free rate, not the risk premium.

Some reports change past practice and adopt a risk free rate noticeably higher than the government bond rate, the rest stick with the practice of using a rate close to the government bond rate. Therefore, by definition the average rate must go up above the government bond rate. However, as the data shows this can hardly be regarded as a consensus view and as discussed above, we consider it quite weak evidence for a change in the risk free rate.

In response to our concerns about dependence, HoustonKemp (2016) has produced a table (Table 10) of averages taken across 23 expert firms rather than the individual reports. We can in this case be less worried about dependence across the observations.[17] The risk free rate used by the experts' averages 33 basis points above the government bond yield, but there is no testing of the significance of this difference. Indeed, there is no information on the distribution of the variables reported. There is also no reporting of regression analysis undertaken with each firm as an observation. What the results of such a regression might be is an open question. However, due

[17] Dependence due to herding might still arise.

to the reduction in sample size, had such regression analysis been undertaken, it is a real possibility that the results may not have been significant

Responded to the AER statement that the results of NERA (2015b) appear counter-initiative.

We believe that the statement above should read counter-intuitive, not counter-initiative. We agree that the results of NERA (2015b) can be seen as counter intuitive relative to the description of equilibrium expected returns from the CAPM. In particular, a zero beta premium equal to the market risk premium is implausible. However we also agree with HoustonKemp (2016) that a relatively flat or inverted relation between beta and realised returns is quite common in empirical work, particularly using data from more recent periods. What this shows is that low beta shares have had realised returns that outperformed and high beta shares have had realised returns that underperformed relative to the CAPM equilibrium expected return benchmark. This may or may not be because the CAPM is a poor model of equilibrium returns and some examples of varying explanations are given in Handley (2014). Harvey, Liu and Zhu (2015) report more than 300 variables have been found significant in explaining the cross section of realised returns. Possibly one or several of these variables might explain the divergence of realised returns from the CAPM. The question is do any of these variables determine equilibrium expected returns and that is a question that is unresolved.

Criticism of Partington and Satchell's Results on Geometric and Arithmetic Mean Returns

We now consider the criticism in HoustonKemp (2016) of our analysis of the arithmetic and geometric rates of return. HoustonKemp's report gets into rather a muddle here and we should explain the errors that are made. We are interested in the term $\exp(\mu) - 1$; which we call the implied arithmetic rate of return. If we know that the true geometric rate of return is μ then the true arithmetic rate of return is $\exp(\mu) - 1$. This is a property of the parameters of the model and, as yet, involves no notion of expectations of estimators, contrary to any assertions by HoustonKemp. We then consider the extent to which estimators, based on the arithmetic mean and the geometric mean over or under estimate $\exp(\mu) - 1$.

We showed that the expected value of the arithmetic mean is $\exp(\mu + \frac{1}{2}\sigma^2) - 1$; independent of the sample size so it is always biased upwards relative to $\exp(\mu) - 1$.

We also showed that the expected value of the geometric mean= $\exp(\mu + \frac{1}{2T}\sigma^2) - 1$, where T is the size of the sample. This is biased upwards relative to $\exp(\mu) - 1$; but the bias disappears as T gets large. HoustonKemp arrive at the same formula, see equation (23), page 36, but then wrongly assume that the parameter function of interest is $\exp(\mu + \frac{1}{2}\sigma^2)$. The report then asserts that the bias, relative to the wrongly assumed parameter $\exp(\mu + \frac{1}{2}\sigma^2)$, is increasing in T. The HoustonKemp analysis is simply irrelevant.

Criticism of Mujisson, Fishwisck and Satchell

Referring to HoustonKemp's (2016) criticism in relation to the blending of long term and short term interest rates and the preferred habitat hypothesis, there is no substance to the argument that the model of Mujisson, Fishwisck and Satchell (2014) fails because the model considers only riskless bonds. All that the model in Mujisson, Fishwisck and Satchell requires is that there are at least two agents in a market who use bonds of different maturities as their "riskless" asset. Their reasons for doing so are outside the model, but an obvious real-world reason would be that they are superannuation funds with fund-level liabilities of different maturity, whose riskless asset choice is determined so that the funds asset duration matches its liability duration. There are other potential reasons for such choices, but in the context of determining the regulated return the preferred habitat issue does not warrant extensive discussion. It is worth noting that while HoustonKemp's criticism is erroneous, their strict insistence on starting from theoretical first principles is in stark contrast to their arguments elsewhere about just relying on empirical results.

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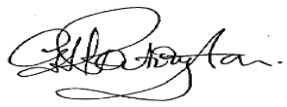
Expert Witness Compliance Declaration

We have read “Expert witnesses in proceedings in the Federal Court of Australia” which are attached as Appendix 3. This report has been prepared in accordance with those guidelines. As required by the guidelines, we have made all the inquiries that we believe are desirable and appropriate and no matters of significance that we regard as relevant have, to our knowledge, been withheld from the Court.

Signed



Graham. H. Partington

Steven. E. Satchell

Appendix 1

APPROACH TO MARKET (ATM) – ATTACHMENT A

REFERENCE NO: WACC.2016.01

Terms of Reference

The Australian Competition and Consumer Commission (ACCC) / Australian Energy Regulator (AER) seeks an expert in corporate finance, specifically, the cost of capital. This is to provide an assessment of the return on equity for regulatory determinations and access arrangements occurring in April and June 2016.

The AER is responsible for the economic regulation of electricity networks and gas pipelines in Australia.[18] In undertaking this role the AER sets the allowed revenues or prices for these monopoly service providers over a fixed period determined in advance (usually 5 years),[19] in accordance with the relevant legislation.[20] As part of determining the total revenues or prices that a service provider may earn, the AER applies a 'building block' framework that includes a return on capital building block, which is derived from a regulated rate of return.[21]

The expert advice is required in the following context and framework:

1. The overarching requirement is that the rate of return on capital must be consistent with the relevant legislation; the NEL, NGL, NER and NGR (see above 'Legal requirements for the allowed rate of return'). Specific to the return on equity, the NER and NGR require:

    a. The return on equity for a regulatory control period must be estimated such that it contributes to the achievement of the allowed rate of return objective.[22]

    b. In estimating the return on equity, regard must be had to the prevailing conditions in the market for equity funds.[23]

18 Excludes Western Australia and the Northern Territory.

19 This period is known in an electricity context as a regulatory control period or in a gas context as an access arrangement period.

20 For electricity networks, this means the National Electricity Law (NEL) and National Electricity Rules (NER). For gas networks, this means the National Gas Law (NGL) and National Gas Rules (NGR).

21 That is, the rate of return on capital is multiplied by the regulated asset base (for electricity networks) or the capital base (gas networks) to derive the return on capital building block for a given year.

22 NER, clauses 6.5.2(f) and 6A.6.2(f). NGR, rule 87(6). The allowed rate of return objective is that the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of its regulated services. The rate of return guideline defines the benchmark efficient entity as a pure play, regulated energy network business operating within Australia.

23 NER, clauses 6.5.2(g) and 6A.6.2(g). NGR, rule 87(7).

2. The rate of return guideline sets out the AER's approach to determining the allowed rate of return in accordance with the relevant legislation. The expert advice should have regard to the guideline approach when identifying issues put forward by the relevant service providers in their proposals. In the guideline, the AER proposes to estimate:

    a. the returns on equity and debt for a benchmark efficient entity[24]

    b. the WACC (post corporate tax, pre personal tax) using a the nominal vanilla formula $WACC_{vanilla} = E(k_e)\frac{E}{V} + E(k_d)\frac{D}{V}$

    where:

        i. $E(k_e)$ is the expected required return on equity

        ii. $E(k_d)$ is the expected required return on debt

        iii. E/V is the proportion of equity in total financing (comprising equity and debt)

        iv. D/V is the proportion of debt in total financing, and is equal to the AER's proposed benchmark efficient entity gearing ratio of 0.6

        v. $WACC_{vanilla}$ is updated annually as a result of the estimated return on debt being updated annually.[25]

    The Guideline is not legally binding on the AER or service providers. However, if the AER or a service provider chooses to depart from the Guideline, it must state its reasons for doing so in the relevant regulatory determination.

The AER is currently considering proposals by VIC DNSPs, ActewAGL, AGN, APTNT, and AusNet Services (TNSP). All of these service providers proposed the AER depart from its rate of return guideline.

The AER seeks expert advice to inform its decisions on the rate of return, in particular the return on equity component for:

- Final decisions for the VIC DNSPs, ActewAGL, AGN, and APTNT; and
- Draft decision for AusNet Services (TNSP)

Further context on the AER's role, recent determinations, and the rate of return guideline is provided at the end of this Attachment A.

