REPORT TO THE AER: DISCUSSION OF SUBMISSIONS ON THE DRAFT 2018 GUIDELINE

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28 November 2018

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 *curricula vitae* can be found in Appendix 2.

We have read the "Federal Court of Australia: Expert Evidence Practice Note" which is attached as Appendix 3. This report has been prepared in accordance with the guidance provided by the practice note. 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 regarding submissions and the Independent Panels report in relation to the Draft Guidelines. In particular, we were asked whether we would:

- Advise the AER to change the manner in which it estimates return on equity in the draft decision for the 2018 rate of return guidelines; or
- Consider that any of the AER's point estimates in the draft guideline for equity beta (or 0.6), the market risk premium (of 6% p.a. compounded annually), or the overall equity risk premium (of 3.60% p.a. compounded annually) would be unlikely to achieve the National Gas or Electricity objective

In response to these two queries, the only substantive change that we would recommend in relation to the Guidelines is to return to using the current cost of debt (the on the day method) rather than using an average of the historic cost of debt. We have commented on this extensively in previous reports, because of this and because it is not part of the current brief, we will not pursue this issue in the current report. With respect to the cost of equity, we have regularly commented in our prior reports that the risk premium was more likely to be lower rather than higher relative to history. Thus, on the balance of the probabilities, it is reasonable in our opinion for the AER to have reduced the risk premium to 6%. The more so if, as we discuss in section 6b, the geometric average of returns were to be given increased weight in order to increase the accuracy of the estimate of expected returns. We have extensively discussed in previous reports why we would give little or no weight to the Black model and so called "low beta bias" in determining the equity beta. We have also previously discussed why submissions in favour an increase in equity betas should be taken with a large grain of salt. Consistent with our prior work, we therefore consider the AER's reduction in the equity beta is appropriate.

The full terms of reference are attached as Appendix 1. For the convenience of readers, we use the specific questions posed by the AER as headings in the text that follows.

Introduction

General Observations on Submissions

In some of our previous reports, for example Partington and Satchell (2016, p9), we have made the following observation:

"The Queensland Council of Social Services (QCOSS, 2015) expressed a concern about the risk of cherry picking where multiple asset pricing models are used. In response to this expression of concern Partington (2015) makes 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."

The hypothesis continues to be well supported in the current round of submissions. In addition to the regulated network businesses, it is also clear that investor's favour higher allowed returns, while in addition to consumers, submissions from retailers tend to favour lower allowed returns. For example, NSG (2018), representing a group of major investors in transmission and distribution networks such as AMP Capital and Macquarie Bank, very strongly oppose the reduction in the allowed return proposed in the new draft guidelines. They suggest that as a result of this reduction in allowed returns investment will stall.[1]

In contrast, Origin Energy (2018, p1), state:

"*As we have highlighted in our previous submission to this process, the commercial risk of a regulated network is very low. We reiterate our views that regulated networks are largely insulated from the business cycle as they are not exposed to volume risk and have a guaranteed revenue stream under the revenue cap arrangements. For this reason, increases in financial risk as leverage increases is also relatively low as the businesses effectively pass on borrowing costs to consumers*.

Networks argue that fair returns are necessary to attract capital for future investment. However, we believe regulation was never designed to deliver a riskless environment. If returns were guaranteed, the regulatory rate of return should trade marginally above government bonds."

[1] We note that several submissions dispute this and claim that the release of the Guidelines only had a temporary price impact on the shares of listed network businesses.

AGL (2016, p2) express a similar sentiment when they state: "*Indeed, investments in network assets could be considered a low risk asset classed with government bonds which theoretically, can have an equity beta of 0.*"

The low risks of network businesses have led to their shares being described as a bond proxies.[2] The status of the networks' equity as a bond proxy is consistent with the suggestions by Origin Energy and AGL that bond like returns are appropriate. However, rates of return marginally above corporate bonds would seem to be more fitting than rates of return marginally above government bonds.[3]

In addition to submissions on the Guideline, we were asked to consider the Independent Panel Report (2018) and, of the documents reviewed, this document is the least likely to be affected by self-interest. The conclusion of the Panel (p. II) is:

"*The AER has undertaken an extensive consultation and engagement process. For the most part, the Explanatory Statement has set out in significant detail the evidence, analysis and conclusions that the AER has reached in determining each of the rate of return parameters and the value of imputation credits, to form an overall estimate of the rate of return.*

However, we have identified a number of areas where the AER's explanations and reasoning supporting its approach to various issues needs to be clarified. We have stated our recommendations in the relevant chapters of this report and we list them at the end of this Executive Summary. If the AER follows these recommendations, then in the Panel's view the resulting Guidelines will be supported by sound reasoning, based on the available information, such that it is capable of promoting achievement of the national gas and electricity objectives."

In our opinion this is an endorsement of the AER's Guidelines, provided that the reasoning that led to the Guidelines is clarified. The Panel considered that its role did not extend to forming a judgement about whether the rate of return was appropriate. However, it would be difficult to conclude that the Guidelines were "*capable of promoting the achievement of the national gas*

[2] See for example https://www.commbank.com.au/guidance/retirement/what-you-need-to-know-about-bond-proxies-201610.html, accessed November 2018.
[3] See Partington and Satchell (2018) for a discussion of bond proxies in relation to regulated utilities.

and electricity objectives" if the Guidelines were considered likely to result in material error in the allowed rate of return estimate.

Black CAPM and low beta bias

Stakeholders submitted a September 2018 report from Frontier titled "Low beta bias and the Black CAPM". Please explain your views on the following findings from the report:

Below we provide a set of brief answers to the discussion dot points provided by the AER. Following the answers to the dot points is a longer discussion of salient issues and detailed mathematical derivations in support of our analysis.

- Frontier's conclusion that low beta bias exists on an ex-ante basis for Australian data

We do not support the proposition that so called low beta bias is a reason for increasing the allowed return for regulated networks and this is discussed in the more detailed analysis of salient issues below. Much of Frontier's report covers old ground that has been seen in multiple past submissions to the AER. The new feature in this work is the use of analyst's forecasts to determine an implied rate of return, which is then taken as a proxy for the return investors expect. The model Frontier uses to estimate the implied rate of return is just one example from a class of models known as implied cost of capital models. Unfortunately, such models perform poorly. If this was not the case, they would be in widespread use to compute the cost of capital (allowed rate of return). An important contributor to their poor performance is that analyst's forecasts are upward biased and sluggish to respond to new information, Easton (2007) and Guay, Kothari and Shu (2011), also see the discussion in relation to Brav et al. (2005) at the dot point below. Thus, it is well established that the implied cost of capital is an upward biased estimator of expected returns. Consequently, in respect to the regression that Frontier uses, the dependent variable, excess implied return, is upward biased. The independent variable, an estimate of the equity beta, is measured with error. This latter gives rise to the problem known as errors in variables and the consequence is that the estimated slope coefficient is a downward biased estimate of the true regression slope. In other words, the estimated regression line is flatter than the true relation between the dependent and independent variables. Forming portfolios represents an attempt to reduce the impact of measurement error, but portfolios may suffer from increasing levels of measurement error as the portfolio beta becomes more distant from the mean value of beta.

The attempt to examine expectations is a welcome development. However, in the light of the foregoing discussion and the discussion that follows we would not attach great weigh to it.

- Literature on ex ante required returns demonstrating the relationship between beta and required returns has a higher intercept and a flatter slope than the SLCAPM would suggest

The literature does not use ex-ante required returns in its analysis. The literature uses estimates of the implied cost of capital. This implied cost of capital is used as a proxy for the ex-ante required return. As we discuss above and below this proxy is not reliable. If it were then we would recommend it as a method to determine the allowed rate of return, whereas we strongly do not recommend this.

- Analyst forecasts (particularly 1 year forecasts) are suitable for proxying expected returns when testing for low beta bias

The evidence on this is based on the paper by Brav et al. 2005, published in *Financial Management*, which argues that analysts' forecasts are unbiased estimates of expected returns over a 1 year horizon. It is very hard to take this assertion seriously. Although the use of analyst's forecasts as a proxy for expectations is quite common, it is well recognised that they are upward biased.

The evidence against unbiased estimates of expected returns over a one year horizon comes from a very considerable literature in empirical finance and accounting. Rather than quote a large number of empirical papers we shall mention the paper by Lim (2001) which argues that optimal buy forecasts for analysts' should be optimistic. Since analysts make many more buy recommendations than sell recommendations, positive bias is expected to prevail.

Furthermore, at least historically, the reward structure for analysts did not directly compensate them for producing unbiased forecasts. They were rewarded for talking up (or down) stocks as they were typically employed by sell-side firms who would hope to benefit from the commissions involved when their clients were persuaded to trade. The emphasis on talking up led to an overall optimism in their forecasts.

- Evidence of low beta bias indicates that actual returns can be used to estimated required returns as is the case for estimating the market risk premium and equity beta

Evidence of low beta bias provides no indication about whether actual returns can be used to estimate required returns. Neither does the use of actual returns as a proxy for expected returns in one context imply that usage is appropriate in all contexts.

- Observed returns are typically used as a proxy for expected/required returns in standard empirical finance**.**

Observed returns are often used as a proxy for expected returns in empirical finance, but this does not mean that they are equally suitable for this use in all applications, or that the methods of analysis have all been appropriate. The fundamental point is that actual returns equal expected returns plus forecast error. This is the natural consequence of risk. The errors can be large and they may be persistently in one direction for extended periods.

Whether actual returns are a reasonable proxy for expected returns depends on how they are employed. For example, the mean of excess returns is often used as an estimate of the expected market risk premium, but it is recognised that the realised returns on the market, observed period by period, are extremely noisy measures of expectations (lots of deviations from expectations) and that therefore averages need to be taken over a very long period when estimating the market risk premium. The return on the market benefits from being the return on a well-diversified portfolio and therefore returns on portfolios less well diversified than the market and on individual securities are expected to be even noisier than the observed market return.

- If observed returns cannot be relied upon to reflect investors' required/expected returns for the purposes of assessing low-beta bias, they cannot be relied upon for any other purpose such as MRP and beta estimation

This statement is clearly incorrect. Data may be inappropriate in one context, but that does not automatically render it inappropriate in other contexts. We would advocate time-series estimation based on observed returns as a suitable procedure for estimating beta and indeed the MRP. However, it is not the only possible procedure and other procedures might be appropriate. Each procedure needs to be analysed on its merits, rather than making sweeping generalisations about the use, or non-use, of actual returns.

- Academic literature shows the relationship between beta and required returns has a higher intercept and a flatter slope than the SLCAPM would suggest

We have previously acknowledged that the foregoing statement is a common result in the academic literature. However, we have also pointed out that not all academic literature supports

this result. While, the result of a higher intercept and a flatter slope is a common result, in our discussion below we point out deficiencies in the literature that make us sceptical of its empirical usefulness in determining the allowed rate of return.

It is worth noting that much of this literature, including by the two Nobel Prize winners cited by Frontier, was written before the development of the conditional CAPM. As we show below, the conditional CAPM gives a clear explanation of where the common observation of a positive intercept might come from and why there may be a gap between the average value of Beta from the conditional CAPM and the unconditional Beta.

Salient Issues

The starting point of this discussion is the claim that the SLCAPM systematically underestimates required returns for betas less than one. The assumptions that underpin this claim are those that are standard in the original literature; namely that the SLCAPM is used as the appropriate model and that the data generating process for returns can be described by a linear model; we give details below.

We present the SLCAPM:
where we define μ_p as the equilibrium expected rate of return for a portfolio p, r_f is the riskless rate of return, normally taken in the Australian regulatory context as the yield of a 10 year government bond. The symbol β_p is the beta of portfolio p with respect to the market portfolio m, $(\mu_m - r_f)$ is the risk premium of the equity market, μ_m is the expected rate of return of the equity market, say the ASX300, and $\beta_p(\mu_m - r_f)$ is the risk premium of portfolio *p*.

Equation (1) is the SLCAPM. As indicated above, this gives a formula for the risk premium of portfolio *p*.

$$\mu_p - r_f = \beta_p(\mu_m - r_f) \qquad (1)$$

When this relationship is tested, it is usual to assume for the data generating process a linear relationship of the form,

$$r_{pt} - r_{ft} = \alpha + \beta_p(r_{mt} - r_{ft}) + \epsilon_{pt} \qquad (2)$$

where r_{pt} is the observed rate of return for a portfolio p at time t, whilst r_{mt} is the observed rate of return for the market at time t, usually taken as the rate of return of a market equity index, such as ASX300, again at time t, ϵ_{pt} is the error term.

There are a number of ways of detecting what has been called low beta bias. The method of detection depends on the model structure used. If we take Equations 1 and 2 as our model, then evidence of a low beta bias is the finding of a positive alpha in equation 2 when equation 2 is estimated using time-series data. This has been discussed at length in our previous reports and we will focus on our last report to the AER, "Report to the AER 2018" where we presented a number of refutations of low beta bias, which have not been addressed in the Frontier paper. We will repeat the arguments, updating them to the context of Frontier's current report.

The SML line and Low Beta Bias

Another way to understand low beta bias is to use a security market line (SML). This is a plot of beta on the x-axis and expected returns on the y-axis. The empirical SML is estimated from realised returns and is commonly found to have a higher intercept and flatter slope than would be expected according to the SLCAPM. One interpretation of this result is that the SLCAPM gives required returns that are biased downwards for low beta stocks, but there are other interpretations. For example, an alternative interpretation is that there are problems with the methods and/or data used to estimate the empirical security market line. Yet another interpretation is that the empirical SML is correctly estimated, but that the result does not necessarily imply "low beta bias". We suggest that the second and third explanation are valid as alternatives to the first explanation. We have discussed this at length in previous reports.

