REPORT TO THE AER: DISCUSSION OF SUBMISSIONS ON THE COST OF EQUITY

By Graham Partington and Stephen Satchell

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Author's Credentials

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

We have read the "Federal Court of Australia: Expert Evidence Practice Note" which is attached as an appendix. 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 in relation to the estimation of the return on equity. The full terms of reference are attached as Appendix 1. The main requirements were to present our views with respect to the following issues:

A1. CEG, *Replication and extension of Henry's beta analysis*, November 2016. In this report, CEG (among other things):

i. Updated the analysis in its September 2016 report to include data up to October 2016 and made similar conclusions as its September 2016 report.

ii. Considered that a comparison of Henry's estimates and its own updated estimates indicated a rising beta and structural breaks in the re-levered equity beta.

iii. Applied the Quandt-Andrews test (using asset betas) that also supported structural breaks in the re-levered equity beta and a rising beta.

A2. HoustonKemp, *The cost of equity and the low-beta bias*, November 2016. In this report, HoustonKemp (among other things):

i. Reviewed existing evidence (that is the Sharpe-Lintner CAPM theory, US studies and Australian studies) which indicate that estimates of the return required on a low-beta asset, delivered by the Sharpe-Lintner CAPM are biased downwards.

ii. Stated that empirical tests indicate return on equity forecasts from the Sharpe-Lintner CAPM and the AER's implementation of the Sharpe-Lintner CAPM are biased downwards for low beta stocks.

iii. Estimated in two ways the alpha of a benchmark efficient entity that, when added to a forecast delivered by the Sharpe-Lintner CAPM of the required return to equity, will ensure that the forecast of the return does not exhibit, in past data, significant bias.

iv. Estimated in two ways the weighted average of an OLS estimate of the equity beta of a benchmark efficient entity that, when used in a forecast delivered by the Sharpe-Lintner CAPM

of the required return to equity, will ensure that the forecast of the return does not exhibit, in past data, significant bias

v. Considers that the AER cannot state that it is implausible for the zero beta premium to be equal to or greater than the MRP using the work of Hong and Srear *(*2016) which shows that when investors do not share the same beliefs a weak or negative relation can appear in the data even in the absence of measurement problems.

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

a. HoustonKemp's material does not imply that an uplift is needed when using the Sharpe-Lintner CAPM to estimate the cost of equity for a benchmark efficient entity.

b. Deviation from the Sharpe-Lintner CAPM may represent disequilibria in the capital markets

c. Data cannot be used to assess the severity of the low-beta bias

d. Reliance on theory will provide a better way of assessing the severity of the low beta bias

e. Satchell's comments appears to differ between his own research and reports written for the AER (and the ERA)

f. differences between expected and realised returns are a problem when testing asset pricing models and the use of work by Isakov (1999)

g. The use of the sample mean forecast error to test whether forecasts of the return required on equity generated by the Sharpe-Lintner CAPM assumes perfect foresight with respect to the realised excess return on the market

A3. Frontier Economics, *An equity beta estimate for Australian energy network businesses*, December 2016. In this report, Frontier Economics (among other things):

i. Noted that a comparison of 10-year estimate of the equity beta to 5-year estimates, and rolling 5-year estimates of the portfolio-level betas, for the 4 comparator firms generally indicates that equity beta has increased since the 2013 Rate of Return Guideline.

A4. APA VTS, *Victorian transmission system access arrangement submission*, 3 January 2017. In this report, APA VTS (among other things):

i. Noted that the Wright approach involves a number of additional assumptions that APA VTS does not make in its proposed implementation of the Sharpe-Lintner CAPM. And noted that the AER's (and its advisors') reasons for rejecting the Wright approach is based on these additional assumptions which are not relevant to the derivation and/or application of the Sharpe-Lintner CAPM

A5. AusNet Services, Gas Access Arrangement review 2018–2022: Access Arrangement information, 16 December 2016. In this submission, AusNet Services

i. Proposed a longer (8 month) equity averaging period than the 20 business day period set out in the Rate of Return Guideline. This is to account for sudden market movements while still allowing fundamental changes in equity markets, and protection from the 'lottery' effect of an ex-ante short sample period selection.

A1. CEG, Replication and extension of Henry's beta analysis, November 2016. In this report, CEG (among other things):

i. Updated the analysis in its September 2016 report to include data up to October 2016 and made similar conclusions as its September 2016 report.