[24] The guideline defines the benchmark efficient entity as a pure play, regulated energy network business operating within Australia.

[25] AER, *Better regulation rate of return guideline*, December 2013, pp. 7–9.

Services required

The AER requires expert advice as set out below. The services required relate to the return on equity, to be applied in the AER's determinations / access arrangements, and which contributes to the achievement of the allowed rate of return objective.

This request is for a capped-price contract. The material relevant to this consultancy is listed below.

Part A.

B. Having reviewed the relevant material, provide a report setting out an overall view, with reasons, whether any matters in the relevant material would cause the consultant to:
   - advise the AER to change the manner in which it estimates return on equity from that applied in its recent decisions, and/or
   - alter, or add to, any of the findings in the reports set out in Table 1 (in the Relevant Material section below)

   for the purpose of estimating the forward-looking return on equity of a regulated 'pure-play' Australian energy[26] network[27] business, which is the return that is just sufficient to induce investors to invest in the business.[28]

   The AER, without intending to directly or by implication provide a view of the relative importance of the expert reports and relevant material wishes to highlight the reports listed in items A1 to A4 below. While the authors of those reports have expressed numerous views, under A1 to A4, some of their specific views are noted. These issues must be specifically addressed in the consultant's report. This is not intended to restrict the consultant in any way or direct his review. In addition to these, the consultant should review and address all relevant issues that support its overall conclusion.

   The consultant is also required to respond to any criticisms levelled against positions/findings in previous advice to the AER (see Table 1 below).

26 Being a gas or electricity business.
27 Being a transmission or distribution network.
28 Given a 60:40 debt to equity ratio.

A1. Frontier Economics, *Estimating the equity beta for the benchmark efficient entity*, January 2016. In this report, Frontier Economics (among other things):

iv. Considered the AER's comparator set of Australian energy network firms is too small and produces unreliable equity beta estimates. It considered the comparator set should be widened to include international energy firms and other Australian infrastructure firms.

v. Calculated equity beta estimates for the nine firms in the AER's comparator set, as well as a set of eight Australian infrastructure firms and a set of 56 US energy firms. It considered (based on a number of tests) that the additional firms are statistically similar to the AER's comparator set; and broadening the comparator set produces equity beta estimates with improved statistical properties.

vi. Recommended the equity beta estimate of 0.82 it proposed in its June 2013 report. This equity beta estimate is based on a comparator set of 9 Australian and 56 US energy firms, with the Australian firms given 24% weight and the US firms given 76% weight.[29]

A2. Frontier Economics, *The relationship between government bond yields and the market risk premium*, January 2016. In this report, Frontier Economics (among other things):

vi. Considered that the decline in government bond yields since the AER's December 2013 Rate of Return Guideline has not caused a commensurate reduction in the required return on equity, which has remained relatively stable.

vii. Considered the prevailing market conditions are currently materially dissimilar to the average historical conditions. Considered that a technique that estimates the MRP by subtracting the average government bond yield from the average market return would not produce a reasonable estimate of the prevailing MRP in these conditions.

viii. Recommended applying an approach of estimating a risk premium that is commensurate with the prevailing conditions in the market by using DGM and Wright approach estimates of market risk premium.

ix. Considered that analysts' forecasts of earnings per share (market capitalisation weighted average) increasing from 2015 to 2017 is

[29] SFG, *Regression-based estimates of risk parameters for the benchmark firm*, June 2013, p. 16.

inconsistent with the proposition that firms might (on average) be borrowing in an unsustainable manner to temporarily maintain dividends at their current levels.

x. Considered that potential upward bias in analyst forecasts of dividends (an input into the AER's DGM) does not have a material impact, is unlikely to have materially changed since the December 2013, and is not relevant as the implied discount rate from analysts' dividend forecasts is useful information.

A3. Frontier Economics, *The required return on equity under a foundation model approach*, January 2016. In this report, Frontier Economics (among other things):

iii. Considered that the AER's 0.7 equity beta estimate applied in its SLCAPM foundation model should be adjusted (using the return on equity from the Black CAPM and Fama-French model) to correct for low beta and book value biases.

iv. Considered that the AER and its advisers quote selectively from reports that they discuss.

A4. HoustonKemp, *The cost of equity: Response to the AER's draft decisions for the Victorian electricity distributors, ActewAGL Distribution and Australian Gas Networks*, January 2016. In this report, HoustonKemp (among other things):

iv. Noted that the AER's own advisers have found evidence against the SLCAPM, and responded to Partington and Satchell's previous comments in a number of areas, including:

a. Criticisms of the Black CAPM, including estimates of the zero beta return and the use of work by Beaulieu, Dufour and Khalaf (2012)

b. Partington's estimation of the market return being similar to NERA and SFG's approach of estimating zero beta return

c. Partington's view that there is little evidence in the data for mean reversion in betas and concludes that the use of the SLCAPM will not generate downwardly biased estimates of the cost of equity for a benchmark efficient firm.

d. The use of works by Ray, Savin and Tiwari (2009) and Da, Guo and Jagannathan (2012)

e. The argument against using the FF3M (being under revision after the development of the FF5M) can also apply to the SLCAPM

f. Criticisms of the FF3M and the use of works by Kan, Robotti and Shanken (2013)

g. Partington and Satchell's suggestion that less weight should be assigned to independent expert reports written by firms who write many reports and more weight should be placed on firms that write few reports.

v. Conducted a regression analysis to model the relationship between the MRP chosen by independent experts and the 10 year CGS yield. The results indicated that as the 10 year CGS yield falls (rises) experts' estimates of the return required on the market portfolio also fall (rise). The results also indicated that there is a tendency for experts to use a risk free rate that exceeds the CGS yield when the CGS yield is low.

vi. Responded to the AER statement that the results of NERA (2015b) appear counter-initiative.

Project Deliverables

The key deliverable is a written report (one each for Part A and Part B) addressing the advice sought as per the services required. Prior to finalisation, the consultant will provide a draft of the report for review by AER staff.

Timeline[30]

Part A

Contract signed (X)	Work commences (22 February)
X + 2 days	Commencement discussion with AER staff
X + 5 business days	Oral update to AER staff (29 February)
X+ 15 business days	Draft report to AER staff (14 March)
X+ 18 business days	AER staff comments on draft report (17 March)
X +23 business days	Final report to AER (23 March)

Merits and judicial review

[30] Dates within brackets are indicative based on the assumed contract signing date.

The regulatory determinations made by the AER under the NER and NGR are subject to merits review by the Australian Competition Tribunal and judicial review in the Federal Court of Australia. Accordingly, the consultant's services and the consultant's final report must be performed to a professional standard which is robust, transparent, well-reasoned and defendable.

Any work required of the consultant as a result of a merits review would be the subject of a separate contract. The consultant may be requested to provide services in support of the final decision of the AER and the consultant must not unreasonably decline a request for assistance.

Relevant material

The expert advice must engage with the key documents set out in Table 1 to Table 7 below (hyperlinks are provided for easy access).

It is expected that the consultant will engage more broadly, including relevant academic literature or other research.

Some submissions may specifically discuss or raise issues with the previous expert advice provided to the AER (set out in Table 1). If this occurs, then the consultant may need to engage with the material in these submissions. The AER staff will identify/nominate particular issues it seeks the consultant to specifically address. However, such identification and/or nomination are not intended to restrict or direct the consultant. The consultant is required to address all issues relevant to the formulation of their opinion.

The expert advice may also need to engage with the final decision by the Tribunal on the current appeal of a number of the AER's recent decisions. This is scheduled to be released by 22 March 2015.

Table 1 Previous expert advice provided to the AER

Professor Michael McKenzie and Associate Professor Graham Partington (McKenzie and Partington)—*Report to the AER: Part A return on equity*, October 2014
Associate Professor John Handley (John Handley)—*Advice on the return on equity*, October 2014
Graham Partington—Report to the AER: Return on equity (Updated), April 2015
Associate Professor Graham Partington and Professor Stephen Satchell (Partington and Satchell)—Report to the AER: Return on equity and comment on submissions in relation to JGN, May 2015
John Handley—Further advice on return on equity, April 2015
John Handley—*Advice on the rate of return for the 2015 AER energy network determination for Jemena Gas Networks*, May 2015
Partington and Satchell—*Report to the AER: Analysis of criticisms of 2015 determinations*, October 2015

Table 2 AER rate of return guideline

AER's current rate of return guideline
AER's current rate of return guideline explanatory statement
AER's current rate of return guideline explanatory statement (appendices)

Table 3 Current regulatory proposals, revenue proposals, access arrangement proposals

Initial proposal from AusNet Services (TNSP) – chapter 10
Revised proposal from ActewAGL (gas distribution network)
Revised proposal from Australian Gas Networks (AGN)
Revised proposal from APTNT (Amadeus gas pipeline) revised submission + revised AAI
Revised proposal from AusNet Services (DNSP) – chapter 7
Revised proposal from United Energy
Revised proposal from CitiPower and Powercor – chapter 10 (these are basically identical)
Revised proposal from Jemena Electricity Networks

Table 4 Previous regulatory proposals, revenue proposals, access arrangement proposals

Initial proposal from ActewAGL
Initial proposal from Australian Gas Networks (AGN)
Initial proposal submission from APTNT (Amadeus gas pipeline) + AAI
Initial proposals from AusNet, United Energy, Citipower, Powercor, and Jemena

Key consultant reports attached to revenue proposals / regulatory proposals / access arrangement proposals are shown in Table 5 and Table 6 below.