The Black SLCAPM and Low Beta Bias

Frontier's report rests heavily on the relevance of the Black CAPM. Again, we have discussed this many times before and we repeat our arguments based on our 2018 report. In what follows we do not simply quote directly from the paper but mix the previous arguments with new observations. The history of applying the Black CAPM to regulatory issues seems to date back to Grundy (CEG 2008) but may well be earlier. Professor Grundy and others argue that there is a term called the zero beta premium that needs to be added to the cost of capital. They make this suggestion in situations where there does exist a good proxy for the risk free rate and the restrictions assumed by Black do not hold, but other restrictions such as different borrowing and

lending rates prevail. Our comment here is there are many approximations in computing beta and the cost of capital, but it seems ill advised to focus on things that seem improbable, relative to the ones that seem reasonably true. Of all the approximations made, assuming that the 10 year government bond rate corresponds to a riskless asset, seems fairly innocuous. This is particularly true when the sovereign debt is highly rated, and inflation is both low and has low volatility.

We suggested that no weight should be given to the Black CAPM. In this section we address the issue of low beta bias and particularly the points made in the paper titled "Low-Beta Bias", Frontier (December 2017) and made again in Frontier's current paper. Frontier present arguments that low-beta stocks are under-priced relative to their betas and should have their betas enlarged. It transpires that this is based on the fallacy that an intercept for the estimated SML higher than the risk free rate and a flatter slope necessarily implies that low beta stocks are under-priced.

In previous reports we have argued that the so called low-beta bias should be not automatically be taken as a compelling argument in favour of increasing the allowed rate of return. Below we provide an example, also presented in our previous paper, which results in an increase in the SML with a higher intercept/flatter slope, but it is not evidence of low beta bias. In response to the comment by APA that it was difficult to evaluate this analysis because of the brevity of the proof, in this version a more extensive proof is presented.

If the SLCAPM holds then the security market line (SML) should have an intercept equal to the riskless rate and a slope equal to the equity risk premium. Virtually all evidence on low-beta bias, as in the evidence presented by Frontier (December 2017), is based on the SML. We list examples from Frontier: Point 18, Black, Jensen and Scholes(1972), Figure 2, Figure 3, Point 26, Fama and Macbeth(1973), point 29, Fama and French (2004) and points 31 and 32, which are both text-book results and, hence, not really direct evidence, but merely evidence of the fact that the result of a higher intercept and flatter slope for the SML is widely accepted. We reiterate, that although widely accepted, this view is not a universal view.

Suppose we have two assets with returns R_i and betas $\widehat{\beta}_i$. One asset has a low beta and is labelled asset 1 and the other has a high beta and is labelled asset 2. We assume the following cross-sectional regression and we estimate π and π_1 which, if the SLCAPM holds should be the riskless rate of return and the equity risk premium respectively.

$$\overline{R_\iota} = \pi + \pi_1 \widehat{\beta_\iota} + e_i$$

We now state the fallacy; that an SML intercept greater than the riskless rate is evidence of low beta assets being under-priced. In the following theorem, we disprove this fallacy. Details of the proof are available in Partington and Satchell (2018) 'Report to the AER 2018', page 28. But since some stakeholders found the argument a little sketchy, we give more details here. We would like to thank APA for their comments in this regard.

Theorem. If high beta assets are over-priced and low beta assets are correctly priced, then the security market line has, on average, an intercept in excess of the riskless rate and a slope less than the equity risk premium

Proof.

Suppose asset 1 is low-beta and correctly priced while asset 2 is high-beta and over-priced. Δ is the penalty in returns arising from over-pricing for the high-beta asset, which for simplicity we assume constant and we have, by assumption that $\widehat{B_2} > \widehat{B_1}$

$$\overline{R_1} = \pi + \pi_1 \widehat{B_1} + e_1$$

$$\overline{R_2} + \Delta = \pi + \pi_1 \widehat{B_2} + e_2$$

In matrix notation, this can be written as

$$R = XG + e$$

Where $R = \begin{bmatrix} \overline{R_1} \\ \overline{R_2} \end{bmatrix}$. $X = \begin{pmatrix} 1 & \widehat{B_1} \\ 1 & \widehat{B_2} \end{pmatrix}$. $G = \begin{bmatrix} \pi \\ \pi_1 \end{bmatrix}$. $e = \begin{bmatrix} e_1 \\ e_2 - \Delta \end{bmatrix}$ We apply least squares to the regression and find that the estimators of the intercept and the slope can be written as:

$$\begin{bmatrix} \hat{\pi} \\ \widehat{\pi_1} \end{bmatrix} = \begin{bmatrix} \pi \\ \pi_1 \end{bmatrix} + (X'X)^{-1} X' \begin{bmatrix} e_1 \\ e_2 - \Delta \end{bmatrix}$$. The term $(X'X) = \begin{pmatrix} 2 & \widehat{B_1 + B_2} \\ \widehat{B_1} + \widehat{B_2} & (\widehat{B_1})^2 + (\widehat{B_2})^2 \end{pmatrix}$.

Inverting the matrix and carrying out necessary multiplications, we see that:

$$\begin{bmatrix} \hat{\pi} \\ \widehat{\pi_1} \end{bmatrix} = \begin{bmatrix} \pi \\ \pi_1 \end{bmatrix} + \begin{bmatrix} \frac{a}{c} \\ \frac{b}{c} \end{bmatrix} where\ c = ((\widehat{B_2 - B_1})^2, \text{ is clearly positive.}$$

Also, a is: $((\widehat{B_1})^2 + (\widehat{B_2})^2)(e_1 + e_2 - \Delta) - (\widehat{B_1} + \widehat{B_2})(\widehat{B_1}e_1 + \widehat{B_2}(e_2 - \Delta))$

And b=$-(\widehat{B_1} + \widehat{B_2})(e_1 + e_2 - \Delta) + (\widehat{B_1}e_1 + \widehat{B_2}(e_2 - \Delta))((\widehat{B_1})^2 + (\widehat{B_2})^2)$

Taking cross-sectional expectations(denoted E_{cs})over e_1 and e_2, we set them to 0 and we are left, after further simplification with E_{cs} (a)= $\Delta(\widehat{B_1}\widehat{B_2} - (\widehat{B_1})^2)$

Since $\widehat{B_2} > \widehat{B_1} > 0$ by assumption, we see that the intercept is biased upwards, even though the low-beta assets are correctly priced. An identical argument shows that the estimated slope, $\widehat{\pi_1}$, will be biased downwards. Indeed E_{cs} (b)= $\Delta(\widehat{B_1} - \widehat{B_2}) < 0$

There are several other reasons why we should be suspicious of low-beta bias as a basis for increasing the allowed rate of return. For example, as noted by Partington and Satchell (2017) estimates of alpha and beta are negatively correlated under normal circumstances so high estimated beta is associated with low estimated alpha and low estimated beta with high estimated alpha. In Partington and Satchell (2018) the authors present the conditional CAPM which we discuss next. There appears to be no discussion of the conditional CAPM in Frontier's report nor in their paper on the market risk premium, see the Market Risk Premium (Frontier, December 2017). The point is that the SML analysis discussed by Frontier is based on unconditional betas. In the standard CAPM beta is fixed, whilst most of the December 2017 paper by Frontier argues that Beta is changing. Thus, the argument is somewhat inconsistent with the theoretical framework. To present a framework that includes both unconditional and changing betas, we move to the conditional CAPM.

The Conditional CAPM

We introduce the conditional CAPM in this section. We advocate it as a model to understand issues surrounding fixed and changing betas. We are not advocating it to the AER as a way of calculating regulatory beta for the current Guideline.[4]

We define $E_t(X_{t+1})$ to mean the expectation of X_{t+1}, given all information known at time t. The conditional SL-CAPM is identical to the unconditional CAPM except that it will change as the

[4] Use of the conditional CAPM would add complexity, is not used much, if at all, in practice to calculate the cost of capital and its use in regulation would probably increase opportunities for gaming.

conditioning information changes; thus it is the natural vehicle for discussing changing beta. The return relation becomes, see Jagannathan and Wang, (1996),

$$E_t(R_{i,t+1}) = E_t(R_{m,t+1})B_{i,t}$$

Where $R_{i,t+1}$ is the excess return on asset i in period t+1, and $R_{m,t+1}$ is the excess return on the market portfolio in period t+1. $E_t(R_{m,t+1})$ can be interpreted as the conditional equity risk premium. The term $B_{i,t}$ is equal to $Cov_t(R_{i,t+1}, R_{m,t+1})/Var_t(R_{m,t+1})$ where Cov_t and Var_t mean covariance and variance conditional upon all information known at time t.

Jagannathan and Wang, (1996) go on to show that if we take unconditional expectations of the conditional CAPM, we arrive at (see their equation 4):

$E(R_{i,t+1}) = E(E_t(R_{m,t+1}))E(B_{i,t}) + \text{Cov}(B_{i,t}, E_t(R_{m,t+1}))$

The first part of the relationship is essentially the SLCAPM taken at the average equity risk premium and the average beta. This model is written in terms of excess returns. In excess returns form the intercept of the empirical SML is expected to be zero under the SLCAPM. However, if the conditional CAPM applies, then as in the equation above there should be a non-zero constant. That constant does not imply that low beta stocks suffer from low beta bias.

The constant in this regression actually measures the covariance between the time varying beta ($B_{i,t}$) and the conditional expectation of the market return next period measured by the average investor at time t ($E_t(R_{m,t+1})$). Thus, a positive alpha for a low beta stock simply means that these two terms move together, for example, when the average investor believes that the market return is going up, this will coincide with the exposure to the market going up. It is extremely unclear to us that such a phenomenon should form the basis of additional compensation for network businesses.

2. In submissions in response to the draft 2018 guidelines, regulated networks and network associations continue to support giving weight to the low beta bias and Black CAPM. Consumer Reference Group (including report from SA Centre for Economic Studies [SACES], Consumer Challenge Panel, Energy Consumers Australia support not giving weight to low beta bias and Black CAPM.

Please advise on the regard that should be given to the low beta bias and/or Black CAPM when estimating the forward-looking required return on equity using the SLCAPM for firms with a similar degree of risk as efficient firms supplying regulated energy network services.

As we have discussed in respect to question1, we would argue that no regard should be given to the low Beta bias and the Black CAPM when estimating the forward-looking required return on equity. This is clearly a view shared by a number of stakeholders. We list examples below. The consumer challenge panel (CCP16) discusses the role of the Black CAPM and low beta bias and consider that neither are appropriate for regulatory decision making. They express their view of the Black CAPM and the estimation of the zero beta premium on p89:

- *"It requires a construction of an artificial 'risk free asset' on assumptions that are agreed not to be realistic. In contrast, the SLCAPM relies on returns on an essentially risk-free asset (Australian Government bonds) that can be observed directly.*
- *The estimation of the value of the 'risk-free asset' is excessively complex, and there is a wide range of values calculated by various experts.*
- *For these reasons, it is rarely used in practice by regulators or the investment community."*

We agree with these points. CCP16 also go on to discuss the low beta bias and refer to Partington and Satchell (2017) where we note that higher returns for low beta stocks are a natural consequence of falling interest rates. They find this discussion pertinent.

Turning now to the report by SACES, they discuss low beta bias on page 4. They are perhaps a little more sympathetic to the low beta bias proposition than CCP16 and say:

"*We are not convinced of Frontier's claim that the AER makes inadequate adjustment for low beta bias, in fact it is possible that the current allowance goes too far. There is no convincing argument to increase the existing allowance for low beta bias*".

In Box 1, on page 4, they quote some of the more ludicrous excesses among Australian consultants, for example, NERA 2013, estimate a zero-beta premium of 13.95%. Although SACES'

tolerance of the zero beta CAPM is greater than ours, they do focus on the two major flaws in the argument for the Black CAPM, namely "*restrictions on financing that are allowed for in the Black CAPM do not seem large enough to justify the magnitudes of estimates of the zero risk premium*". This is similar to a point we have made previously, that the only sensible justification for a premium over the government bond rate might be different borrowing and lending rates, but this effect would be much smaller than any of the estimates presented for the zero beta risk premium. The second point SACES make is that "*test statistics that are relied on in many studies are not valid, leading to unwarranted rejections of SL-CAPM".* We agree with the broad thrust of this.

Energy Consumers Australia make occasional mention of the Black CAPM, especially on page 15. In common with others, they refer to the work by Kevin Davis (2011), discussing differential borrowing and lending rates and argue that "*the practical difficulty is that nobody has developed a way to estimate the "Zero Beta Rate" to substitute the risk-free rate*". Whilst this is rather an overstatement, as estimates have been made, it would be correct to say that reliable estimation of the zero beta rate has not been achieved.

APA (2018) discuss low beta bias in the Black CAPM on page 15; again, they advance the argument of market imperfections about investor borrowing and lending. However, they do not discuss the plausibility of these assumptions. They argue in favour of low beta bias based on the reputation of the researchers involved and claim it to be well represented in standard finance textbooks. This is not in dispute; its relevance to determination of the allowed return is the relevant question. They argue in favour of Black's model notwithstanding its implausible assumptions on the grounds that SL CAPM also makes assumptions, "*which are similarly implausible"*. We take issue with this. The only effective difference between the two is the existence of a riskless rate of return that allows you to lend or borrow in unlimited amounts. Whilst we recognise that this is untrue, in the world of theory, it is not the most implausible assumption.