In Partington and Satchell (2017) we comment on CEG's September 2016 report and reach the following conclusion:

> "With respect to re-levered betas:
>
> 1. Overall some weak evidence of increased beta at the portfolio level for a restricted set of portfolios
> 2. Overall some weak evidence of increased beta at the individual firm level based on last five years data set.
> 3 No evidence of changes in beta at the individual firm level for the maximum length data set.
>
> However if we transfer our focus onto the raw equity betas, we see little evidence of change and so we are led to conclude that any beta change (if there is change) comes from gearing adjustments. Given our concerns about the element of arbitrariness in re-levering beta and upward bias in the method used, we are not convinced that there has been material change in beta."

We find little in the current CEG (2016 Nov) report that would lead us to substantively change these conclusions. This is unsurprising, given that the current CEG report only contains a slightly extended sample and reaches similar conclusions to their prior report. There is, however, one important difference between the current CEG report and their prior report and that is the addition of some statistical testing. The absence of such testing was a feature that we highlighted as a particular weakness of their prior report. We suggested that an appropriate test was the Chow test for a structural break, but CEG have chosen to use the Quandt Andrews test. This latter is a suitable test and somewhat less restrictive than the Chow test in that the point of

the structural break can be determined from the data rather than requiring specification of the date of the break in advance of the test.

We discuss the use of the Quandt Andrews test in more detail below. However one point merits discussion here. The Quandt Andrews test was not applied either to the re-levered beta, or to the raw beta, but rather to the asset beta. The asset beta is obtained by the first part of the re-levering process in converting from raw betas to asset betas and then to re-levered betas. Why the test for the structural break was undertaken on the asset betas, when the thrust of CEG's (2016 Nov) argument is about re- levered betas is not explained. We also note that although it is made clear at paragraph 10 of CEG's report that the structural break test is for asset betas, there is a risk that reader's might construe paragraph 12 and 13 of the report as relating to a structural break test for re-levered betas. It should be clearly understood that this is not the case, no structural break test for re-levered betas has been carried out.

In respect of their estimates of re-levered beta for the longest data series available CEG (2016 Nov, para 24) observes: "We note that most of the difference in re-levered equity is due to differences in gearing estimates." While for re-levered betas, based on the most recent five years of data, paragraph 3 of CEG's report also attributes much of the change in those betas to changes in gearing (leverage). These observations are consistent with our conclusion in Partington and Satchell (2017) that there was relatively little difference in the raw beta estimates and hence increases in the re-levered beta were driven by changes in leverage.

We have repeatedly expressed our reservation about the re-levering process, firstly on the grounds that there are multiple re-levering formulae available that can give very different results. Secondly because the re-levering formula used in this case makes the assumption that the debt beta is zero. This assumption results in an upward biased estimate of beta. An assumption that the debt beta is zero may be appropriate for risk free or very low risk debt, but it is not appropriate for BBB rated debt. Let us be absolutely clear that we agree that higher leverage leads to a higher beta. The question is which re-levering formula to use? While this choice is debateable, we are strongly of the opinion that the current formula results in an upward biased estimate of the re-levered beta.

A further issue in re-levering is the specification of the leverage ratios to be used in the re-levering process. The choice of leverage ratio can have a significant influence of the estimate of

the re-levered beta. The leverage to be used in computing the levered beta from the asset beta is fixed at 60%, but the leverage ratio to be used in first converting the raw equity beta to an asset beta is not fixed. Differing values for this latter leverage adjustment can have a substantive effect on the final value for the re-levered beta. This is evident from a comparison of the beta estimates provided by CEG (2016 Nov) and Frontier (2016 Dec) for weekly beta estimates over the last five years. These estimates, which are reproduced as Table 1 (Frontier's Table 1) and Table 2 (CEG's Table 13) show that, despite covering an almost identical period, all of GEG's estimates of re-levered beta are higher than those of Frontier. In particular for APA the beta estimates are 0.71 (Frontier) and 0.81 (CEG), while for AST they are 0.72[1] and 0.81. These differences are of the order of 0.10 which in the current context is a substantive difference.

Since the data used by GEG (2016 Nov) and Frontier (2016 Dec) only differs by one month it would be expected that the beta estimates would be quite similar and this is the case for the raw beta estimates, with the CEG estimates only slightly larger. The slightly higher raw betas for CEG contribute somewhat to the higher re-levered betas that CEG reports. However, the lion's share of the difference in re-levered betas is accounted for by the differences in the level of leverage used when computing the asset beta.

The differences in leverage between Frontier (2016 Dec) and CEG (2016, Nov) are not large, but the sensitivity of the outcome to these differences highlights the importance of the level of leverage used. According to both Frontier (paragraph 49) and CEG (paragraph 62) the leverage (gearing) used was the average leverage over the relevant sample period so the differences in leverage are puzzling. It should be borne in mind these leverage issues flow through to the asset betas that CEG uses in its structural break tests.