Table 5 New expert reports

Frontier (2016a)	Frontier, Estimating the equity beta for the benchmark efficient entity, January 2016
Frontier (2016b)	Frontier, The relationship between government bond yields and the market risk premium, January 2016
Frontier (2016c)	Frontier, The required return on equity under a foundation model approach, January 2016
Frontier (2016d)	Frontier, An updated estimate of the required return on equity: Report for Australian Gas Networks, January 2016
Frontier (2016e)	Frontier, Response to submissions on the relevance of the TransGrid sale: Report prepared for Jemena Electricity Networks, ActewAGL Distribution, and United Energy, February 2016
HoustonKemp (2016)	HoustonKemp, The cost of equity: Response to the AER's draft decisions, January 2016
HoustonKemp (2016b)	HoustonKemp, Australian Gas Networks – AER Gas Price Review, A second report for Johnson Winter & Slattery, 4 February 2016

Table 6 Previously-submitted expert reports

CEG (2015a) (attached)	CEG, Measuring risk free rates and expected inflation, April 2015
Frontier (2015a)	Frontier (Kumareswaran & Sood), Review of the AER's conceptual analysis of equity beta, June 2015
Frontier (2015b)	Frontier, Key issues in estimating the return on equity for the benchmark efficient firm, June 2015
Frontier (2015c)	Frontier, An updated estimate of the required rate of return, AGN, June 2015
Frontier (2015d)	Frontier, Cost of equity estimates over time, Report prepared for Ergon Energy, June 2015
Frontier (2015d) (attached)	Frontier, Cost of equity estimates over time – excel model, June 2015
Grant Samuel (2015)	Grant Samuel & Associates Pty Ltd, Australian Energy Regulator – Draft Decision, January 2015
HounstonKemp (2015)	HoustonKemp, Implications for Jemena Gas Networks (NSW) of increasing competition in the consumer energy market, February 2015
Incenta (2015)	Incenta Economic Consulting, Further update on the required return on equity from independent expert reports, February 2015
Knecht (2015)	Knecht (Nevada State Controller) , Witness statement (on equity models) 19 June 2015
Malko (2015)	Malko Energy Consulting, Statement of Dr J Robert Malko, June 16 2015
NERA (2015a)	NERA, The cost of equity: Response to the AER's final decisions for the NSW and ACT electricity distributors and JGN, June 2015
NERA (2015b) (attached)	NERA, The relation between the MRP and the risk free rate: Evidence from independent expert reports, April 2015
NERA (2015c)	NERA, Further assessment of the Historical MRP: Response to the AER's final decisions for the NSW and ACT electricity distributors, June 2015
NERA (2015d)	NERA, Energy Regulation Insights: European regulators' WACC decisions risk undermining investment decisions (issue 41) February 2015
NERA (2015e)	NERA, Historical estimates of the market risk premium, February 2015
NERA (2015f)	NERA, Empirical Performance of Sharpe-Lintner and Black CAPMs, February 2015
NERA (2015g)	NERA, Review of the Literature in Support of the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French Three-Factor Model, March 2015
RBA (2015a)	RBA, RBA Governor's speech: The world economy and Australia, 21 April 2015, New York, USA
RBA (2015b)	RBA, Firm's Investment decisions and interest rates, Lane and Rosewall, RBA Bulletin, June 2015
RBA (2015c)	RBA, Low inflation in a world of monetary stimulus, speech by Philip Lowe, 5 March 2015
RBA (2015d)	RBA, Opening statement to House of Representatives Standing Committee on Economics, speech by Glenn Stevens, 13 February 2015
RBA (2015e)	RBA, Global and domestic influences on the Australian bond market, speech by Guy Debelle, 16 March 2015
SFG (2015c)	SFG, The required return on equity for the benchmark efficient entity, 25 February 2015
SFG (2015d)	SFG, Using the Fama-French model to estimate the required return on equity, 13 February 2015
SFG (2015e)	SFG, Beta and the Black Capital Asset Pricing Model, 13 February 2015
SFG (2015f)	SFG, Share prices, the dividend discount model and the cost of equity for the market and a benchmark energy network, 13 February 2015
SFG (2015g)	SFG, The foundation model approach of the Australian Energy Regulator to estimating the cost of equity, 27 March 2015

Table 7 Key submissions

NAB (2016) (attached)	National Australia Bank, Re: Victorian Electricity Distribution Price Review 2016-20, 4 February 2016 [CONFIDENTIAL]
VECUA (2016)	Victorian Energy Consumer and User Alliance, Submission to the AER, AER Preliminary 2016---20 Revenue Determinations for the Victorian DNSPs, 6 January 2016
ECCSA (2016)	Energy Consumers' Coalition of South Australia, A Response to the Australian Energy Regulator Draft Decision on Australian Gas Networks AA2016 Revenue Reset, February 2016

Any reports referenced in the above reports can be provided upon request.

Legal requirements for the allowed rate of return

In determining the rate of return, the AER is guided by requirements in:

- the national electricity law (NEL) and national gas law (NGL)
- the national electricity rules (NER) and national gas rules (NGR).

The expert advice is required in the context of these requirements.

Requirements of the law

Under the NEL and the NGL, the AER must determine the rate of return in a manner that will or is likely to contribute to the achievement of the national electricity objective (NEO) and the national gas objective (NGO).

The **national electricity objective (and NGO)** is to promote efficient investment in, and efficient operation and use of, electricity (gas) services for the long term interests of consumers of electricity (gas) with respect to:

- price, quality, safety, reliability and security of supply of electricity (gas), and
- the reliability, safety and security of the national electricity system.

If the AER is making a decision and there are two or more possible decisions that will or are likely to contribute to the achievement of the national electricity objective (NGO), the AER must make the decision that the AER is satisfied will or is likely to contribute to the achievement of the national electricity objective (NGO) to the greatest degree.

The AER must also take into account the revenue and pricing principles when determining the rate of return.

Of relevance to the rate of return are the following **revenue and pricing principles**:

- A regulated network service provider should be provided with a reasonable opportunity to recover at least the efficient costs the operator incurs in:
    - providing regulated network services, and
    - complying with a regulatory obligation or requirement or making a regulatory payment.
- A regulated network service provider should be provided with effective incentives in order to promote economic efficiency with respect to regulated network services the operator provides. The economic efficiency that should be promoted includes:
    - efficient investment in a distribution system or transmission system with which the operator provides regulated network services; and
    - the efficient provision of electricity network services; and
    - the efficient use of the distribution system or transmission system with which the operator provides regulated network services.
- A price or charge for the provision of a regulated network service should allow for a return commensurate with the regulatory and commercial risks involved in providing the regulated control network service to which that price or charge relates.
- Regard should be had to the economic costs and risks of the potential for under and over investment by a regulated network service provider in, as the case requires, a distribution system or transmission system with which the operator provides regulated network services.
- Regard should be had to the economic costs and risks of the potential for under and over utilisation of a distribution system or transmission system with which a regulated network service provider provides regulated network services.

Equivalent provisions apply under the NGL.

The NEO and revenue and pricing principles have been in place for some time, and previous AER decisions were also conducted under this framework. However, what is new is the requirement concerning adopting the decision that would contribute to the achievement of the NEO 'to the greatest degree' if two or more decisions are possible.

Requirements of the rules

Under the NER, the allowed rate of return is to be determined such that it achieves the allowed rate of return objective.[31]

> The **allowed rate of return objective** is that the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of regulated network services.

The NER require that the allowed rate of return for a regulatory year must be:[32]

- a weighted average of the return on equity for the regulatory control period in which that regulatory year occurs and the return on debt for that regulatory year
- determined on a nominal vanilla basis that is consistent with the estimate of the value of imputation credits.

In determining the allowed rate of return, the NER also require that regard must be had to:[33]

- relevant estimation methods, financial models, market data and other evidence

[31] NER, clauses 6.5.2(b) and 6A.6.2(b).
[32] NER, clauses 6.5.2(d) and 6A.6.2(d). The value of imputation credits is referred to in clause 6.5.3 and 6A.6.4 of the NER and rule 87A of the NGR.
[33] NER, clauses 6.5.2(e) and 6A.6.2(e).