One of APA's other points is the one cited by the AER of the difficulties of testing for the Black CAPM, stating that this in itself "*is not now a valid reason to give zero beta bias no weight but coupled with its other problems suggests that the decision by the AER to do so is probably correct"*. They also argue in favour of using analysts' forecasts as Frontier has done elsewhere and they quote Brav et al's (2005) research, see page 19, we have dealt with the deficiencies of that analysis in our response to Question 1. On page 20, in relation to low beta bias APA agree with our

arguments that there is the negative correlation between estimates of beta and the intercept term, alpha. They question our analysis on the fallacy of low beta bias due to the sketchiness of the proof that we offer. With that in mind we have earlier provided a more detailed proof. The discussion they provide on page 21 is clear and composed and we find it very interesting. We agree with their recommendation that time-series data provides a more robust statistical approach to approach to testing for a positive value for alpha. Whilst we have not attempted to summarise the time series literature, we will be surprised if the time series evidence is stronger than the cross-sectional evidence. We note, for example, the correlation between estimates of beta and the intercept term, alpha, that arises in the time series analysis. Overall, APA provide a coherent critique of our position and we would certainly agree with them in recommending an emphasis on time-series approaches to these questions.

Equity beta

3. Stakeholders submitted a September 2018 report from HoustonKemp titled "Australian estimates of the equity beta of a gas business". In relation to a firm with a similar degree of risk as a benchmark efficient firm in the supply of regulated energy network services, please explain your views on the following findings from the report:

- Re-levered firm-level estimates does not support an equity beta of less than 0.7 for pure gas firms
- Re-levered pure-gas portfolio estimates support an increase over time and that recent data does not support a beta less than 0.7.

We do not provide separate answers to the dot points as the same analysis applies to them both. The report by HoustonKemp indicates work that has been carefully done. However, it suffers from two key problems. The first is that in decomposing the beta of a firm into its constituent parts the market value weights of the constituent parts are required. This is because the beta of any portfolio is the weighted average of the betas of the individual assets, where the weights are given by the market value of the individual assets divided by the market value of the portfolio. In this case, market value weights are not available, so they have to be inferred. In the HoustonKemp report this is done on the basis of segmental information contained in the companies' annual reports.

In segmental reporting, accounting data is allocated to particular parts of the organisation, but allocation in accounting is not an exact science. As HoustonKemp point out it is also the case that accounting standards in relation to segmental reporting have changed over the years.

Consequently, attempts to allocate value proportions to different operating segments even in book value terms (as in Table 2) result in approximations.

However, the bigger problem in estimating market value weights is that there is no tight link between book values and market values. Market value to book value ratios are commonly not equal to one and vary through time. Neither can it be assumed that the market to book ratios for the gas and electricity segments of a network business are the same. Indeed, since the argument has been that the nature of the businesses differ and that consequently gas and electricity segments have different risks it is logical that they are quite likely to have different market to book ratios. Consequently, there is quite a big jump in moving from "sector weights" based on accounting data in Table 2 to using those weights as "Proportion of the value of firm" for the portfolio in Table 5. The results for computing the beta of the pure play gas portfolio will be sensitive to errors in weights arising from the measurement problems. How sensitive is an open question.

The second key problem, and it is a major concern for us, is that the betas are estimated using the gearing adjustment. We have repeatedly discussed difficulties with the gearing adjustment, most recently at the concurrent expert evidence session. We have also pointed out that submissions by the network businesses that beta has increased were driven by the gearing adjustment. Consequently, we have placed little weight on the evidence of increases in the re-levered equity beta. If, however, it is generally accepted that the approach to adjusting beta for leverage is correct then there is no need to compute either a re-levered beta, or the weighted average cost of capital. Instead, unlevered betas can be calculated and an industry average taken. This industry average can then be plugged straight into the CAPM to give the required rate of return for the assets of the network businesses. It would be instructive for the AER to undertake this calculation as it would give them an additional benchmark for the allowed rate of return.

HoustonKemp provides estimates for a pure play gas beta both greater than and less than 0.7, but only the evidence for a beta below 0.7 is statistically significant. This is the evidence from the data, but it is mixed evidence and in the light of the issues we raise above we would not regard it as strong evidence in support of a particular value of beta.

4. Stakeholders (ENA, APGA and NSG) have submitted that more weight should be given to short term estimates and that international and other Australian regulators have done so. The ENA also submitted a September 2018 report from John Earwaker titled 'The AER's draft WACC guideline: an international perspective''. The report noted that international regulators tend to give more weight to recent data than the AER with examples from the UK and New Zealand. The report also noted that a recent study commissioned by UK regulators indicated issues with short term estimates which has triggered further investigations. Please advise on how long and short term data should be assessed and used to estimate the equity beta for a forward-looking required return on equity of an efficient firm in the supply of regulated energy network services.

The critical document here is Wright, Burns, Mason and Pickford (2018) who undertake a comprehensive analysis for UK regulators and recommend the use of a long horizon:

"Recommendation 2 (Horizon): On balance, we are in favour of choosing a fairly long horizon, for example, 10 years, in estimating the CAPM-WACC. But we would argue that, more important than the choice of horizon per se is that all components of the CAPM-WACC are estimated using a methodology that is consistent with the chosen horizon."

They return to this point in Appendix G (written by Wright and Robertson) on beta estimation. who state:

"*Our Recommendation 2 (Horizon) emphasised that, while the authors of the report do not have strong views on the choice of horizon regulators make in estimating the CAPM-WACC, it is crucial for all components to be estimated in a way that is as far as possible consistent with that horizon. Recommendation 6 stressed that this is particularly crucial in the context of beta estimation, because if we are concerned to assess the nature of systematic risk at long horizons, we should ensure that our estimation techniques are consistent with that horizon.*" (ibid, page G-139.)

The approach used by Wright and Robertson involves fairly technical models that are not the typical ones used in Australian energy regulation. They use univariate and multivariate GARCH models to assess covariances and variances through time. These two scholars are both very experienced in their academic work and also in terms of their regulatory experience. Professor Wright invented the Wright approach and was also the author of a definitive piece on regulatory

beta written in 2003. As a consequence of this study it seems that the same debates are occurring in the UK and Australia about length of data that is required to estimate beta. They conclude:

"*We certainly do not wish to claim that the above results provide the final word on beta estimation. But they do both encapsulate econometric best practice, by allowing for the clear evidence of time variation in volatility, and help to explain the observed pattern of rolling betas. As such, since, on the most recent samples the latter end up at exceptionally high values, given the evidence of stable long run variances and covariances, this appears to give quite strong grounds to view recent rolling beta estimates as implausibly high. Indeed our results cast strong doubt on the whole approach of using rolling OLS beta estimation (which has indeed always been known to be difficult to defend econometrically)*"

Whether this should change the procedure of for estimation of how to calculate regulatory beta is an open question. On balance, we are not convinced that AER should do anything different than they are currently doing. However, there is merit in consistency between the inputs to the CAPM, ten year risk free rate, an expected market risk premium appropriate to a ten year horizon and a beta estimated over a ten year horizon.

It might be tempting to consider using higher frequency data. For example, we could use daily data for ten years and that might give us more information than before. However, the difficulties with high frequency data has been shown in Hong and Satchell (2012). With higher frequency data there tends to be more autocorrelation in returns. Whilst the correlation is modest, it will influence the value of the beta that is estimated. Furthermore, it is not clear how the problem created by the autocorrelation should be best addressed.

5. Submissions from consumers/consumer groups and networks have focussed on the weight/level of confidence the AER put on the DGM. The ENA, APGA, AusNet and APA stated that the Draft Guidelines' statements on the DGM were overly critical and did not give enough weight to the model when estimating the MRP. In support, they presented work by HoustonKemp which stated that growth rate forecast should not be an issue for the AER when considering the DGM.

The reasons for giving relatively little weight to the DGM estimate are considerably more extensive than the problems in estimating the long term growth rate. We have discussed these issues at length in previous reports and most recently at the concurrent expert evidence session, so we will not recapitulate them here. We will, however, indulge our fondness for quoting Hathaway (2005, p. 3), who said of the DGM:

"*It is a perpetuity model that has constant assumptions, but it is applied in an ever-changing world. The poor thing is not up to the task*."

We do not consider the HoustonKemp estimates for DPS growth to be definitive estimates. They are just another set of estimates to add to the multiple estimates that have previously been proposed. We also observe that towards the end of October 2018, Fenebris, who have no stake in the regulatory process, estimate the nominal long run dividend growth rate to be 2.5% and the nominal market risk premium based on the DGM is estimated to be 4.32%. These values are substantially below the values proposed by the regulated network businesses. The Fenebris estimate of the dividend growth rate is also just another estimate to add to the multiple estimates that have been previously proposed. It does, however, demonstrate the variation in estimates of the long run growth rate and the market risk premium that can be obtained from the DGM, and it has the advantage that there is no underlying self-interest in relation to the regulatory outcome.

a. Having reviewed HoustonKemp's report on dividend growth, to what extent can GDP growth forecasts be used to reliably forecast the dividend growth rate for use in the DGM?

For the following reason, and for reasons discussed at 5c below, we find the HoustonKemp conclusion that the long run dividend growth rate equals the long run growth rate in GDP implausible as a long run equilibrium relation. Australian firms on average have very high dividend

payout ratios, among the highest, if not the highest in the world. In order to help fund these dividends additional shares are being issued, for example by dividend reinvestment plans. It has been well understood since Miller and Modigliani (1961) that this equity dilution has a depressing effect on the growth rate of DPS for existing shareholders.

The implausibility of the HoustonKemp conclusion suggested to us that either there were errors in the computation of DPS, or other errors in the analysis, or that the result represented a period of disequilibrium. With respect to the latter, in 2017 Australia experienced its 26th consecutive year of uninterrupted growth in GDP. This was a world record for a developed country and it is difficult to claim that this is the long run norm. These 26 years comprise over two-thirds of the sample period for the HoustonKemp study and so would have been influential in determining the results of the study.

There was a clear break in the behaviour of dividends over the sample period. Prior to the introduction of the imputation system in 1987 average dividend payout ratios were of the order of forty to fifty percent. Following the introduction of the imputation system average dividend payout ratios increased in response to pressure to distribute imputation credits. As a result, payout ratios increased to be of the order of sixty to seventy percent. This change would have caused an apparent increase in dividend growth rates. However, the apparent increase in growth rates would be misleading. Companies rely heavily on profit retention to fund their investment in replacement assets and new projects. The need for this funding to support investments did not suddenly disappear as payouts rose. The funds had to be replaced and as we discuss next net payouts were substantially lower than apparent payouts. In effect the increase in dividends was being funded by the issue of additional shares.

There clearly are errors in the HoustonKemp DPS estimate because no account is taken of the effect of dividend reinvestment plans, and this leads to an overestimate of dividends per share. Following the introduction of the imputation tax system the use of dividend reinvestment plans grew quite rapidly until it was commonplace.[5] This is unsurprising, given the need for the companies to recover some of the cash to be distributed through the increased dividend payouts. It is common for the participation rates in dividend reinvestment plans to be of the order of thirty

[5] Unlike American dividend reinvestment plans, Australian dividend reinvestment plans involve the issue of new shares, rather than the purchase of existing shares in the market. Consequently, Australian dividend reinvestment plans raise capital and increase the number of shares on issue.

to forty percent and therefore net payouts were substantially lower than the raw DPS values would suggest. Consequently, unless allowance is made for the effect of the dividend reinvestment plans, it is misleading to use the raw DPS in valuations and in inferring the required return from implied cost of capital models, such as the DGM.

Consider for example a company has 1,000 shares on issue and is paying a dividend of $0.40 per share and has a share price of $10.00, giving a dividend yield of 4%. Suppose this company operates a dividend reinvestment plan that has a 25% participation rate then the company's total cash distribution is only $300 and the dividend yield is effectively 3% ($300/$10,000) equivalent to $0.30 per share.

There are other possible sources of measurement error in the HoustonKemp results since DPS is not measured directly but is inferred from the relation between the daily price and accumulation indices for the S&P/ASX all ordinaries. There have been changes in the method of index construction, there are regular changes in the composition of the indices, and the indices are subject to various adjustments for cash dividends, special dividends, and capitalisation changes, such as stock splits, rights offerings, and other types of share issue. The indices also include preference shares, which would have different dividend behaviour to ordinary shares. We would expect that these factors involved in the construction of indices would have second order effects on the accuracy of the inferred DPS. So, we do not expect this to be a significant problem in the HoustonKemp study. We do point out, however, that the choice of adjustment method can have significant effects in some circumstances. For example, Chu and Partington (2001) consider five alternative methods for adjusting for the effect of rights. Adjustments for such capitalisation changes are made by computing dilution factors. Chu and Partington (2001) show that the choice of method for computing rights issue dilution factors can lead to significant differences in dilution factors and in the rates of return that arise from the application of those dilution factors. They conclude p.166:

"*The availability of large computerised databases has been a boon to researchers freeing them from much of the tedium of data collection and management. But at the same time researchers have become distanced from their data. The risk is that uncritical acceptance of that data may well lead the researcher to erroneous conclusions*."

HoustonKemp provide their estimates of real DPS growth rates and real GDP growth rates in Table 1. It is clear that the means of the DPS growth rates are smaller than the means of the GDP growth rates and substantially so in the case of continuously compounded growth rates. It is also clear that the dividend growth rates are much more volatile. The high volatility of DPS growth rates would result in a wide 95% confidence interval and low power statistical tests for differences between the mean DPS and mean GDP growth rates. Indeed, the 95% confidence interval would encompass negative real growth rates in DPS. Thus, the mean values for DPS growth are not particularly helpful as a guide to expected future DPS growth rates and this is a conclusion that we would extend to the overall HoustonKemp analysis.

b. Advise on the usefulness of estimates of long-run DPS growth rate (in the DGM) which are based on geometric means?

HoustonKemp attempt to reject the use of geometric means for computation of expected long run DPS growth rates on the basis that the appropriate investment horizon for determining discount rates is one year. In sections 6a and 6b we explain why the appropriate investment horizon for determining discount rates is at least 10 years and also explain why it is therefore appropriate to consider both arithmetic and geometric means in forming expectations of rates of return. Dividend growth compounds in the same fashion as returns. Consequently, if we take the investment horizon to be 10 years, then we should consider both arithmetic and geometric means in determining the expected DPS growth rate.

However, when we are considering the long run DPS growth rate, we are considering expectations over a much longer period than 10 years. Strictly speaking, we are considering the expected dividend growth rate to infinity. As a practical matter we might not forecast to infinity, but we are looking at a very long period as the expectation horizon. Consequently, the investment horizon (N) will generally be greater than the sample period (T) used for estimating the geometric and arithmetic means.

Blume (1974) finds that the arithmetic mean is an upward biased estimator of expected returns when N is greater than one and T is finite, and that the geometric mean is an upward biased estimator when N is greater than T.[6] Jacquier, Kane and Marcus (2005) extended Blume's analysis

[6] Blume observes that the geometric mean is not consistent. In other words, it does not necessarily converge to the true mean as the sample size T increases towards infinity.

from normal to log normal returns. They also find that both the arithmetic and geometric means are upward biased when *N* is greater than *T*. It can therefore be reasonably concluded that both the arithmetic and geometric means are upward biased estimates of the long run dividend growth rate.

Jacquier Kane and Marcus (2005) derive alternative estimators, one that is unbiased and one that has smaller estimation errors, which we discuss in section 6 below. However, if the choice is between the arithmetic average and the geometric average as an estimator of the long run dividend growth rate, then in terms of accuracy at longer horizons, the results clearly favour the geometric average. To quote Jacquier Kane and Marcus (p.48):

"*To summarize, the catastrophic lack of precision of A, the relatively disappointing imprecision of U, and strong performance of the geometric estimator in the middle range of investment horizons are the striking features of Figure 3.*"

Where A = the arithmetic average, U is the unbiased estimator, G is the geometric average, and Figure 3 from Jacquier Kane and Marcus (2005) is shown below.

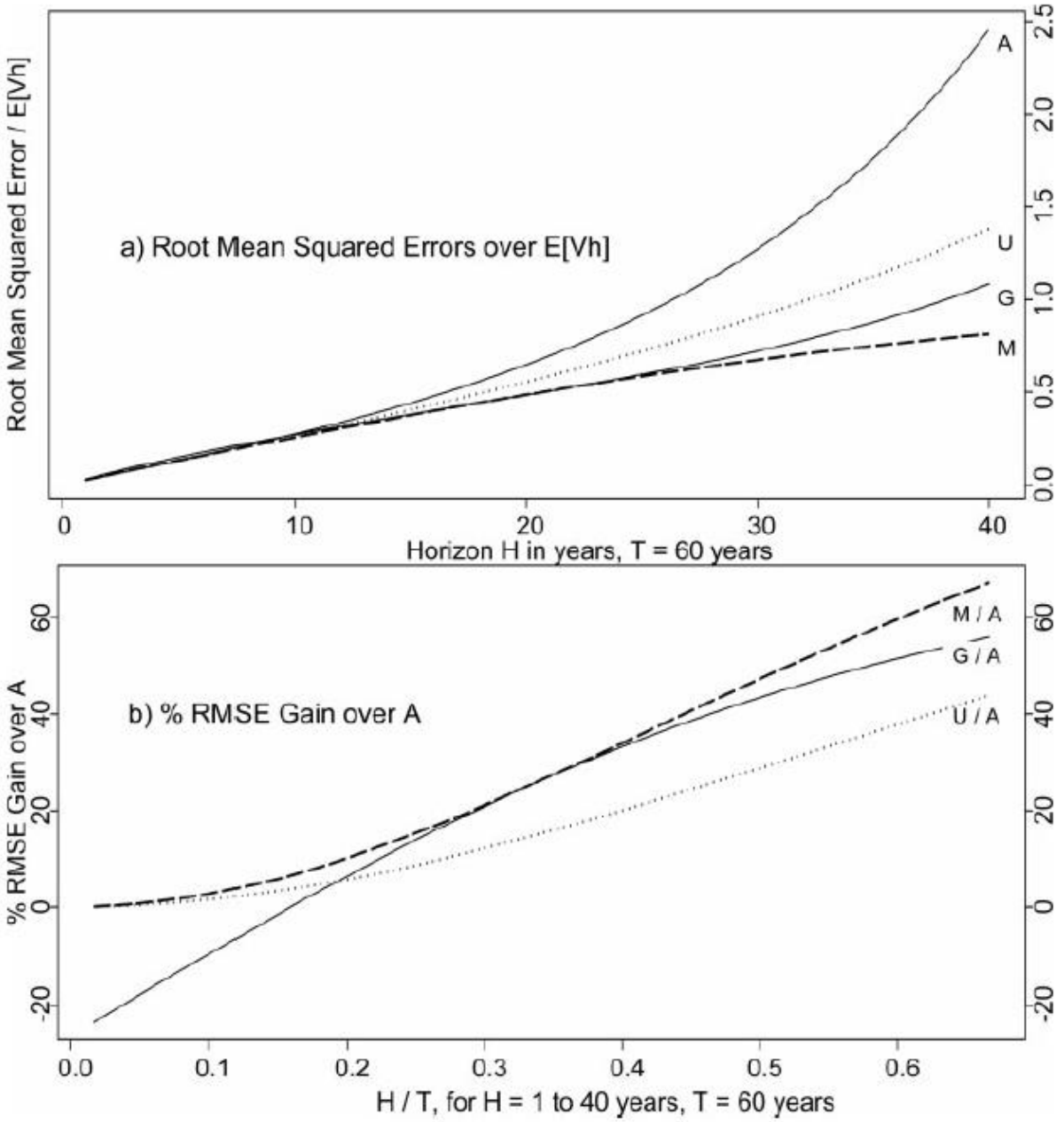

Figure 3 Root mean-squared errors of estimators *A*, *G*, *U*, *M*. $\hat{\mu} = 0.1$, $\sigma = 0.2$, $T = 60$ years.

Source: Jacquier Kane and Marcus (2005), where M is the minimum error estimator.

In summary, the geometric mean is preferable, relative to the arithmetic mean, as an estimate of the long term dividend growth rate. In contrast to HostonKemp's argument that no weight should be given to the geometric mean, there is a very much stronger argument that all the weight should be given to the geometric mean. Although an upward biased estimate of the long run dividend growth rate is the expected outcome, it avoids the "catastrophic lack of precision" of the arithmetic mean.

c. Should the AER be adjusting the real DPS growth rate downwards from real GDP growth (to account for new capital entering the market) as stated in Bernstein and Arnott (2004) and previous AER work on the DGM?

Yes, the AER should be adjusting the real growth rate downwards because some of the growth in GDP will come from additional investment funded in part by new capital obtained from share issues by existing companies, and as we explain in section 5c there will be dilution from shares issued to fund dividend payouts. Some of the growth will come from additional investment in capital contributed for shares issued by companies that do not currently exist. Consequently, all of the future growth in GDP will not accrue to shares currently on issue. Thus, it is infeasible for the DPS of existing shares to grow at the growth rate of GDP.

Cornell (2010) makes similar points with respect to earnings. Earnings are relevant here since dividends cannot grow faster than earnings, except in the short run when dividends can be financed by share issues. The latter naturally depresses the future dividend growth rates for existing shareholders. Cornell emphasises the earnings dilution for existing shareholders caused by start-up companies. He provides the following simple illustration to demonstrate why the earnings attributable to existing shareholders grow more slowly than the economy.

"… consider a simple example in which all companies in the economy are identical and earn $10 per share per period. Furthermore, assume that each company has a market value of $100 per share and has 1,000 shares outstanding. All earnings are paid out, so the values of the companies remain constant. Finally, assume that at the outset there are only two companies in the economy so that aggregate earnings are$20,000. If a current investor holds 1% of each company, his pro rata share of aggregate earnings is $200. Now assume that the economy grows, and a third company is started. As a result, aggregate earnings rise to $30,000, but the current investor does not participate in that growth. He still holds 1% of the first two companies with rights to earnings of $200.To add the third company to his portfolio, without investing new cash, the current investor would have to dilute his holdings of the first two companies. After the dilution, the investor would hold 0.67% of each of the three companies and, thereby, still have rights to earnings of $200. Thus, the growth in earnings experienced by the current investor does not match the growth in aggregate earnings."

Cornell's analysis is backed up by the evidence of Barra (2010) where the results show that for the period 1969 to 2009, across the 16 developed countries studied, real EPS growth was lower than real GDP growth in all cases. In the case of Australia real EPS growth was 0.5%, which was 2.7% lower than real GDP growth.

Bernstein and Arnott's (2003) headline estimate is that growth for existing shareholders is about 2% lower than GDP growth. Cornell (2010) utilises Bernstein and Arnott's method of estimating dilution and finds that for the US economy from 1926 to 2008 the average rate of earnings dilution was 2%. Bernstein and Arnott estimate that in the case of Australia DPS growth was about 2.4% less than real GDP growth. Thus, the evidence both internationally and for Australia is that DPS and EPS grow substantially more slowly than the growth rate in GDP.

d. Assuming any required adjustment to forecast of GDP growth can be made, how reliable are long run forecasts of GDP growth likely to be?

Forecasts of GDP growth could not be called outstandingly accurate in the short to medium term, see for example Tease (2015) and Davis (2017). Relative to short-run forecasts, long run forecasts embody more sources of uncertainty. For example, will growth in productivity and changes in the labour force participation rate offset the impact of an aging population and substantial increases in the proportion of the population of retirement age and above? Will the current trade conflict between the USA and China lead to an extended period of protectionism with a long term dampening of world trade? In particular, will the trade war have long term consequences for Australia's trade with China? Although, it also may be that in the forecasting of long run GDP, the period by period errors average out.

However, in computing the investors required rate of return, the accuracy of long run GDP forecasts is not really the relevant question. The relevant question is what forecast of GDP are investors using in forming their estimate of the dividend growth rate? This is an open question. However, if the estimates of GDP growth are based on historic averages of the GDP growth rate this leads us back into the discussion of the choice between arithmetic and geometric averages. When making long run forecasts, as discussed under 5b, the geometric average will provide a better estimate of the expected long run GDP growth rate.

6. A common theme in submissions has been the choice between geometric and arithmetic averages.

a. Based on the submissions, please advise on the use of the geometric averages of historic returns and its appropriateness for estimating a forward looking MRP?

Consider the following investment. A million dollars is invested and in the first year it earns a 100% return, doubling to two million dollars. In the second year there is a negative return of 50% so that at the end of two years the investment has a value of one million dollars. The arithmetic average return on this investment is 25% and the geometric average return is zero. Given this data on investment returns and contemplating a long-term investment, we expect that many readers of this report would feel uneasy about using 25% as forecast of the returns that they should expect.[7] They would be correct to feel uneasy. Following Blume's (1974) paper it has been widely accepted that compounding the arithmetic average of one period returns gives an upward biased estimator of expected return over *N* periods. Blume also shows that compounding the geometric average of one period returns underestimates the expected return over *N* periods when the sample period *T* exceeds N. Thus, Blume concludes that an unbiased estimate of the expected *N* period returns lies between the compounded value of the arithmetic mean and the geometric mean.

Blume's (1974) analysis is extended by Indro and Lee (1997) to include the effect of negative autocorrelation (mean reversion) in returns and time varying volatility. They confirm Blume's finding of the biases inherent in the use of arithmetic and geometric averages and that the biases tend to be exacerbated in the presence of autocorrelation in returns. They also find that the bias arising from the use of the arithmetic average increases as the investment horizon (*N*) lengthens and also as the volatility of returns increases. The geometric average also shows increased bias as the volatility of returns increases.[8]

Blume (1974) makes the point that the one-period arithmetic average return is an unbiased estimate of the one period expected return. Thus, the one-year arithmetic average return is widely viewed as an unbiased estimate of the one year expected return. It has subsequently been argued, by consultants to the regulated network businesses, that since the AER does not

[7] Some readers may also feel uneasy about using 25% as a forecast of returns even over an investment horizon as short as a year.
[8] Similar results are reported by HoustonKemp (2018, Memo) Table 4, for estimates of the dividend growth rate.

compound returns, except they argue in a minor way, the appropriate basis for estimating the MRP (market risk premium) is to use the annual arithmetic average of the MRP. We note that several of the submissions, other than by the regulated networks, strongly oppose this view.

The objective for the AER is to determine the rate of return that investors expect in equilibrium, and investors do compound returns. The fundamental principle involved is to determine what return the capital market requires for a long-term investment with the same risk as the network businesses, and in equilibrium this return is equal to the investors' expected long term return. Thus, whether or not the AER compounds returns is not the relevant issue.

It is clear that utility investments are typically very long-term investments. This is consistent with the ten-year government bond rate being used as r_f (the risk-free rate) in the AER's application of the CAPM. Use of the ten-year government bond rate is standard practice for the measurement of returns appropriate to investment over a long horizon.[9] It was also suggested in the concurrent expert evidence session that many investors in the regulated utilities had long investment horizons, for example 20 years. Over a long horizon, therefore, the use of the annual arithmetic average MRP will give rise to an upward biased estimate of expected returns.

Using a one-year arithmetic average of the MRP is inconsistent with the use of the ten-year government bond rate as r_f. To be consistent, the one-year arithmetic average for the MRP should be used with the one-year government bond rate for r_f and a one-year horizon for investment. This, however, does not match the nature of the investments that the regulated businesses make.