- the desirability of using an approach that leads to the consistent application of any estimates of financial parameters that are relevant to the estimates of, and that are common to, the return on equity and the return on debt

- any interrelationships between estimates of financial parameters that are relevant.

There are also provisions in the NER that refer specifically to the return on equity, the return on debt and the value of imputation credits.[34]

Equivalent provisions apply under the NGR.[35]

The NER and NGR concerning the determination of the rate of return were revised in 2012 by the AEMC. The AER's recent rate of return guideline was conducted under this framework.

However, these rules differ from the framework under which the AER made regulated determinations in the past. The current regulatory determinations are the first ones to be conducted under this new rules framework.

Of particular importance under the new rules framework is the introduction of the allowed rate of return objective, and the primacy given to this objective over other rule requirements.

Context for the determination of the allowed rate of return

Better regulation rate of return guideline

In November 2012, the Australian Energy Market Commission (AEMC) published changes to the National Electricity and Gas Rules (NER, NGR). The AER's Better Regulation program was initiated to update and improve its processes under these new rules, with the aim of delivering an improved regulatory framework focused on the long term interests of electricity and gas consumers.

The Better Regulation program involved the publication of several guidelines. The Rate of Return Guideline (the Guideline) was developed through extensive consultation with

[34] See NER, clause 6A.6.2 and clause 6.5.2.
[35] See NGR, rule 87.

service providers, consumer representatives and other stakeholders and sets out the AER's approach to determining the allowed rate of return in accordance with the relevant legislation.[36] An explanatory statement (including appendices to the explanatory statement) accompanies the Guideline, and sets out the AER's reasons for the positions it reached in the Guideline.[37]

The Guideline and explanatory statement apply to both electricity and gas distribution and transmission service providers.

The Guideline sets out the approach the AER proposes to use to estimate the returns on equity and debt for a benchmark efficient entity.[38] The Guideline also sets out the approach the AER proposes to use to estimate the value of imputation credits under the Australian tax system. The value of imputation credits mostly impacts on the separate corporate income tax building block. However, the rate of return must be set on a nominal vanilla basis consistent with the estimate of the value of imputation credits.

The Guideline does not consider the AER's position on forecast inflation or transaction costs (equity and debt raising costs), though the AER's position on these matters has been established through previous regulatory determinations.

The Guideline is not legally binding on the AER or service providers. However, if the AER or a service provider chooses to depart from the Guideline, it must state its reasons for doing so in the relevant regulatory determination.

Return on equity approach

The rate of return guideline sets out the AER's proposed approach for estimating the expected return on equity. The AER's proposed approach uses the Sharpe–Lintner capital asset pricing model (CAPM) as our 'foundation model'. Our foundation model estimate provides a starting point, and our final estimate of the expected return on equity has regard to a broad range of relevant material. This foundation model approach contains six steps,

[36] AER, *Rate of return guideline*, December 2013.
[37] AER, *Explanatory statement—Rate of return guideline*, December 2013; AER, *Explanatory statement—Rate of return guideline—Appendices*, December 2013.
[38] The guideline defines the benchmark efficient business as a pure play, regulated energy network business operating within Australia.

and results in a single point estimate for the expected return on equity. The six steps are outlined below.

Step one: identify relevant material—the relevant legislation requires the AER to have regard to all relevant estimation methods, financial models, market data and other evidence when determining our estimate of the return on equity for the benchmark efficient entity. The first step therefore, is to identify the relevant material that may inform the AER's estimate of the return on equity.

Step two: determine role—the relevant material (identified in step one) is assessed against the AER's criteria to determine where the relevant material may inform its estimate of the return on equity. Specifically, the AER may use relevant material in one of four different ways:

1. As the foundation model
2. To inform the estimation of parameters within the foundation model
3. To inform the overall return on equity estimate
4. Not used to estimate the return on equity.

Step three: implement foundation model—the Sharpe-Lintner CAPM will be estimated as the sum of the risk free rate, and the product of the equity beta and market risk premium (MRP). Both a range and point estimate will be determined for equity beta and the MRP. Various relevant estimation methods, financial models, market data and other evidence will be used to estimate each of these parameters (outlined in the Return on equity Sharpe-Lintner CAPM parameters sub-section).

Step four: other information—other information that may inform the AER's final return on equity estimate is considered. The manner in which the AER uses the other information may differ for each alternative source. Specifically, some of the other information may provide a range (at a point in time) for the return on equity, while others may provide only directional information.

Step five: evaluate information set—evaluation of the full set of material that we propose to use to inform, in some way, the estimation of the expected return on equity. This includes assessing the foundation model range and point estimate alongside the other information from step four. In evaluating the full information set, the consistency (or

otherwise) of the information is expected to be important. The strengths and limitations of each source of additional information will also be an important factor.

Step six: distil a point estimate of the expected return on equity— the final point estimate is expected to be selected from within the foundation model range. The final estimate of the expected return on equity, however, will ultimately require the exercise of regulatory judgement so may result in a point estimate outside the foundation model range. This recognises that, ultimately, our rate of return must meet the allowed rate of return objective. Further, under our approach, if the foundation model point estimate is not adopted the final estimate of the return on equity will be determined as a multiple of 25 basis points. This recognises the limited precision that the return on equity can be estimated.

AER regulatory determinations / access arrangements recently finalised

In April and June 2015, the AER finalised regulatory determinations / access arrangements for the following service providers:

- TransGrid
- TasNetworks (formerly Transend)
- Directlink
- Ausgrid, Endeavour Energy, Essential Energy
- ActewAGL
- Jemena Gas Networks (JGN).

In October 2015, the AER finalised regulatory determinations for the following service providers:

- SA Power Networks (SAPN)
- Energex and Ergon (QLD Electricity distribution network service providers [DNSP]).

A number of service providers[39] have appealed the AER's final decision on the rate of return (including the return on equity) to the Australian Competition Tribunal (Tribunal). The hearing for this process concluded on 9 October 2015. However, the Tribunal is yet to release its final decision on the matter. The final decision is scheduled to be released by 22 March 2016.

AER regulatory determinations / access arrangements under consideration

Between April and August 2015, the AER received regulatory / access arrangement proposals[40] from the following service providers:

- AusNet Services—VIC electricity distribution network
- Citipower —VIC electricity distribution network
- Powercor—VIC electricity distribution network
- Jemena—VIC electricity distribution business.
- United Energy—VIC electricity distribution network[41]
- ActewAGL—ACT gas distribution network
- Australian Gas Networks (AGN)—SA gas distribution network[42]
- APTNT— Amadeus gas pipeline in NT.[43]

In October and November 2015, the AER published preliminary determinations and draft access arrangements for these service providers. In January 2015, these service providers submitted revised proposals, which have been published on the AER's website.

Additionally, on 31 October 2015, the AER received a revenue proposal from AusNet Services—VIC electricity transmission network.

39 ActewAGL, Ausgrid, Endeavour Energy, Essential Energy, Jemena Gas Networks, and SA Power Networks.

40 Electricity transmission network service providers submit a revenue proposal, electricity distribution network service providers submit a regulatory proposal and gas pipeline service providers submit a access arrangement proposal.

41 Together, these service providers are the VIC DNSPs. They submitted their regulatory proposals to the AER on 30 April 2015.

42 These service providers submitted their access arrangement proposals to the AER on 30 June 2015 or 1 July 2015.

43 This service provider submitted its access arrangement proposal to the AER on 4 August 2015.

The abovementioned service providers have (and continue to) departed from the Guideline on many aspects.

Finally, on 31 January 2015, the AER received revenue/regulatory proposals from:

- Powerlink—QLD electricity transmission network
- TasNetworks—TAS electricity distribution network.

These service providers have adopted the Guideline in their proposals, subject to the outcome of the current appeal of a number of the AER's final decisions to the Tribunal.

Table 1 sets out the key dates for the current determination processes:

Table 8: Key dates for current regulatory determination processes

Service provider	Regulatory control period / Access arrangement period	Regulatory process					
		Proposal	Submissions on proposal*	Draft decision	Revised proposal*	Submissions draft/revised proposal*	Final decision
VIC DNSPs	1 January 2016 – 31 December 2020	30 April 2015	13 July 2015	31 October 2015	6 January 2016	4 February 2016	30 April 2016
ActewAGL	1 July 2016 – 30 June 2021	30 June 2015	31 July 2015	30 November 2015	6 January 2016	4 February 2016	30 April 2016
AGN	1 July 2016 – 30 June 2021	1 July 2015	10 August 2015	30 November 2015	6 January 2016	4 February 2016	30 April 2016
APTNT	1 July 2016 – 30 June 2021	4 August 2015	11 September 2015	30 November 2015	6 January 2016	4 February 2016	30 April 2016
AusNet (TNSP)	1 April 2017 – 31 March 2022	31 October 2015	Feb 2016	30 June 2016	September 2016	October 2016	31 January 2017
Powerlink	1 July 2017 – 30 June 2022	31 January 2016	May 2016	30 September 2016	December 2016	January 2017	30 April 2017
TasNetworks (DNSP)	1 July 2017 – 30 June 2022	31 January 2016	May 2016	30 September 2016	December 2016	January 2017	30 April 2017

* Indicative dates only.