Since the unbiased estimate of the expected return for a long-term investment is bounded by the arithmetic and geometric averages, both are relevant to the determination of the MRP for a long horizon investment. Blume (1974), assumes returns are normally distributed and proposes a weighting scheme for combining the geometric and arithmetic averages of value relatives to give approximately unbiased estimates of the expected return. Given a horizon of N periods and a sample of one period returns over T periods, the weight (w_A) attached to the arithmetic mean

[9] Given the very long term nature of utility assets it is debateable whether 10 years is a sufficiently long horizon, but as a practical matter 10 years is commonly taken as the horizon for estimating the required return of long lived assets including the required return on equity.

return is (T-N)/(T-1) and the weight (w_G) attached to the geometric mean return is (1- w_A) = (1-N)/(T-1).

Alternative weighting schemes are provided by Jacquier Kane and Marcus (2003, 2005) under the assumption that returns are log-normal. They provide weightings for an unbiased estimator and for an efficient estimator. The latter assumes that losses from errors in the estimate are minimised by minimising the mean squared error. The weightings for the unbiased estimator are: $w_A = 1 - N/T$ and w_G = 1- $w_A = N/T$. For the efficient estimator the weightings are: $w_A = 1 - 3N/T$ and w_G = 1- $w_A = 3N/T$.

For the unbiased estimator, there is generally not much difference between Blume's (1974) weightings and those of Jaquier Kane and Marcus (2003). When the investment horizon (N) is substantially less than the number of observations (T) of one period returns, the weighting scheme give substantially more weight to the arithmetic mean. As the sample period shortens, or if there is more concern for accuracy over unbiasedness, then the weight on the geometric average increases. These effects are illustrated in Table 1. For example, if the horizon is 10 years and there are 50 observations of annual returns, then for an unbiased estimator the weight for the arithmetic average is about 80% and for an efficient estimator the weight on the arithmetic average is 40%. In the light of the foregoing discussion, it is clear that the AER should give some weight to the geometric average in determining a forward looking MRP. We have more to say on the weighting of the geometric average in the following discussion in section 6b.

Table 1: Weights for Arithmetic and Geometric Averages

		Blume Unbiased		Jacquier Unbiased		Jacquier Efficient	
N	T	w_A	w_G	w_A	w_G	w_A	w_G
10	50	0.82	0.18	0.80	0.20	0.40	0.60
10	100	0.91	0.09	0.90	0.10	0.70	0.30

b. The CRG submitted a report detailing a method of estimating the forward looking MRP by taking the rolling geometric average of sequential years, then taking the arithmetic average of those averages. Please comment on the potential benefits and/or limitations of this approach for the AER's estimation of the MRP.

As well as his weighted estimator, Blume (1974) suggests two alternative unbiased estimators of the long horizon expected return, which he calls the simple unbiased estimator and the overlapped unbiased estimator. The simple unbiased estimator takes the one period returns and compounds them to give one plus the *N* period return, that is the *N* period value relative. This procedure is applied to the first set of one period returns of size *N*, and then to the next set of *N* one period returns starting at *N*+1 and so on until all the *T* observations have been used. The result is several estimates of the *N* period value relative, which are then averaged. The unbiased estimate of the expected *N* period return can then be obtained by subtracting one from the average value relative. The overlapped unbiased estimator is similar, except that a rolling window is used. One return observation is added and one return observation is dropped as the window rolls forward one period at a time.

CRG (2018, p. xiv) provide geometric return estimates of the MRP based on the average historic equity return (HER) and these are given in Table 2 below. They describe their estimation process in the quote below and at first sight there appears to be some similarity to Blume's approach.

"*On this basis the CRG recalculated the HER as an investment compounding over a 5 year period by using the geometric mean over the 5 year investment period and then arithmetically averaging the 5 year geometric means over the entire period of the data; for periods of 2 years and 10 years.*"

Table 2: CRG (2018) Computation of Geometric Returns

Period	AER MRP (Geo)	AER MRP (Arith)	CRG MRP (Arith of 2 year Geo)	CRG MRP (Arith of 5 year Geo)	CRG MRP (Arith of 10 year Geo)
1883-2017	0.050	0.063	0.055	0.050	0.048
1937-2017	0.042	0.060	0.049	0.045	0.044
1958-2017	0.042	0.065	0.051	0.044	0.041
1980-2017	0.043	0.064	0.052	0.047	0.041
1988-2017	0.045	0.060	0.054	0.048	0.044
2000-2017	0.044	0.061	0.050	0.046	0.045

Source: CRG based on AER data, including the effect of imputation (theta = 0.6)

From CRG's description it is not entirely clear to us what CRG actually did. There are two main areas of ambiguity. The question from the AER at 6b states that a rolling geometric average was used, but from the description above it is not clear whether the 5 year estimation windows were non-overlapping, or overlapping windows. More importantly, it is not clear whether CRG took the geometric average of the individual year's returns, or the geometric average of the five year's compounding factors (value relatives) and then subtracted 1 to get the average geometric return. The former would have the issues of downward bias associated with geometric averages of returns. The latter would give the annual return that when compounded over five years would result in the actual five year value relative. If the next step had been to average the five year value relatives, the result would have been Blume's unbiased estimator. This is what we recommend should have been done. The average one year geometric return could then be computed from the average five year value relative.

Comparing the MRPs computed by CRG with the AER's MRP estimate based on annual geometric returns (see Table 2), they are quite similar. This suggests to us that CRG may have taken the geometric average of annual returns (not value relatives) over five year periods, which would give a downward biased estimator. It is also evident that no standard errors are reported for the CRG estimates. As we discuss below for Blume's estimator, the standard errors are likely to be substantial. It is entirely plausible that the 95% confidence interval easily encompasses a 6% MRP. We see little merit in the CRG geometric return estimates.

One factor that has inhibited the use of Blume's (1974) simple unbiased estimator is the limited number of data points that are obtained. For example, with N = 10 and 100 years of data, there will only be 10 estimates of the ten year geometric return. With volatile returns, relatively small samples are likely to result in large standard errors. Neither, as Blume (1974) demonstrates, does the use of the overlapped estimator help in improving precision. Blume provides both a theoretical example and simulation results in which the standard error of the overlapped unbiased estimator is higher than the standard error of the simple unbiased estimator.

A more extensive simulation study was undertaken by Indro and Lee (1997). They compare the bias and efficiency (magnitude of the standard error) for the arithmetic average, geometric average, Blume's weighted average and the overlapped unbiased estimator, but they did not simulate the simple unbiased estimator. The results vary somewhat depending on the length of

the investment horizon, the level of autocorrelation, the volatility of returns and the extent to which volatility was time varying. In some cases, the weighted average provided the estimate that was closest to the true value, in other cases it was the overlapped estimate. However, of the four estimators used, the overlapped estimator was consistently the least efficient estimator (highest standard error).

In summary, the potential benefit of correctly estimating an *N* period estimator of returns is that it provides an unbiased estimator of the expected return for investment horizons of length *N*. The limitation of the approach is that it is likely to be an estimate with a wide confidence interval. An alternative is to use a weighted estimator, but then the question becomes which weighting scheme to use. The choice of weighting scheme hinges on two issues, what is the distribution of returns[10] and how important is unbiasedness relative to greater accuracy? The former question has several possible answers, the latter question requires the exercise of judgement. If greater accuracy is desired, the question is what loss function should be used in the assessment of accuracy? Having chosen a weighting scheme there is then the task of selecting the appropriate investment horizon (*N*) and the appropriate sample period (*T*). Since determining the weights to attach to the arithmetic and geometric averages involves several questions that have contestable answers, the AER inevitably needs to exercise judgement in making this determination. However, it is clear that some weight should be attached to the geometric return and that weight should be greater the more the concern for accuracy relative to unbiasedness. [11] The mean square error, which is the equal to the bias squared plus the variance, combines both features.

[10] The difference between weightings for the unbiased estimator for normal and log-normal distributions is small, but this is not necessarily the case for other possible return distributions.

[11] Much previous regulatory discussion of the arithmetic and geometric averages has focussed on the unbiasedness of the MRP estimator. However, in discussion of the length of the sample period *T*, the case is commonly put that a long period is needed to improve the standard error (accuracy) of the estimate. It would therefore be consistent to take into account the impact on accuracy of combining the arithmetic and geometric averages.

7. Submissions on the MRP highlighted a potential relationship, or lack thereof, with the risk free rate. Taking into account Appendix B of the SACES report and other submissions on the subject please comment on:

a) If the relationship between the risk free rate and the MRP can be reliably determined for use in estimating a forward looking MRP.

The SACES report shows, in Appendix B, regression analysis between MRP and bond rates. This is carefully done and, using excess returns in year t as a proxy for the MRP in year t, finds no relation between the MRP and bond rates. (i.e. SACES cannot reject the hypothesis that the regression coefficient is zero). They do point out, however, that the data are highly variable and that one cannot also reject the hypothesis that the regression slope is -1. Thus, the evidence from SACES is that the relation between the risk free rate and the proxy for the MRP (excess returns) cannot be reliably determined.

In Partington and Satchell (2018) we discussed the evidence of Ilmanen (2003) and Rankin and Idil (2014) that the correlation between the return on the market and the government bond yield was generally positive during the 20th Century, but that there have been periods of negative correlation in the 1930s, 1950s, and since the latter part of the 1990s. A positive correlation between the return on the market and bond yields is equivalent to a negative correlation between the level of the market index and bond yields. The evidence mainly relates to the US market, but Rankin and Idil also report similar results for Australia. What the evidence shows is that stock markets tend to rise when bond yields fall and vice versa, but sometimes this pattern reverses. While this is not a direct analysis of the relation between bond yields and the MRP, the fact that the that equity markets generally rise when bond yields fall is not consistent with a fall in bond yields being associated with an increase in the MRP. The fact that the correlation changes sign at times suggests that estimating a reliable relation between the MRP and bond yields is an unlikely outcome.

b) Whether such a link is necessarily causal or just correlation.

As always, it is helpful to see what theory might say on this question, without assuming that the theory is a perfect fit for the Australian economy and the Australian energy market. Abel (2006) provides a general equilibrium model of the equity risk premium and the term structure where the primitives involved are agents' multi-period utility functions and a benchmark level of

consumption that allows for such realistic features as habit formation and keeping up with the Jones. The point being that the risk free rate and the MRP are both jointly determined rather than there being a necessary causal link between them. Although Abel does not calculate the correlation between the risk-free rate and the MRP, it would be possible to do so and such a result could inform future discussion.

We have not provided comprehensive review of theory on this subject, but we are sympathetic to the claim of SACES that mainstream theories do not provide any rationale for a negative correlation between the MRP and bond rates. Empirically such correlations might exist at a point in time, but as the discussion at 7a suggests, it is unlikely that this would form the basis of a reliable estimate of a forward looking MRP. In particular we would give no credence on any claim of such a relation ship based on estimates of the MRP from the DGM.

Equity cross checks

Please explain your views on the HoustonKemp report – 'The relation between the equity and debt risk premiums' including considering:

a) The use of the Merton model for assessing the relationship between the equity and debt risk premium.

The Merton model provides a well-accepted theoretical framework. While the model is derived under restrictive assumptions it can reasonably be used to analyse the relation between the equity risk premium and the defaultable/corporate debt risk premium.

b) The conclusions that:

- the equity risk premium and the debt risk premium need not move together in lockstep so that the gap between the two risk premiums need not remain constant

This statement is true since the return on equity and the return on debt are measured differently. The return on equity represents an expected return, while the return on debt is measured as a promised return. The risk premium on debt, often called the credit spread, is equal to the promised return minus the risk free rate. The return promised on the debt may not be the return delivered as there may be default on the debt. Thus, the debt risk premium depends in part on default risk. The bigger the probability of losses due to default and the larger the expected loss given default, the larger the promised return required to offset the potential losses. Consequently, the debt risk premium increases. Changes in default risk, or the expected loss given

default, may change the debt risk premium, without necessarily leading to a change in the equity risk premium. Clearly the expected return on equity and the promised return on debt need not move in lockstep and the same is true for their respective risk premia. We note that this is a robust result that can be demonstrated without resort to the Merton model.

The value of debt and equity can have differential responses to changes in factors relating to the value of the firm, the risk free rate, the time to maturity of the debt, the face value of the debt and the standard deviation of the firm's returns. The consequence is that depending on the variables that are changing and the direction of their change the risk premiums of debt and equity may move together or apart. As HoustonKemp show there can be differential movements in the magnitude of debt and equity betas, for example as the volatility of the firm's returns changes. Consequently, the expected returns on equity and debt can move together or apart and this feeds through into the risk premiums.

- the equity risk premium and the debt risk premium need not even necessarily move together

For the reasons discussed above, this statement is true in theory, but as HoustonKemp observe, whether it is true in practice is an empirical question. An extended period of low debt premiums coupled with an extended period of low volatility in equity markets suggests a stable low risk environment. In a stable low risk environment, it is more likely for the equity risk premium to be lower rather than higher. The environment that has prevailed over recent years is, therefore, one where the joint observation of a low debt risk premium and a low equity risk premium is likely.

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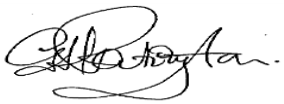
Expert Witness Compliance Declaration

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

Return on equity questions

The AER requires advice from the consultant on the rate of return that achieves the National Gas and Electricity Objectives.

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 in the draft decision for the 2018 rate of return guidelines; or
- Consider that any of the AER's point estimates in the draft guideline for equity beta (or 0.6) , the market risk premium (of 6% p.a. compounded annually), or the overall equity risk premium (of 3.60% p.a. compounded annually) would be unlikely to achieve the National Gas or Electricity objective

for the purpose of estimating a forward-looking required return on equity of an efficient firm in the supply of regulated energy network services, which is the return that is just sufficient to induce investors to invest in the business.