Appendix 2

CURRICULUM VITAE GRAHAM PARTINGTON

PERSONAL

Name:	Graham Harold Partington
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	Finance Discipline, School of Business,
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	NSW 2006
	Australia
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HIGHER EDUCATION AND EMPLOYMENT

Academic Qualifications:	B.Sc. (Hons) Economics/Forestry, University of Wales, 1971
	MEc. (Hons) by thesis, Macquarie University, 1983.

My current position is Associate Professor of Finance in the Finance Discipline at the University of Sydney. I have been chair of the Finance Discipline and was also head of the postgraduate research program in finance. Concurrent with my position at the University of Sydney I was also the Education Director for the Capital Markets Co-operative Research Centre PhD

program. In a career stretching back more than thirty years I have held Associate Professorships in finance at The University of Technology Sydney and The University of British Columbia. I have also held academic positions at Macquarie University and the University of Bangor I have had extensive teaching and research responsibilities in finance and accounting as well as being head, or deputy head, of University Departments and Schools. I have been very influential in the design of several undergraduate and masters degrees in finance and also PhD programs.

I have written in excess of thirty consulting and expert witness reports covering topics such as valuation, the cost of capital, the value of imputation tax credits, and the market risk premium.

Awards and Major Research Grants

Awards

2013 Best paper prize for accounting, banking economics and finance, Global Business Research Conference.

2012 Bangor University: Honorary Visiting Senior Research Fellow title extended for the period 2013-2016.

2010 The GARP (Global Association of Risk Professionals) Prize for Quantitative Finance/Risk Management/Derivative Instruments, Finance and Corporate Governance Conference.

2009 The CFA (Chartered Financial Analyst) Prize Asian Investments, Asian Finance Association Conference

2009 Bangor University: Honorary Visiting Senior Research Fellow for the period 2009-2012.

2008: PhD students name their rock group after me “The Partingtons”

2001: Manuscript award for the best paper: Education Notes, *Accounting Research Journal,* 2000.

2000: Peter Brownell Manuscript Award. Awarded by the Accounting Association of Australia and New Zealand for the best paper in *Accounting and Finance*, 1999

1985: Butterworths Travelling Fellowship

Major Research Grants

2014-2016 Centre for International Financial Regulation (CIFR), *Measuring Market Quality: Current Limitations and New Metrics*, $170,000.

2007-2014: National Co-operative Research Centre Scheme, grant for the Capital Markets Cooperative Research Centre (CMCRC) $98 million ($49 million in cash and matching in kind contributions.) About $21 million cash over the term of the grant was under my management to run the scholarship and education program.

2000-2003: Australian Research Council, industry linked grant, *Intangibles, Valuation and Dividend Imputation* ($667,000).

1985-1988: Australian Research Grants Scheme, *The Determinants and Consequences of Dividend Policy* ($30,000).

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A. Ainsworth, A. Lee, G. Partington and T. Walter, 2013, *Analysis of ASX Cum Dividend Trading in the Ex Dividend Period 2003-2013: Submission to the Treasury on "Preventing Dividend Washing",* submission to Treasury Inquiry: Protecting the Corporate Tax base from Erosion and Loopholes - Preventing 'Dividend Washing'

G. Partington, 1991, *Pricing and Capital Adequacy: Are the Banks Getting it Wrong*? a submission to The Australian Banking Inquiry.

G. Partington, 1989, *Accounting in Higher Education*, a submission to The Review of The Accounting Discipline in Higher Education.

J. McKinnon and G. Partington, 1980, *Statement of Sources and Applications of Funds - A Comment on the Exposure Draft,* a submission to the Australian Accounting Research Foundation.

C. Le Gras and G. Partington, 1979, *Commission Rates - Sheep and Cattle Sales,* a submission to the Prices Justification Tribunal.

R. Chenhall and G. Partington, 1979, *Financial Effects of Corporate Taxation,* an invited submission, Australian Financial System Inquiry.

R. Chenhall and G. Partington, 1979, *Submission on Corporate Sector Finance,* a submission to the Australian Financial System Inquiry.

Miscellaneous

G. Partington, 1989, Careers in Finance, *Focus on Careers*; *National Graduate Careers Magazine*. (Updated 1993, at the request of the Department of Education Employment and Training, Careers Reference Centre.)

D. Leece, G. Partington and R. Skellington, 1975, *Not All Over the Audience*, Bangor Arts Festival, Bangor.

D. Leece, G. Partington, D. Power and R. Skellington, 1974, *A Spring Revue,* Bangor Arts Festival, Bangor.

MEMBERSHIPS

Accounting and Finance Association of Australia and New Zealand (Current))

American Finance Association (Current))

American Accounting Association (1978–1992)

European Accounting Association (1984–1987)

Australian Institute of Bankers (1993–1997)

Royal Forestry Society (1978-1984)

CURRICULUM VITAE STEPHEN SATCHELL

NAME Stephen Ellwood SATCHELL

CURRENT POSITION College Teaching Fellow

COLLEGE Trinity College, Cambridge University

DATE OF BIRTH 22nd February 1949

CAREER 1971-73 - School Teacher

1973-74 - Computer Executive

1974-76 - Research Officer

1977-78 - Economic Advisor 10 Downing Street, (part-time)

1978-79 - Lecturer (Statistics Department) at LSE

1979-80 - Lecturer (Economics Department) at LSE

1980-86 - Lecturer, University of Essex

1986-2014 - Fellow(Title C), Trinity College

1986-89 - Assistant Lecturer, University of Cambridge

1989-2000 - University Lecturer at the University of Cambridge

1991-93 - Reader, Birkbeck College

2000-2009 - The Reader of Financial Econometrics, Cambridge University.

2010-2012 - Visiting Professor, Sydney University.

2011 - The Emeritus Reader of Financial Econometrics, Cambridge University.

2012- 2014 -Visiting Lecturer ,RHUL, London University

2013 -Professor, Sydney University

2014 - Fellow(Title E), Trinity College

CURRENT RESEARCH

I am working on a number of topics in the broad areas of econometrics, finance, risk measurement and utility theory. I have an interest in both theoretical and empirical problems. Many of my research problems are motivated by practical investment issues. My current research looks at alternative methods of portfolio construction and risk management, as well as work on non-linear dynamic models. I am active in researching the UK mortgage and housing markets.

I have strong links with Inquire (Institute for Quantitative Investment Research). This is a city-based organization that finances academic research on quantitative investment. I am also on the management committee of LQG (London Quant Group).

JOURNAL AFFILIATIONS

I am the Founding Editor of *Journal of Asset Management* (Palgrave Macmillan publishers) first issue, July 2000

I am the Series Editor of a book series, *Quantitative Finance* (Academic Press/Elsevier publishers).

I am the Editor of *Journal of Derivatives and Hedge Funds* (Palgrave Macmillan publishers). I am on the Editorial Board of *Applied Financial Economics*, *Journal of Financial Services Marketing*, *Journal of Bond Trading and Management. QASS, Journal of Financial Policy* and *European Journal of Finance* and senior associate editor of *Journal of Mathematical Finance.*

I am the Founding Editor of a journal for Incisive-Media Ltd, *Journal of Risk Model Validation.* and was editor for another of their journals, *Journal of Financial Forecasting.*

SUBMITTED PUBLICATIONS

Estimating Consumption Plans for Endowments with Recursive Utility by Maximum Entropy Methods, (with S. Thorp and O. Williams), submitted to *Applied Mathematical Finance*

Aligned with the stars: the Morningstar rating system and the cross-section of risk aversion (with S. Thorp and R. Louth)

"Individual capability and effort in retirement benefit choice" (with H. Bateman, S. Thorp, , J. Louviere, C. Eckert) submitted to *Journal of Risk and Insurance*

("Default and Naive Diversification Heuristics in Annuity Choice",(with H. Bateman, S. Thorp, , J. Louviere, C. Eckert) submitted to *Journal of Behavioural Finance*

Selfish Banks and Central Price Setting :The LIBOR price setting mechanism(with O. Ross and M. Tehranchi) submitted to OR

."Investigating a Fund Return Distribution when the Value of the Fund under Management is Irregularly Observed", with John Knight and Jimmy Hong, submitted to the *Journal of the Royal Statistical Society: Series A*.

Biased estimates of beta in the CAPM(with R.Philip and H. Malloch) submitted to *Applied Economics*

An Equilibrium Modelof Bayesian Learning(with O.Ross and M.Tehranchi) submitted to *Econometrica.*

FORTHCOMING PUBLICATIONS

Time Series Momentum, Trading Strategy and Autocorrelation Amplification", (with J. Hong) in *Quantitative Finance. A*

Theoretical Decomposition of the Cross-Sectional Dispersion of Stock Returns(with A.Grant) forthcoming in *Quantitative Finance. A*

Evaluating the Impact of Inequality Constraints and Parameter Uncertainty on Optimal Portfolio Choice with A.Hall and P. Spence, forthcoming in *Applied Economics*

2015 Publications

On the Difficulty of Measuring Forecasting Skills in Financial Markets, (with O. Williams), in *Journal of Forecasting A* http://onlinelibrary.wiley.com/journal/10.1002/%28ISSN%291099-131X

2014 Publications

'Modelling Style Rotation: Switching and Re-Switching',(with Golosov, E.) in

Journal of Time Series Econometrics,(A) vol.6, no. 2, pp.103-28. Citation Information: Journal of Time Series Econometrics. Volume 0, Issue 0, Pages 1–26, ISSN (Online) 1941-1928, ISSN (Print) 2194-6507, DOI: 10.1515/jtse-2012-0028, April 2013

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A General Theory of Smoothing and Anti-Smoothing (with M.Mackenzie and W.Wongwachara) in *Journal of Empirical Finance, vol 28, pp 215-219.(A)*

Risk Presentation and Portfolio Choice (with H.Bateman, S. Thorp, J. Geweke, J. Louviere, C. Eckert) in *Review of Finance.* ((A+) 12/2010; DOI: 10.2139/ssrn.1776525, Source: OAI

'Financial Competence, Risk Presentation andRetirement Portfolio Preferences', (with - Bateman, H., Eckert, C., Geweke, J., Louviere, J., Satchell, S. and Thorp, S. *) in Journal of Pension Economics and Finance*, vol. 13, no. 1, pp. 27-61

Is Rating associated with better Retail Funds' Performance in Bull or Bear Markets? (with R.Louth and W.Wongwachara)in *Bankers, Markets and Investors*. In Vol 132,sep-oct 2014, 4,25

Testing linear factor models on individual stocks using the average F-test', (with S.Hwang,) in *European Journal of Finance*, vol. 20, no. 5, pp. 463-98. DOI:10.1080/1351847X.2012.717097; Version of record first published: 10 Sep 2012

'The sensitivity of beta to the time horizon when log prices follow an Ornstein-Uhlenbeck process', (with - Hong, K.H.) in *European Journal of Finance*, vol. 20, no. 3, pp. 264-90 DOI:10.1080/1351847X.2012.698992;Version of record first published: 24 Jul 2012

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Efund research.com 07/10/2014; http://ch.e-fundresearch.com/newscenter/120-lombard-odier/artikel/23090-what-factors-drive-the-us-labour-market

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2013 PUBLICATIONS

How Much does an Illegal Insider Trade? (with A. Frino and H. Zheng) in *The International Review of Finance* Article first published online: 4 FEB 2013 | DOI: 10.1111/irfi.12006

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Optimal Forecasting Horizon for Skilled Investors, (with O. Williams); in *Forecasting Expected Returns,* S. Satchell (editor).

The Hidden Binomial Economy and The Role of Forecasts in Determining Prices, (with O. Williams) in *Forecasting Expected Returns;* S. Satchell (editor).

Stochastic Volatility Models with Markov Regime Switching State Equations' with S. Huang and P. Valls in J*ournal of Business ,Finance and Accounting,* vol 34, issue 5-6, pp 1002-1024, (June/ July 2007).

Analytic Models of the ROC Curve: Applications to Credit Rating Model Validation, *Journal of Risk Management in Financial Institutions*, (with W. Xia), volume 1, 1.

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Enhancing Available Returns From Short-term Client Funds, with R. A. Lewin & M. J. Sardy, *Papers & Proceedings of Academy of Economics and Finance*, (2007).

2006 PUBLICATIONS

Estimation of the Risk Aversion of the Representative U.K. Pension Fund Investor, (with Wei Xia), published as S. Satchell, and W. Xei (2006),"A Matter of Attitude", *Life and Pensions*, (December 2006).

Measures of Equity Duration, (with R. A. Lewin and M. J. Sardy), in *International Finance Review,* vol. 7, *Value Creation in Multinational Enterprise*, (edited by J. J. Choi and R. W. Click), chapter 13, pp. 315-349, (2006) .

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in *The European Journal of Finance*, vol. 12, no. 4, pp. 313-332, (2006).

2005 PUBLICATIONS

GARCH Model with Cross-sectional Volatility; GARCHX Models (with S. Hwang), in *Applied Financial Economics*, vol. 15, no. 3., pp. 203-216, (February, 2005).

A Re-examination of Sharpe's Ratio for Log-Normal Prices, (with J. Knight), in *Applied Mathematical Finance*. vol. 12, no. 1, pp. 87-100, (March 2005).

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Simple and Cross Efficiency of CTA's Using Data Envelopment Analysis.(2003) (with Gregoriou, G, Rouah, F. and Diz, F.) in *The European Journal of Finance* October 2005, Vol. 11, No. 5, pp. 393-410.

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B) PAPERS (PAST)

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Are There Bubbles in the Art Market? (with N. Srivastava)

EDUCATION

1965-9 - BA in Economics, Mathematics, Statistics and Politics, University of New South Wales.

1971 - Diploma in Education, Balmain Teachers' College

1972 - Teachers Certificate, Department of Education, NSW

1972-73 - MA in Mathematics, University of Sydney

1974-75 - M. Commerce in Economics, University of New South Wales

1976-80 - Ph.D. in Economics, University of London (The Ph.D. was supervised by Professor J.D. Sargan), examined by P. Phillips and D. Sargan.

1990 - MA (Cambridge).

1995 - Ph.D (Cambridge), examined by P. Robinson and P. Schmidt.

2001 - FIA (Institute of Actuaries) Honorary

SUPERVISION

1987-2007 Have supervised students from all colleges in Paper 12, now Paper 11. Have supervised papers 1, 2, 5, 6 of Prelim and papers 7, 11, and 12 of Part 2 (now 6, 10, and 11).

TEACHING

1973 - Taught for two years in high school, was inspected and received Teacher's Certificate.

1975 - Taught again at NCR, learnt and taught various computing languages.

1976-78 - Taught Introductory Econometrics in a September Mathematics Course to MA in Economics students at the LSE.

1977 - Whilst Lecturer in Statistics, taught:

(i) post-graduate course in Causal Analysis

(ii) post-graduate course in Advanced Time-Series

1978 - Shared courses in Econometric Theory

1979-86 - At Essex: Taught courses in Econometric Theory

(i) Statistics

(ii) Econometrics

(iii) Computing

(iv) Mathematical Economics

(v) Finance

1987-90 - Finance, Econometrics (Cambridge Papers 12, 25, 31)

1990-91 - Taught Advanced Econometrics at Birkbeck.

1991-92 - Taught Introduction to Mathematical Economics.
Advanced Econometrics.

BASE (Birkbeck Advanced Studies in Economics) course on Finance

1992-93 - Taught September course Mathematics, taught Theory of Finance (M.Sc.), Financial Econometrics (M.Sc.), Financial Econometrics (B.Sc.).

1993-2004 - Taught Papers 7, 12, 31 201, 231, 301 and 321 (not all simultaneously).

2005-2007 Taught Papers 7, 11, and 403, also taught Risk Management in Msc, Financial Engineering, Birkbeck , and Corporate Finance, University of Sydney.

CONSULTING EXPERIENCE

My consulting experience is very extensive, particularly in the areas of asset management and investment technology. I have supervised the building and maintenance of portfolio risk models. I have organised conferences for risk managers, investment professionals, and academics. I have carried out risk analysis on investment strategies and investment products. I can provide specific details on any of these areas if requested. I have worked with large numbers of international financial institutions and can provide testimonies as to my value – added if required.

I also work in mortgages, house prices, and real estate generally; recently, I designed with G. Christodoulakis the FT House Price Index for Acadametrics. I have also built mortgage default and loss models for Acadametrics. In conjunction with Acadametrics, I have been involved in the validation of risk models for lending institutions; this has been part of Basle II work in the recent past.