In providing its advice, the consultant should have regard to:

- The draft 2018 rate of return guidelines (that includes both the actual Draft guideline and the explanatory statement published with this document)
- Independent Panel, Review of the Australian Energy Regulator's rate of return draft guidelines, 7 September 2018.
- The likelihood that the rate of return on equity is to be applied as part of a binding rate of return guideline (details provided below)
- The revenue and pricing principles in National Electricity Law and National Gas Law (details provided below)
- A range of relevant material including:
    - the current 2013 Guidelines,
    - issues/discussion papers and submissions published as part of our 2018 review of our Guideline,
    - the concurrent expert evidence sessions,
    - previous expert advice provided to the AER,
    - expert reports commissioned by regulated energy businesses and any other stakeholders and submitted to the AER during past regulatory determination processes,
    - previous and current regulatory proposal from regulated energy businesses.

The consultant may comment on their assumptions, methodological choices and findings in their advice.

While specific topics are raised and questions are asked below, the consultants may comment on any issue they consider relevant to risk, the return on equity and overall rate of return for the benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of regulated energy network services.

The consultant/s may also wish to respond to any criticisms levelled against positions/findings in previous advice to the AER.

Black CAPM and low beta bias

3. Stakeholders submitted a September 2018 report from Frontier titled "Low beta bias and the Black CAPM". Please explain your views on the following findings from the report:

- Frontier's conclusion that low beta bias exists on an ex-ante basis for Australian data
- Literature on ex ante required returns demonstrating the relationship between beta and required returns has a higher intercept and a flatter slope than the SLCAPM would suggest
- Analyst forecasts (particularly 1 year forecasts) are suitable for proxying expected returns when testing for low beta bias
- Evidence of low beta bias indicates that actual returns can be used to estimated required returns as is the case for estimating the market risk premium and equity beta
- Observed returns are typically used as a proxy for expected/required returns in standard empirical finance.
- If observed returns cannot be relied upon to reflect investors' required/expected returns for the purposes of assessing low-beta bias, they cannot be relied upon for any other purpose such as MRP and beta estimation
- Academic literature shows the relationship between beta and required returns has a higher intercept and a flatter slope than the SLCAPM would suggest

4. In submissions in response to the draft 2018 guidelines, regulated networks and network associations continue to support giving weight to the low beta bias and Black CAPM. Consumer Reference Group (including report from SA Centre for Economic Studies [SACES], Consumer Challenge Panel, Energy Consumers Australia support not giving weigh to low beta bias and Black CAPM.

Please advise on the regard that should be given to the low beta bias and/or Black CAPM when estimating the forward-looking required return on equity using the SLCAPM for firms with a similar degree of risk as efficient firms supplying regulated energy network services.

Equity beta

5. Stakeholders submitted a September 2018 report from HoustonKemp titled "Australian estimates of the equity beta of a gas business". In relation to a firm with a similar degree of risk as a benchmark efficient firm in the supply of regulated energy network services, please explain your views on the following findings from the report:

- Re-levered firm-level estimates does not support an equity beta of less than 0.7 for pure gas firms
- Re-levered pure-gas portfolio estimates support an increase over time and that recent data does not support a beta less than 0.7.

6. Stakeholders (ENA, APGA and NSG) have submitted that more weight should be given to short term estimates and that international and other Australian regulators have done

so. The ENA also submitted a September 2018 report from John Earwaker titled 'The AER's draft WACC guideline: an international perspective''. The report noted that international regulators tend to give more weight to recent data than the AER with examples from the UK and New Zealand. The report also noted that a recent study commissioned by UK regulators indicated issues with short term estimates which has triggered further investigations. Please advise on how long and short term data should be assessed and used to estimate the equity beta for a forward-looking required return on equity of an efficient firm in the supply of regulated energy network services.

Market risk premium

7. Submissions from consumers/consumer groups and networks have focussed on the weight/level of confidence the AER put on the DGM. The ENA, APGA, AusNet and APA stated that the Draft Guidelines' statements on the DGM were overly critical and did not give enough weight to the model when estimating the MRP. In support, they presented work by HoustonKemp which stated that growth rate forecast should not be an issue for the AER when considering the DGM.
    a. Having reviewed HoustonKemp's report on dividend growth, to what extent can GDP growth forecasts be used to reliably forecast the dividend growth rate for use in the DGM?
    b. Advise on the usefulness of estimates of long-run DPS growth rate (in the DGM) which are based on geometric means?
    c. Should the AER be adjusting the real DPS growth rate downwards from real GDP growth (to account for new capital entering the market) as stated in Bernstein and Arnott (2004) and previous AER work on the DGM?
    d. Assuming any required adjustment to forecast of GDP growth can be made, how reliable are long run forecasts of GDP growth likely to be?
8. A common theme in submissions has been the choice between geometric and arithmetic averages.
    a. Based on the submissions, please advise on the use of the geometric averages of historic returns and its appropriateness for estimating a forward looking MRP?
    b. The CRG submitted a report detailing a method of estimating the forward looking MRP by taking the rolling geometric average of sequential years, then taking the arithmetic average of those averages. Please comment on the potential benefits and/or limitations of this approach for the AER's estimation of the MRP.
9. Submissions on the MRP highlighted a potential relationship, or lack thereof, with the risk free rate. Taking into account Appendix B of the SACES report and other submissions on the subject please comment on:
    a. If the relationship between the risk free rate and the MRP can be reliably determined for use in estimating a forward looking MRP.
    b. Whether such a link is necessarily causal or just correlation.

Equity cross checks

10. Please explain your views on the HoustonKemp report – 'The relation between the equity and debt risk premiums' including considering:
    a. The use of the Merton model for assessing the relationship between the equity and debt risk premium.
    b. The conclusions that:

- the equity risk premium and the debt risk premium need not move together in lockstep so that the gap between the two risk premiums need not remain constant

- the equity risk premium and the debt risk premium need not even necessarily move together

11. ***(To be confirmed)*** *Submissions such as those from the Energy Network Association (ENA) and Network Shareholder Group (NSG) compared the draft 2018 Guidelines' equity risk premium and return on equity with those from international regulators. The ENA has also submitted a September 2018 report titled 'The AER's draft WACC guideline: an international perspective' that compared the draft 2018 Guidelines' return on equity estimates with those from international regulators. Please provide your views on what extent regard should be given to estimates from international regulators when estimating the forward looking return on equity for a benchmark efficient firm with a similar degree of risk as that in the supply of regulated energy network services.*

Appendix 2

CURRICULUM VITAE GRAHAM PARTINGTON

PERSONAL

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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 forty 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 of the order of fifty 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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G. Partington, and M. Kim, 2014 *The Dynamic Prediction of Company Failure: The Influence of Time Non-linearity and the Economy*, 2014 China Meeting of the Econometric Society, Xiamen, China, 25 - 27 June.

S. Foley, G. Partington, J. Svec and N. Pritcha, 2014 *The Effects of Underwriting Dividend Reinvestment Plans*, CFA-JCF-Schulich Conference on Financial Market Misconduct, Toronto, April.

R. Philip, P. Buchen and G. Partington, 2013, *Returns and Doubling Times,* Global Business Research Conference, Kathmandu. (Best paper prize for accounting, banking economics and finance.)

R. Philip, P. Buchen and G. Partington, 2013, *The transformation of returns to the time domain as doubling times*, 6th MEAFA Workshop, Sydney

M. McKenzie and G. Partington, 2012, *Selectivity and Sample Bias in Dividend Drop-off Studies*, 10th INFINITI Conference on International Finance, Dublin.

L. Hodgkinson and G. Partington, 2011 *Capital Gains Tax Managed Funds and the Value of Dividends*, Accounting and Finance Association of Australia and New ZealandConference, Darwin.

A. Jun and G. Partington 2011, *Taxes International Clienteles and the Value of ADR Dividends*, 9th INFINITI Conference on International Finance, Dublin.

A. Ainsworth, K. Fong, D. Gallagher, and G. Partington, 2010, *Taxes, Price Pressure and Order Imbalance around the Ex-Dividend Day*, Financial Management Association (FMA) Asian Conference, Singapore

H. Dang and G. Partington, 2010, *The Dynamic Estimation of Rating Migration Hazard*, Finance and Corporate Governance Conference, Melbourne, (Awarded the GARP prize in Quantitative finance/Risk Management/Derivatives).

Partington G and Xu Y 2010, *Rights issue announcements motives and price response,* 8th INFINITI Conference on International Finance - International Credit and Financial Market Integration: After the Storm?, Dublin.

A. Ainsworth, K. Fong, D. Gallagher, and G. Partington, 2009, *Institutional Trading Around the Ex-Dividend Day*, Asian Finance Association Conference, Brisbane. Awarded the CFA best paper prize (Asian Investments.)

H. Dang and G. Partington, 2009, *Rating Migrations: The Effect of History and Time*, Financial Management Association (FMA) European Conference, Turin.

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G. Partington, M. Stevenson, and J. Yao, 2008, *Predicting the Directional Change in Consumer Sentiment*, The 28th Annual Symposium on Forecasting, Nice.

M. Kim and G. Partington, 2008, *The Dynamic Prediction of Corporate Failure*, Australasian Finance and Banking Conference.

M. Dempsey and G. Partington, 2007, *Cost of Capital and Valuation Equations that Work for Any Tax System: Their Application under the Australian Imputation Tax System*, Multinational Finance Society Conference, Thessalonica.

H. Dang and G. Partington, 2007, *Modeling Rating Migrations*, Poster Session, CREDIT Conference, Venice

G. Truong and G. Partington, 2007, *Alternative Estimates of the Cost of Equity Capital for Australian Firms*, 20th Australasian Finance and Banking Conference, Sydney,

G. Partington, 2006, *Dividend Imputation Credits and Valuation*, Business Tax Reform Meet the Critics, Australian Tax Research Foundation Conference, Sydney.

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G. Partington, P Russell, M. Stevenson and V. Torbey, 2001, *Predicting Return Outcomes for the Shareholders of Companies Entering Chapter 11 Bankruptcy*, Accounting Association of Australia and New Zealand Conference, Auckland.

H. Chu, L. Hodgkinson and G. Partington, 2001, *Right's Trade Adjustments: Evidence from the UK,* British Accounting Association Conference, Nottingham

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V. Alaganar, G. Partington and M. Stevenson, 2000, *Do Ex-dividend Drop-offs Differ Across Markets? Evidence From Internationally Traded* (*ADR*) *Stocks*, Accounting Association of Australia and New Zealand Conference, Hamilton Island.

G. Partington and S. Walker, 2000, *A Theory of Ex-Dividend Equilibrium Under Imputation and Some Empirical Results*, Accounting Association of Australia and New Zealand Conference, Hamilton Island,.

G Partington and S. Walker, 1999, *The 45-Day Rule: The Pricing of Dividends and the Crackdown on Trading in Imputation Credits*, Accounting Association of Australia and New Zealand Conference, Cairns.

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G. Hobbes, G. Partington and M. Stevenson, 1997, *A General Model of Earnings Dividends and Returns,* Australasian Finance and Banking Conference, University New South Wales, Sydney.

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G. Hobbes, G. Partington and M. Stevenson, 1995, *Earnings Dividends and Returns: A Theoretical Model,* Asia-Pacific Finance Association Conference, Hong Kong.

G. Partington and E. Hutson, 1994, *Share Prices, Takeover Outcomes and the Expected Value Hypothesis*, invited paper at the University of Wales Finance & Accounting Colloquium, Gegynog.

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G. Partington, M. Peat and M. Stevenson, 1992, *The Probability and Timing of Corporate Financial Distress: Preliminary Results for Australia,* Australasian Finance and Banking Conference, Sydney.

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P. Eddey, G. Partington and M. Stevenson, 1989, *Predicting the Probability and Timing of Takeover Success,* Australasian Finance and Banking Conference, Sydney.

G. Partington and T. Valentine 1984, *Finance for Australian Industry*, Metal Trades Industry Conference, Sydney.

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R. Philip, A. Kwan, G. Partington, 2015, *Is High Frequency Trading Good for Market Quality?* A Report to the Centre for International Finance and Regulation.

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A. Ainsworth, G. Partington, G. Warren, (2015) *Do Franking Credits Matter: Exploring the Financial Implications of Dividend Imputation,* Australian Tax Review 2015, Submission on the Australian Tax Discussion Paper, on Behalf of the Centre for International Financial Regulation (CIFR)

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.

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

<u>CURRENT RESEARCH</u>

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

Steady State Distributions for Models of Locally Explosive Regimes: Existence and Econometric Implications (with J.Knight and N. Srivastava) in *Economic Modelling.* (A) Volume 41, August 2014,

Pages 281-288, ISSN 0264-9993, http://dx.doi.org/10.1016/j.econmod.2014.03.015. (http://www.sciencedirect.com/science/article/pii/S0264999314001114)

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

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'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

What factors drive the US labour market?(with S.Ahmed and P.Burchardt

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

Art as a Luxury Good, with N. Srivastava in"*Risk and Uncertainty in the Art World*", edited by A. Dempster, ;Chapter 9, Bloomsbury Publishing, London; 2014.

Quantitative Approaches to High Net Worth Investment (with A. Rudd,) 2014, (London, Risk Books,2014).

High Net Worth Consumption: The Role of Luxury Goods" (with N. Srivastava,)in *Quantitative Approaches to High Net Worth Investment*, edited by Steve Satchell and Andrew Rudd, 183–212. London: Risk Books,2014.

Modelling Sustainable Spending Plans for Family Offices, Foundations and Trusts (with S. Thorp) in *Quantitative Approaches to High Net Worth Investment*, edited by Steve Satchell and Andrew Rudd, 213–251. London: Risk Books, 2014.