GENERAL CONTRIBUTION

I received colours from the LSE for cross-country running in 1977 and 1978 . I was also Secretary of London University Cross-Country Club 1978. I represented Trinity College at cross-country running 1987-1988, completed the London Marathon on 5 occasions, best 3.04.41 (1987). I was

reserve for Cambridge University Marathon Team (1990). In recent years, I ran 10 km in 44.32, Oct 2000, 44.05 in Mar, 2001; 44.48 in Jan, 2003, 44.52 in March 2005 , 42.53 in Feb, 2006, 44.24 in April 2007. I have won a number of medals in Veteran's road running.

CAMBRIDGE FACULTY ADMINISTRATION

At various stages I have been on:

Management Board for Management Studies Tripos

Statistics Committee (Chair)

Graduate Admissions Committee, was acting Admissions Officer 1989

Organised Seminar Series in Finance

Organising Seminar Series in Econometrics

Future Needs and Lecture List Committee

Faculty Board

Appointments Committee

College Administration

Director of Studies (1987- 2011) and Director of Admissions in Economics (1987-1994)

Trinity College

Finance Committee (1991-2003) ,2008 to 2011 and Treasurer of Trinity in Camberwell (charity) (1989-1992) plus other minor committees. Inspector of Accounts 1994-5 and 1996-97.

Wine Committee from 2005 to 2012.

Birkbeck Administration 1991-92

Department Seminar Organiser

Chairman Finance Examinations

Appointments Committee

Ph.D. Admissions

M.Sc. Finance Admissions

Jointly responsible for the creation of the new M.Sc. Finance (currently 70 students) which has now run successfully for 15 years.

Cambridge Administration 1993 to present

Appointments Committee

M.Sc. Finance Admissions

Chairman Finance Exams

M.Sc. Finance Co-ordinator

1993-94 Coordinator Papers 12, 31, 201, 231.
MSc Finance Admissions

1994-95 Coordinator Papers 12 and 231.

1995-96 Coordinator Papers 12, 201,231. Chairman ETE Exams.

1996-1999 Coordinator Papers 7 and 12.

1999-2000 Acting Graduate Chairman

2000-2001 Coordinator Paper 301.

2002-2006 Coordinator Papers 6 and 11. Head of Part 1 Examiners (2004).

PROFESSIONAL CONTRIBUTIONS

Refereeing

I have refereed articles for the *Journal of Econometrics*, *Econometrica, IER*, *Mathematical Social Sciences*, *Journal of Public Economics*, *Review of Economic Studies*, *Econometric Theory*, and *Journal of Applied Econometrics* plus many other journals.

Visiting and Seminars

I have given seminars at many British and Australian Universities and have been a visitor at Monash University (1985), (1987) and the University of New South Wales (1986) and Australian National University (1986), (1987). I have visited the University at Western Ontario (1988) and been a Visiting Fellow to University College, London. In 1989, I visited Complutense, Madrid. I am currently 4 times a Visiting Professor at Birkbeck College, London (1994 -). I recently visited University of Technology, Sydney (1998-2006). I have been appointed Visiting Professor at CASS/CUBS (2000-2006) and Visiting Professor at Birkbeck College (2000-2006) and Visiting Lecturer in Applied Mathematics at Oxford University (2002-2004). I am currently an Adjunct Professor at UTS (Sydney), and have had an association since 1997.

Supervision and Examination

I have supervised numerous post-graduate students and have successfully supervised the Ph.D.'s of A. Nasim at Essex and of M. Ncube and Y. Yoon, B. Eftekhari and S Hwang, G. Kuo, C. Pedersen, M. Sokalska, S. Bond, L. Middleton(Judge), M. Pitsillis, T. Darsinos, A. Sancetta, S. Yang, R. Lewin(Judge), G. Davies, W. Cheung , R. Corns, O. Williams and P. Contreras ,J.Zhang, R. Louth, Jimmy Hong, Nandini Srivastava, Omri Ross(Maths) at Cambridge, plus other Cambridge students on a joint supervision basis including A. Timmermann and L. Shi. Other successful PhD students supervised at Birkbeck include Y. Hatgioniddes, R. Daccó, M. Karanassou, G. Christodoulakis , B. Chu , Wei Jin, Wei Xia , Riko Miura and John Wylie from Sydney University.

My current students consist of four Cambridge Ph.D. students in Economics and three Birkbeck students. Plus one from Sydney University I have been an Examiner every year that I have taught at University. I have been external examiner at Queen Mary College and London School of Economics (Econometrics), and at London School of Economics (Economics), Imperial College, and Essex University. I have also examined over forrty doctoral dissertations in Econometrics, Finance and Land Economy at universities in Great Britain, Europe, Canada, and Australia.

Awards and Prizes

My research project was awarded a prize (the Inquire Prize for the best presentation at the annual Inquire Conference, Bournemouth, 1991 value £3,000).

Received Econometric Theory Multa Scripsit Award (1997).

My paper The Pricing of Market-to-Market Contingent Claims in a No-Arbitrage Economy was runner-up 1997 E. Yetton Award for the best paper published in AJM (1997).

Received Honorary Membership of the Institute of Actuaries (2001), received F.I.A.

Fund Raising

I have raised well in excess of £1,000,000 since 1991, I give details below:

I raised £105,000 for a financial econometrics project, the research was done at the Department of Applied Economics (Cambridge). This was funded by Inquire and the Newton Trust. The research project brought Professor W. Perraudin to Cambridge and employed Y. Yoon.

I have received £9,000 from the Newton Trust for 1993-94; and have had 2 research grants from ESRC joint with W. Perraudin, total value about £60,000. I have received £17,500 from Inquire for 93-94. I have received a further £20,000 from the Newton Trust (1993).

I started a new research project on the Econometrics of Emerging Markets. I received £30,000 from the Newton Trust (1994) and £10,000 from Inquire (1995) and £30,000 from Kleinwort Benson Investment Management (1995) plus a further £28,000 from Alpha Strategies (1998). This project has employed R. Daccó, and S. Huang.

I received £26,000 from the DSS to work on Pension Funds (joint with C. Pratten). I received £10,000 from Inquire (1996). I received a further £10,000 from Inquire (1997). In 1998, I received £7,500 for research on trading rules from a private donor and a further £25,000 from the Newton Trust. I received £4,500 research donation from Alpha Strategies and £2,500 from General-Re to speak at their annual conference (joint with C. Pratten), plus £6,500 from Inquire (1998) and £9,000 from Inquire (2000), £8,000 from Inquire (2003) and a grant of £6,000 from Acadametrics to employ J. Zhang.

I have received an ESRC grant of £80,000, which employed A. Sancetta for two years (2003-2004).

In 2005 I received with S. Hwang and B. Chu £45,000 from the ESRC to research on risk-management and non-linear correlation.

I have also received two grants of 3000 pounds each from Reading University(2005-2006) to work on real estate finance and a grant of (approx.) 20.000 pounds in 2006,joint with S.Bond and S.Hwang to work on asset allocation issues, the grant being from IRF.

Summary of Discovery Project Proposal for Funding to Commence in 2010

DP1093842 A/Prof HJ Bateman; Prof JJ Louviere; Dr SJ Thorp; Dr C Ebling; A/Prof T Islam; Prof S Satchell; Prof JF Geweke

Approved The paradox of choice: Unravelling complex superannuation decisions

Approximately A$960,0000

CIFR Grant Graham Partington, Steve Satchell, Richard Philip, Amy Kwan Measuring market quality: current limitations and new metrics $140,000 total

CIFR Grant: Identifying Asset Price Bubbles in Australian Listed Securities
$122,000 total

Popular Articles

Making Money Out of Chaos, Investors Chronicle, 10th July 1992. (Interview)

Articles in the *International Broker*, (with Allan Timmermann), (15 pieces), listed next.

Weekly columns on Investment Techniques:

Equity switch programme (Vol. 6, page 7)
Making money out of chaos (Vol. 7, page 6)
Where random walks trips up (Vol. 8, page 7)
Ignorance can be profitable (Vol. 9, page 7)
Making money from market volatility (Vol. 10, page 7)
High-low prices in options trading (Vol. 11, page 7)
Can heavy trading be profitable? (Vol. 12, page 7)
Economic variables show stock returns (Vol. 13, page 7)
No mean return on shares (Vol. 14, page 9)
Do option prices augur a crash? (Vol. 15, page 9)
Puzzles in closed-end fund prices (Vol. 16, page 9)
Capital asset pricing model challenged (Vol. 17, page 9)
How dividends affect share prices (Vol. 18, page 9)
The relationship between price and volume (Vol. 19, page 9)
How persistent are financial market shocks? (Vol. 22, page 9)

Research work written up by International Management (April 1993).

Article in the *Professional Investor* (May 1995), Short-termism (with D.C. Damant), (pages 21-27).