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

Sequential Variable Selection as Bayesian Pragmatism in Linear Factor Models

(with John Knight, Jessica Qi Zhang) in *Journal of Mathematical Finance*

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Portfolio Skewness and Kurtosis (with A.D. Hall) in *Journal of Asset Management* 14, 228–235. doi:10.1057/jam.2013.18

2012 PUBLICATIONS

Financial Competence and Expectations Formation: Evidence from Australia, (with H. Bateman, C. Eckert, J. Louviere, and S. Thorp), *Economic Record*, Vol. 88, Issue 280, pp. 39-63, March 2012.

Unsmoothing Real Estate Returns: A Regime-Switching Approach"(with C. Lizieri and W. Wongwachara) in *Real Estate Economics*. 40(4).2012.

Why All Equity Portfolios Still Remain the Exception, (with R. Lewin and M. J. Sardy), in *Academy of Economics and Finance Journal*.3,73-83.

An Assessment of the Social Desirability of High Frequency Trading; in

JASSA; Finsia Journal of Applied Finance,vol 3,7-11.

Retirement investor risk tolerance in tranquil and crisis periods: experimental survey evidence (with H.Bateman, S. Thorp, J. Geweke, J. Louviere, C. Ebling.), in *Journal of Behavioural Finance. Vol 12,No 4.*

Some Exact Results for an Asset Pricing Test Based on the Average F Distribution

(with S.Huang)in *Theoretical Economic Letters. Vol 2,No5,435-437.*

Defining Single Asset Price Momentum in terms of a Stochastic Process

(with K.Hong); in *Theoretical Economic Letters.Vol 2,No 3,274-277.*

Nonlinearity and smoothing in venture capital performance data ,(with Michael McKenzie, ,Warapong Wongwachara), in *Journal of Empirical Finance.* DOI:10.10.10/jempfin.2012.08.004 Version of record first published: 4 Aug 2012

Discussion on "Log-optimal economic evaluation of probability forecasts" by David Johnstone. ;*Journal of the Royal Statistical SocietyA* (2*012)*

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2011 PUBLICATIONS

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The Best of Intentions? The Allocation of Resources between Large and Small Subjects, (with O. Williams)*, Higher Education Review,* Vol 39.Number 2 , pp. 65-73, (Spring 2007).

The Disappearance of Style in the US Equity Market, (with S. Hwang), *Applied Financial Economics*, vol 17, pp 597-613, (May 2007).

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Will Private Equity and Hedge Funds Replace Real Estate in Mixed-Asset Portfolios?"(with S. Bond, S. Huang, P. Williams), in the Fall 2007 PREA sponsored special issue of the *Journal of Portfolio Management.*

Robust Optimisation for Utilising Forecasted Returns in Institutional Investment: (with C. Koutsoyannis) in *Forecasting Expected Returns;* S. Satchell(editor).

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).

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A Bayesian Confidence Interval for Value-at-Risk. Submitted to theDAE Working Paper Series. (with Contreras, P.). 2003

PAPERS (CURRENT)

"Using the Large Deviation Technique to Estimate Asymmetric Financial Risk", Institute for Financial Research, Birkbeck College, IFR 1/2003 (with Ba Chu and Knight, J.). 2003

A Bayesian Confidence Interval for Value-at-Risk. Submitted to theDAE Working Paper Series. (with Contreras, P.). 2003

The Impact of Background Risks on Expected Utility Maximisation (with V. Merella).

Valuation of Options in a Setting With Happiness-Augmented Preferences (with V. Merella) (QFRC discussion paper, Number 182), (2006).

Information Ratios, Sharpe Ratios and the Trade-off Between Skill And Risk (with P. Spence and A.D. Hall)

The Impacts of Constraints on the Moments of an Active Portfolio (with P. Spence and A.D. Hall)

Exact Properties of Optimal Investment for Institutional Investors (with J. Knight), Birkbeck College WP, 0513, 2005.

Distribution of Constrained Portfolio Weights and Returns, (with J. Knight,).

Improved Testing for the Validity of Asset Pricing Theories in Linear Factor Models, Financial Econometric Research Centre working paper WP99-20, Cass Business School. (With S. Hwang) 2001.

Optimal Portfolio for Skew Symmetric Distributions, (with R. Corn).

Scenario Analysis with Recursive Utility: Dynamic Consumption Paths for Charitable Endowments, (with S. Thorp), working paper, UTS.

Incorporating Gain-Loss and Mean-Variance in a Single Framework, (with S. Cavaglia, and K. Scherer).

'Heuristic Portfolio Optimisation: Bayesian Updating with the Johnson Family of Distributions', Callanish Capital Partners Technical Paper (with R. J. Louth)

'The Impact of Ratings on the Assets Under Management of Retail Funds', S&P Internal Report, (with R. J. Louth).

'The Impact of Ratings on the Performance of Retail Funds', S&P Internal Report (with R. J. Louth)

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

<u>Popular Articles</u>

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)

Research Affiliations (past and present)

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

EXPERT EVIDENCE PRACTICE NOTES (GPN-EXPT)

General Practice Note

1. INTRODUCTION

1.1 This practice note, including the *Harmonised Expert Witness Code of Conduct* ("**Code**") (see **Annexure A**) and the *Concurrent Expert Evidence Guidelines* ("**Concurrent Evidence Guidelines**") (see **Annexure B**), applies to any proceeding involving the use of expert evidence and must be read together with:

(a) the Central Practice Note (CPN-1), which sets out the fundamental principles concerning the National Court Framework ("**NCF**") of the Federal Court and key principles of case management procedure;

(b) the Federal Court of Australia Act 1976 (Cth) ("**Federal Court Act**");

(c) the *Evidence Act 1995* (Cth) ("**Evidence Act**"**),** including Part 3.3 of the Evidence Act;

(d) Part 23 of the *Federal Court Rules 2011* (Cth) ("**Federal Court Rules**"**)**; and

(e) where applicable, the Survey Evidence Practice Note (GPN-SURV).

1.2 This practice note takes effect from the date it is issued and, to the extent practicable, applies to proceedings whether filed before, or after, the date of issuing.

2. APPROACH TO EXPERT EVIDENCE

2.1 An expert witness may be retained to give opinion evidence in the proceeding, or, in certain circumstances, to express an opinion that may be relied upon in alternative dispute resolution procedures such as mediation or a conference of experts. In some circumstances an expert may be appointed as an independent adviser to the Court.

2.2 The purpose of the use of expert evidence in proceedings, often in relation to complex subject matter, is for the Court to receive the benefit of the objective and impartial assessment of an issue from a witness with specialised knowledge (based on training, study or experience - see generally s 79 of the Evidence Act).

2.3 However, the use or admissibility of expert evidence remains subject to the overriding requirements that:

(a) to be admissible in a proceeding, any such evidence must be relevant (s 56 of the Evidence Act); and

(b) even if relevant, any such evidence, may be refused to be admitted by the Court if its probative value is outweighed by other considerations such as the evidence being unfairly prejudicial, misleading or will result in an undue waste of time (s 135 of the Evidence Act).

2.4 An expert witness' opinion evidence may have little or no value unless the assumptions adopted by the expert (ie. the facts or grounds relied upon) and his or her reasoning are expressly stated in any written report or oral evidence given.

2.5 The Court will ensure that, in the interests of justice, parties are given a reasonable opportunity to adduce and test relevant expert opinion evidence. However, the Court expects parties and any legal representatives acting on their behalf, when dealing with expert witnesses and expert evidence, to at all times comply with their duties associated with the overarching purpose in the Federal Court Act (see ss 37M and 37N).

3. INTERACTION WITH EXPERT WITNESSES

3.1 Parties and their legal representatives should never view an expert witness retained (or partly retained) by them as that party's advocate or "hired gun". Equally, they should never attempt to pressure or influence an expert into conforming his or her views with the party's interests.

3.2 A party or legal representative should be cautious not to have inappropriate communications when retaining or instructing an independent expert, or assisting an independent expert in the preparation of his or her evidence. However, it is important to note that there is no principle of law or practice and there is nothing in this practice note that obliges a party to embark on the costly task of engaging a "consulting expert" in order to avoid "contamination" of the expert who will give evidence. Indeed the Court would generally discourage such costly duplication.

3.3 Any witness retained by a party 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 in the specialised knowledge of the witness[12] should, at the earliest opportunity, be provided with:

(a) a copy of this practice note, including the Code (see Annexure A); and

(b) all relevant information (whether helpful or harmful to that party's case) so as to enable the expert to prepare a report of a truly independent nature.

[12] Such a witness includes a "Court expert" as defined in r 23.01 of the Federal Court Rules. For the definition of "expert", "expert evidence" and "expert report" see the Dictionary, in Schedule 1 of the Federal Court Rules.

3.4 Any questions or assumptions provided to an expert should be provided in an unbiased manner and in such a way that the expert is not confined to addressing selective, irrelevant or immaterial issues.

4. ROLE AND DUTIES OF THE EXPERT WITNESS

4.1 The role of the expert witness is to provide relevant and impartial evidence in his or her area of expertise. An expert should never mislead the Court or become an advocate for the cause of the party that has retained the expert.

4.2 It should be emphasised that there is nothing inherently wrong with experts disagreeing or failing to reach the same conclusion. The Court will, with the assistance of the evidence of the experts, reach its own conclusion.

4.3 However, experts should willingly be prepared to change their opinion or make concessions when it is necessary or appropriate to do so, even if doing so would be contrary to any previously held or expressed view of that expert.

Harmonised Expert Witness Code of Conduct

4.4 Every expert witness giving evidence in this Court must read the *Harmonised Expert Witness Code of Conduct* (attached in Annexure A) and agree to be bound by it.

4.5 The Code is not intended to address all aspects of an expert witness' duties, but is intended to facilitate the admission of opinion evidence, and to assist experts to understand in general terms what the Court expects of them. Additionally, it is expected that compliance with the Code will assist individual expert witnesses to avoid criticism (rightly or wrongly) that they lack objectivity or are partisan.

5. CONTENTS OF AN EXPERT'S REPORT AND RELATED MATERIAL

5.1 The contents of an expert's report must conform with the requirements set out in the Code (including clauses 3 to 5 of the Code).

5.2 In addition, the contents of such a report must also comply with r 23.13 of the Federal Court Rules. Given that the requirements of that rule significantly overlap with the requirements in the Code, an expert, unless otherwise directed by the Court, will be taken to have complied with the requirements of r 23.13 if that expert has complied with the requirements in the Code and has complied with the additional following requirements. The expert shall:

(a) acknowledge in the report that:

(i) the expert has read and complied with this practice note and agrees to be bound by it; and

(ii) the expert's opinions are based wholly or substantially on specialised knowledge arising from the expert's training, study or experience;

(b) identify in the report the questions that the expert was asked to address;

(c) sign the report and attach or exhibit to it copies of:

(i) documents that record any instructions given to the expert; and

(ii) documents and other materials that the expert has been instructed to consider.

5.3 Where an expert's report refers to photographs, plans, calculations, analyses, measurements, survey reports or other extrinsic matter, these must be provided to the other parties at the same time as the expert's report.

6. CASE MANAGEMENT CONSIDERATIONS

6.1 Parties intending to rely on expert evidence at trial are expected to consider between them and inform the Court at the earliest opportunity of their views on the following:

(a) whether a party should adduce evidence from more than one expert in any single discipline;

(b) whether a common expert is appropriate for all or any part of the evidence;

(c) the nature and extent of expert reports, including any in reply;

(d) the identity of each expert witness that a party intends to call, their area(s) of expertise and availability during the proposed hearing;

(e) the issues that it is proposed each expert will address;

(f) the arrangements for a conference of experts to prepare a joint-report (see Part 7 of this practice note);

(g) whether the evidence is to be given concurrently and, if so, how (see Part 8 of this practice note); and

(h) whether any of the evidence in chief can be given orally.

6.2 It will often be desirable, before any expert is retained, for the parties to attempt to agree on the question or questions proposed to be the subject of expert evidence as well as the relevant facts and assumptions. The Court may make orders to that effect where it considers it appropriate to do so.

7. CONFERENCE OF EXPERTS AND JOINT-REPORT

7.1 Parties, their legal representatives and experts should be familiar with aspects of the Code relating to conferences of experts and joint-reports (see clauses 6 and 7 of the Code attached in Annexure A).

7.2 In order to facilitate the proper understanding of issues arising in expert evidence and to manage expert evidence in accordance with the overarching purpose, the Court may require experts who are to give evidence or who have produced reports to meet for the purpose of identifying and addressing the issues not agreed between them with a view to reaching

agreement where this is possible ("**conference of experts**"). In an appropriate case, the Court may appoint a registrar of the Court or some other suitably qualified person ("**Conference Facilitator**") to act as a facilitator at the conference of experts.

7.3 It is expected that where expert evidence may be relied on in any proceeding, at the earliest opportunity, parties will discuss and then inform the Court whether a conference of experts and/or a joint-report by the experts may be desirable to assist with or simplify the giving of expert evidence in the proceeding. The parties should discuss the necessary arrangements for any conference and/or joint-report. The arrangements discussed between the parties should address:

(a) who should prepare any joint-report;

(b) whether a list of issues is needed to assist the experts in the conference and, if so, whether the Court, the parties o r the experts should assist in preparing such a list;

(c) **t**he agenda for the conference of experts; and

(d) arrangements for the provision, to the parties and the Court, of any joint-report or any other report as to the outcomes of the conference ("**conference report**").

Conference of Experts

7.4 The purpose of the conference of experts is for the experts to have a comprehensive discussion of issues relating to their field of expertise, with a view to identifying matters and issues in a proceeding about which the experts agree, partly agree or disagree and why. For this reason the conference is attended only by the experts and any Conference Facilitator. Unless the Court orders otherwise, the parties' lawyers will not attend the conference but will be provided with a copy of any conference report.

7.5 The Court may order that a conference of experts occur in a variety of circumstances, depending on the views of the judge and the parties and the needs of the case, including:

(a) while a case is in mediation. When this occurs the Court may also order that the outcome of the conference or any document disclosing or summarising the experts' opinions be confidential to the parties while the mediation is occurring;

(b) before the experts have reached a final opinion on a relevant question or the facts involved in a case. When this occurs the Court may order that the parties exchange draft expert reports and that a conference report be prepared for the use of the experts in finalising their reports;

(c) after the experts' reports have been provided to the Court but before the hearing of the experts' evidence. When this occurs the Court may also order that a conference report be prepared (jointly or otherwise) to ensure the efficient hearing of the experts' evidence.

7.6 Subject to any other order or direction of the Court, the parties and their lawyers must not involve themselves in the conference of experts process. In particular, they must not seek to

encourage an expert not to agree with another expert or otherwise seek to influence the outcome of the conference of experts. The experts should raise any queries they may have in relation to the process with the Conference Facilitator (if one has been appointed) or in accordance with a protocol agreed between the lawyers prior to the conference of experts taking place (if no Conference Facilitator has been appointed).

7.7 Any list of issues prepared for the consideration of the experts as part of the conference of experts process should be prepared using non-tendentious language.

7.8 The timing and location of the conference of experts will be decided by the judge or a registrar who will take into account the location and availability of the experts and the Court's case management timetable. The conference may take place at the Court and will usually be conducted in-person. However, if not considered a hindrance to the process, the conference may also be conducted with the assistance of visual or audio technology (such as via the internet, video link and/or by telephone).

7.9 Experts should prepare for a conference of experts by ensuring that they are familiar with all of the material upon which they base their opinions. Where expert reports in draft or final form have been exchanged prior to the conference, experts should attend the conference familiar with the reports of the other experts. Prior to the conference, experts should also consider where they believe the differences of opinion lie between them and what processes and discussions may assist to identify and refine those areas of difference.

Joint-report

7.10 At the conclusion of the conference of experts, unless the Court considers it unnecessary to do so, it is expected that the experts will have narrowed the issues in respect of which they agree, partly agree or disagree in a joint-report. The joint-report should be clear, plain and concise and should summarise the views of the experts on the identified issues, including a succinct explanation for any differences of opinion, and otherwise be structured in the manner requested by the judge or registrar.

7.11 In some cases (and most particularly in some native title cases), depending on the nature, volume and complexity of the expert evidence a judge may direct a registrar to draft part, or all, of a conference report. If so, the registrar will usually provide the draft conference report to the relevant experts and seek their confirmation that the conference report accurately reflects the opinions of the experts expressed at the conference. Once that confirmation has been received the registrar will finalise the conference report and provide it to the intended recipient(s).

8. CONCURRENT EXPERT EVIDENCE

8.1 The Court may determine that it is appropriate, depending on the nature of the expert evidence and the proceeding generally, for experts to give some or all of their evidence concurrently at the final (or other) hearing.

8.2 Parties should familiarise themselves with the *Concurrent Expert Evidence Guidelines* (attached in Annexure B). The Concurrent Evidence Guidelines are not intended to be exhaustive but indicate the circumstances when the Court might consider it appropriate for concurrent expert evidence to take place, outline how that process may be undertaken, and assist experts to understand in general terms what the Court expects of them.

8.3 If an order is made for concurrent expert evidence to be given at a hearing, any expert to give such evidence should be provided with the Concurrent Evidence Guidelines well in advance of the hearing and should be familiar with those guidelines before giving evidence.

9. FURTHER PRACTICE INFORMATION AND RESOURCES

9.1 Further information regarding Expert Evidence and Expert Witnesses is available on the Court's website.

9.2 Further information to assist litigants, including a range of helpful guides, is also available on the Court's website. This information may be particularly helpful for litigants who are representing themselves.

J L B ALLSOP
Chief Justice

25 October 2016

Annexure A

HARMONISED EXPERT WITNESS CODE OF CONDUCT[13]

APPLICATION OF CODE

1. This Code of Conduct applies to any expert witness engaged or appointed:

   (a) to provide an expert's report for use as evidence in proceedings or proposed proceedings; or

   (b) to give opinion evidence in proceedings or proposed proceedings.

GENERAL DUTIES TO THE COURT

2. An expert witness is not an advocate for a party and has a paramount duty, overriding any duty to the party to the proceedings or other person retaining the expert witness, to assist the Court impartially on matters relevant to the area of expertise of the witness.

CONTENT OF REPORT

3. Every report prepared by an expert witness for use in Court shall clearly state the opinion or opinions of the expert and shall state, specify or provide:

   (a) the name and address of the expert;

   (b) an acknowledgment that the expert has read this code and agrees to be bound by it;

   (c) the qualifications of the expert to prepare the report;

   (d) the assumptions and material facts on which each opinion expressed in the report is based [a letter of instructions may be annexed];

   (e) the reasons for and any literature or other materials utilised in support of such opinion;

   (f) (if applicable) that a particular question, issue or matter falls outside the expert's field of expertise;

   (g) any examinations, tests or other investigations on which the expert has relied, identifying the person who carried them out and that person's qualifications;

   (h) the extent to which any opinion which the expert has expressed involves the acceptance of another person's opinion, the identification of that other person and the opinion expressed by that other person;

   (i) a declaration that the expert has made all the inquiries which the expert believes are desirable and appropriate (save for any matters identified explicitly in the report), and that no matters of significance which the expert regards as relevant have, to the knowledge of the expert, been withheld from the Court;

   (j) any qualifications on an opinion expressed in the report without which the report is or

[13] Approved by the Council of Chief Justices' Rules Harmonisation Committee

may be incomplete or inaccurate;

(k) whether any opinion expressed in the report is not a concluded opinion because of insufficient research or insufficient data or for any other reason; and

(l) where the report is lengthy or complex, a brief summary of the report at the beginning of the report.

SUPPLEMENTARY REPORT FOLLOWING CHANGE OF OPINION

4. Where an expert witness has provided to a party (or that party's legal representative) a report for use in Court, and the expert thereafter changes his or her opinion on a material matter, the expert shall forthwith provide to the party (or that party's legal representative) a supplementary report which shall state, specify or provide the information referred to in paragraphs (a), (d), (e), (g), (h), (i), (j), (k) and (l) of clause 3 of this code and, if applicable, paragraph (f) of that clause.

5. In any subsequent report (whether prepared in accordance with clause 4 or not) the expert may refer to material contained in the earlier report without repeating it.

DUTY TO COMPLY WITH THE COURT'S DIRECTIONS

6. If directed to do so by the Court, an expert witness shall:

(a) confer with any other expert witness;

(b) provide the Court with a joint-report specifying (as the case requires) matters agreed and matters not agreed and the reasons for the experts not agreeing; and

(c) abide in a timely way by any direction of the Court.

CONFERENCE OF EXPERTS

7. Each expert witness shall:

(a) exercise his or her independent judgment in relation to every conference in which the expert participates pursuant to a direction of the Court and in relation to each report thereafter provided, and shall not act on any instruction or request to withhold or avoid agreement; and

(b) endeavour to reach agreement with the other expert witness (or witnesses) on any issue in dispute between them, or failing agreement, endeavour to identify and clarify the basis of disagreement on the issues which are in dispute.

ANNEXURE B

CONCURRENT EXPERT EVIDENCE GUIDELINES

APPLICATION OF THE COURT'S GUIDELINES

1. The Court's Concurrent Expert Evidence Guidelines ("**Concurrent Evidence Guidelines**") are intended to inform parties, practitioners and experts of the Court's general approach to concurrent expert evidence, the circumstances in which the Court might consider expert witnesses giving evidence concurrently and, if so, the procedures by which their evidence may be taken.

OBJECTIVES OF CONCURRENT EXPERT EVIDENCE TECHNIQUE

2. The use of concurrent evidence for the giving of expert evidence at hearings as a case management technique[14] will be utilised by the Court in appropriate circumstances (see r 23.15 of the *Federal Court Rules 2011* (Cth)). Not all cases will suit the process. For instance, in some patent cases, where the entire case revolves around conflicts within fields of expertise, concurrent evidence may not assist a judge. However, patent cases should not be excluded from concurrent expert evidence processes.

3. In many cases the use of concurrent expert evidence is a technique that can reduce the partisan or confrontational nature of conventional hearing processes and minimises the risk that experts become "opposing experts" rather than independent experts assisting the Court. It can elicit more precise and accurate expert evidence with greater input and assistance from the experts themselves.

4. When properly and flexibly applied, with efficiency and discipline during the hearing process, the technique may also allow the experts to more effectively focus on the critical points of disagreement between them, identify or resolve those issues more quickly, and narrow the issues in dispute. This can also allow for the key evidence to be given at the same time (rather than being spread across many days of hearing); permit the judge to assess an expert more readily, whilst allowing each party a genuine opportunity to put and test expert evidence. This can reduce the chance of the experts, lawyers and the judge misunderstanding the opinions being expressed by the experts.

5. It is essential that such a process has the full cooperation and support of all of the individuals involved, including the experts and counsel involved in the questioning process. Without that cooperation and support the process may fail in its objectives and even hinder the case management process.

CASE MANAGEMENT

[14] Also known as the "hot tub" or as "expert panels".

6. Parties should expect that, the Court will give careful consideration to whether concurrent evidence is appropriate in circumstances where there is more than one expert witness having the same expertise who is to give evidence on the same or related topics. Whether experts should give evidence concurrently is a matter for the Court, and will depend on the circumstances of each individual case, including the character of the proceeding, the nature of the expert evidence, and the views of the parties.

7. Although this consideration may take place at any time, including the commencement of the hearing, if not raised earlier, parties should raise the issue of concurrent evidence at the first appropriate case management hearing, and no later than any pre-trial case management hearing, so that orders can be made in advance, if necessary. To that end, prior to the hearing at which expert evidence may be given concurrently, parties and their lawyers should confer and give general consideration as to:

   (a) the agenda;

   (b) the order and manner in which questions will be asked; and

   (c) whether cross-examination will take place within the context of the concurrent evidence or after its conclusion.

8. At the same time, and before any hearing date is fixed, the identity of all experts proposed to be called and their areas of expertise is to be notified to the Court by all parties.

9. The lack of any concurrent evidence orders does not mean that the Court will not consider using concurrent evidence without prior notice to the parties, if appropriate.

CONFERENCE OF EXPERTS & JOINT-REPORT OR LIST OF ISSUES

10. The process of giving concurrent evidence at hearings may be assisted by the preparation of a joint-report or list of issues prepared as part of a conference of experts.

11. Parties should expect that, where concurrent evidence is appropriate, the Court may make orders requiring a conference of experts to take place or for documents such as a joint-report to be prepared to facilitate the concurrent expert evidence process at a hearing (see Part 7 of the Expert Evidence Practice Note).

PROCEDURE AT HEARING

12. Concurrent expert evidence may be taken at any convenient time during the hearing, although it will often occur at the conclusion of both parties' lay evidence.

13. At the hearing itself, the way in which concurrent expert evidence is taken must be applied flexibly and having regard to the characteristics of the case and the nature of the evidence to be given.

14. Without intending to be prescriptive of the procedure, parties should expect that, when evidence is given by experts in concurrent session:

    (a) the judge will explain to the experts the procedure that will be followed and that the nature of the process may be different to their previous experiences of giving expert evidence;

    (b) the experts will be grouped and called to give evidence together in their respective fields of expertise;

    (c) the experts will take the oath or affirmation together, as appropriate;

    (d) the experts will sit together with convenient access to their materials for their ease of reference, either in the witness box or in some other location in the courtroom, including (if necessary) at the bar table;

    (e) each expert may be given the opportunity to provide a summary overview of their current opinions and explain what they consider to be the principal issues of disagreement between the experts, as they see them, in their own words;

    (f) the judge will guide the process by which evidence is given, including, where appropriate:

        (i) using any joint-report or list of issues as a guide for all the experts to be asked questions by the judge and counsel, about each issue on an issue-by-issue basis;

        (ii) ensuring that each expert is given an adequate opportunity to deal with each issue and the exposition given by other experts including, where considered appropriate, each expert asking questions of other experts or supplementing the evidence given by other experts;

        (iii) inviting legal representatives to identify the topics upon which they will cross-examine;

        (iv) ensuring that legal representatives have an adequate opportunity to ask all experts questions about each issue. Legal representatives may also seek responses or contributions from one or more experts in response to the evidence given by a different expert; and

        (v) allowing the experts an opportunity to summarise their views at the end of the process where opinions may have been changed or clarifications are needed.

15. The fact that the experts may have been provided with a list of issues for consideration does not confine the scope of any cross-examination of any expert. The process of cross-examination remains subject to the overall control of the judge.

16. The concurrent session should allow for a sensible and orderly series of exchanges

between expert and expert, and between expert and lawyer. Where appropriate, the judge may allow for more traditional cross-examination to be pursued by a legal representative on a particular issue exclusively with one expert. Where that occurs, other experts may be asked to comment on the evidence given.

17. Where any issue involves only one expert, the party wishing to ask questions about that issue should let the judge know in advance so that consideration can be given to whether arrangements should be made for that issue to be dealt with after the completion of the concurrent session. Otherwise, as far as practicable, questions (including in the form of cross-examination) will usually be dealt with in the concurrent session.

18. Throughout the concurrent evidence process the judge will ensure that the process is fair and effective (for the parties and the experts), balanced (including not permitting one expert to overwhelm or overshadow any other expert), and does not become a protracted or inefficient process.