Article in the *Professional Investor* (July 1995), Accounting for Derivatives (with D.C. Damant).

Book Review on Ethnic Minorities and Higher Education in *Higher Education Review*, 1996, 28:2, 96.

Article in the *Professional Investor* (June 1996), Downside Risk (with D.C. Damant).

Contribution to discussion British *Actuarial Journal*, Volume 3, Part I, pages 10-11, 1997

Contribution to discussion British *Actuarial Journal*, 1998.

Article on Lloyd's Syndicate Valuations Methodology, (*ALM News*), 1998.

Research discussed in Observer (26th April 1998, page 11).

Research discussed in Inside Monthly (April 1998, pages 12-14).

Interviewed on Bloomberg TV (27th February 1998)

Pension Scheme Investment Policies, DSS Research Report No. 82 (with C. Pratten), 1998.

Designed the FT Acadametrics House Price Index, 2003. This Index appears monthly in the FT and is

usually discussed by journalists and market pundits.

Contribution to discussion, British *Actuarial Journal,* 2006.

The Impact of Utility on Endowment Strategy, *Professional Investor, April 2007.*

Interviewed on ABC re financial crisis(October 2008)

<u>Research Affiliations (past and present)</u>

Head of Research,Bita-Risk.

Academic Advisor, Alpha Strategies

Advisory Panel, IFC (Subsidiary of the IMF)

Academic Advisor, Kleinwort Benson Asset Management

Academic Advisor Kiln Colesworth Stewart (Member's Agents, Lloyds)

Academic Panel, Panagora Asset Management (1992-1998)

U.K. Representative, Pension Research Institute (State University of California)

Fellow, Pensions Institute (Birkbeck College)

Academic Adviser, Quantec

Academic Panel, State Street Global Advisors

Research Advisor, Thesys Forecasting, currently Acadametrics.

Visiting Professor, Cass Business School, City University,

Visiting Professor University of Technology, Sydney.

Visiting Professor, Birkbeck College.

Honorary Visiting Professor University of Sydney

Academic Advisor, Style Research Associates

Visiting Lecturer, University of Oxford, applied mathematical finance diploma.

Academic Adviser, Northern Trust.

Academic Advisory Board, Old Mutual Asset Management.

Expert Witness between fund Manager and Pension Fund., 2003.

Expert Witness between fund Manager and Pension Fund, 2004-2006.

Expert Witness between Insurance Company and Lettuce Grower.

Adviser in Risk Management to the Governor of the Bank of Greece.

Head of Research, BITA Risk..

Member, Advisory Board, Quantitative Finance Research Centre, UTS.

Member, Steering Committee, CIMF, Cambridge University.

Area Coordinator, Fundamentals of Economic Analysis, Libros de Economia y Empresa, Real Academia de Ciencias Morales Y Politicas.

Consultant, JP Morgan AM,Behavioural Equity Team.

Academic Advisor, Lombard-Odier Asset Management.

Program Committees

European Meeting of the Econometric Society (1997)

Forecasting FX Conference organized by Imperial College and B.N.P. (1996 to 2007)

Inquire UK (2006, 2007)

Program Committee, UK Inquire.

Prize Committee, European Inquire.

Conferences and Seminars

NZ Econometric conference, feb,2011.

Conferences and Seminars (2009)

Presented seminars at:
Sydney University (April 3rd);
Macquarie Bank (April 7th),
CRMC Sydney (April 8th);
Sydney Q group, April 15th.

Conferences (2008)

Finance Conference, London, October, key-note speaker.

Chair, LQ conference (Cambridge, September), presented.

Prize Committee, Inquire Europe(Bordeaux, October).

Conferences (2007)

Finance Conference, Imperial College, March 2007, Discussant.

Finance Conference, Zurich, March 2007. Invited Key Note Speaker.

Alpha Strategies Finance Conference, April 2007, Duke University, chaired conference.

UKSIP Lecture on Endowments, April 2007.

Alpha Strategies Finance Conference, September 2007, Oxford University, chaired conference.

Conferences (2006)

Alpha Strategies Finance Conference, April 2006, Duke University, chaired conference.

Risk Management Conference, June 2006, Bank of Greece, Athens. Gave paper, helped organize programme.

Asset Allocation Summit, July 2006, London, presented paper.

New Zealand Econometrics Conference Dunedin August 2006, chaired session, gave paper, was on prize committee.

Alpha Strategies Finance Conference, September 2006, Cambridge University, chaired conference.

FEDERAL COURT OF AUSTRALIA

Practice Note CM 7

EXPERT WITNESSES IN PROCEEDINGS IN THE FEDERAL COURT OF AUSTRALIA

Practice Note CM 7 issued on 1 August 2011 is revoked with effect from midnight on 3 June 2013 and the following Practice Note is substituted.

Commencement

1. This Practice Note commences on 4 June 2013.

Introduction

2. Rule 23.12 of the Federal Court Rules 2011 requires a party to give a copy of the following guidelines to any witness they propose to retain for the purpose of preparing a report or giving evidence in a proceeding as to an opinion held by the witness that is wholly or substantially based on the specialised knowledge of the witness (see **Part 3.3 - Opinion** of the *Evidence Act 1995* (Cth)).

3. The guidelines are not intended to address all aspects of an expert witness's duties, but are intended to facilitate the admission of opinion evidence[44], and to assist experts to understand in general terms what the Court expects of them. Additionally, it is hoped that the guidelines will assist individual expert witnesses to avoid the criticism that is sometimes made (whether rightly or wrongly) that expert witnesses lack objectivity, or have coloured their evidence in favour of the party calling them.

[44] As to the distinction between expert opinion evidence and expert assistance see *Evans Deakin Pty Ltd v Sebel Furniture Ltd* [2003] FCA 171 per Allsop J at [676].

Guidelines

1. General Duty to the Court[45]

1.1 An expert witness has an overriding duty to assist the Court on matters relevant to the expert's area of expertise.

1.2 An expert witness is not an advocate for a party even when giving testimony that is necessarily evaluative rather than inferential.

1.3 An expert witness's paramount duty is to the Court and not to the person retaining the expert.

2. The Form of the Expert's Report[46]

2.1 An expert's written report must comply with Rule 23.13 and therefore must

(a) be signed by the expert who prepared the report; and

(b) contain an acknowledgement at the beginning of the report that the expert has read, understood and complied with the Practice Note; and

(c) contain particulars of the training, study or experience by which the expert has acquired specialised knowledge; and

(d) identify the questions that the expert was asked to address; and

(e) set out separately each of the factual findings or assumptions on which the expert's opinion is based; and

(f) set out separately from the factual findings or assumptions each of the expert's opinions; and

(g) set out the reasons for each of the expert's opinions; and

[45] The "*Ikarian Reefer*" (1993) 20 FSR 563 at 565-566.
[46] Rule 23.13.

(ga) contain an acknowledgment that the expert's opinions are based wholly or substantially on the specialised knowledge mentioned in paragraph (c) above[47]; and

(h) comply with the Practice Note.

2.2 At the end of the report the expert should declare that "[the expert] has *made all the inquiries that* [the expert] *believes are desirable and appropriate and that no matters of significance that* [the expert] *regards as relevant have, to* [the expert's] *knowledge, been withheld from the Court*."

2.3 There should be included in or attached to the report the documents and other materials that the expert has been instructed to consider.

2.4 If, after exchange of reports or at any other stage, an expert witness changes the expert's opinion, having read another expert's report or for any other reason, the change should be communicated as soon as practicable (through the party's lawyers) to each party to whom the expert witness's report has been provided and, when appropriate, to the Court[48].

2.5 If an expert's opinion is not fully researched because the expert considers that insufficient data are available, or for any other reason, this must be stated with an indication that the opinion is no more than a provisional one. Where an expert witness who has prepared a report believes that it may be incomplete or inaccurate without some qualification, that qualification must be stated in the report.

2.6 The expert should make it clear if a particular question or issue falls outside the relevant field of expertise.

2.7 Where an expert's report refers to photographs, plans, calculations, analyses, measurements, survey reports or other extrinsic matter, these must be provided to the opposite party at the same time as the exchange of reports[49].

[47] See also *Dasreef Pty Limited v Nawaf Hawchar* [2011] HCA 21.
[48] The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565
[49] The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565-566. See also Ormrod *"Scientific Evidence in Court"* [1968] Crim LR 240

3. Experts' Conference

3.1 If experts retained by the parties meet at the direction of the Court, it would be improper for an expert to be given, or to accept, instructions not to reach agreement. If, at a meeting directed by the Court, the experts cannot reach agreement about matters of expert opinion, they should specify their reasons for being unable to do so.

J L B ALLSOP

Chief Justice

4 June 2013