The differences in re-levered betas between CEG (2016, Nov) and Frontier (2016, Dec) highlight the result that lower levels of leverage inflate the asset beta, and the subsequent use of a higher level of leverage in re-levering inflates the re-levered beta. For the four companies that CEG used in Table 2 the average level of leverage used in computing the asset betas is equal to 48.25% as against the 60% assumed in the re-levering. The sample of firms used to estimate

[1] On the numbers given in Frontiers table this beta should be 0.71, but possibly the difference is accounted for by rounding in constructing the table. We also note that the confidence bounds in the table appear to have been reversed, with the upper bound labelled the lower bound and vice versa. This, however, is not a matter of substance.

beta have a lower leverage than 60%, not only on average, but also for three out of the four firms used. If indeed the target population leverage is 60% there is a question of the representativeness of the sample, at least with respect to leverage. This would not matter, if the sample was representative with respect to asset betas and if we had confidence in the re-levering process, but with respect to the latter we consider that the re-levering process is upward biased.

Table 1: Frontier's Beta Estimates

Table 1: Weekly beta estimates over the last 5 years

Statistic	APA	AST	DUE	SKI	Equally-Weighted Portfolio	Value-Weighted Portfolio
Average gearing	0.50	0.60	0.65	0.30	0.52	0.53
Adjustment factor	1.25	1.00	0.87	1.75	1.21	1.18
Raw beta	0.57	0.71	0.30	0.47	0.53	0.61
Re-levered beta	0.71	0.72	0.26	0.83	0.65	0.72
Standard error	0.08	0.08	0.07	0.11	0.06	0.08
Confidence interval upper bound	0.55	0.57	0.12	0.61	0.53	0.56
Confidence interval lower bound	0.88	0.87	0.40	1.04	0.76	0.88
R^2	0.19	0.25	0.06	0.11	0.27	0.21
Observations	260	260	260	260	260	260

Table 2: CEG's Beta Estimates

Table 13: CEG extension of weekly individual beta estimates for the most recent 5 years

Bloomberg ticker	Equity beta	Asset beta	W	Gearing	Re-levered equity beta (Henry actual)	Re-levered equity beta (CEG extension)	Change
APA AU Equity	0.59	0.32	1.36	0.46	0.54	0.81	0.27
DUE AU Equity	0.31	0.12	0.93	0.63	0.24	0.28	0.04
SKI AU Equity	0.47	0.34	1.83	0.27	0.30	0.86	0.56
AST AU Equity	0.74	0.32	1.08	0.57	0.27	0.81	0.54
Average	**0.53**	**0.28**	**1.30**	**0.48**	**0.34**	**0.69**	**0.35**

ii. Considered that a comparison of Henry's estimates and its own updated estimates indicated a rising beta and structural breaks in the re-levered equity beta.

Taken at face value there is evidence of structural breaks in the portfolio estimates for asset betas, but no testing was done for individual asset betas. However, from our discussion above it is clear that we are sceptical about the re-levering process and this applies to both the asset betas and re-levered beta estimates. The estimates of the re-levered beta are higher than Henry's estimates, but there is no testing of the statistical significance of the increase. We stress that the tests for structural breaks are for the asset betas, not for the re-levered betas. As discussed above it is the re-levering process that drives the increases in both re-levered betas and the asset beta. It is also evident that the consultants to the regulated businesses get different re-levered beta estimates driven by the different levels of leverage that they used in the re-leveraging process. These differences in leverage would also result in differences in asset betas, with CEG (2016, Nov) computing higher asset betas.

It is also evident that portfolio 6, which is the focus of much of CEG's(2016, Nov) analysis, only contains four firms. Consequently portfolio betas will be sensitive to the weightings for individual stocks and as CEG points out in paragraph 3 the increase in weighting of high beta stocks such as APA contributes to the increase in re-levered beta for value weighted portfolios. Even in equally weighted portfolios the effect of a single stock can be of consequence when the number of stocks is small. For example, CEG Table 7, gives re-levered equity betas for the longest available sample in the column headed "Re-levered equity beta (CEG extension)". Taking all five re-levered betas listed (which constitute portfolio 5) and equally weighting them gives a portfolio beta of 0.49. While excluding the lowest beta stock of the five (ENV), as CEG does when creating portfolio 6, gives a portfolio beta of 0.53.

CEG (2016, Nov) Table 10, reports higher betas for these portfolios at 0.54 for both portfolios 5 and 6. This appears to be because CEG uses a different procedure to compute equally weighted re-levered betas for the portfolios. The estimates of re-levered betas in Table 10 starts from the raw beta of the portfolio and then re-levers that beta, rather than equally weighting the re-levered betas for individual stocks, as in the preceding paragraph.

iii. Applied the Quandt-Andrews test (using asset betas) that also supported structural breaks in the re-levered equity beta and a rising beta.

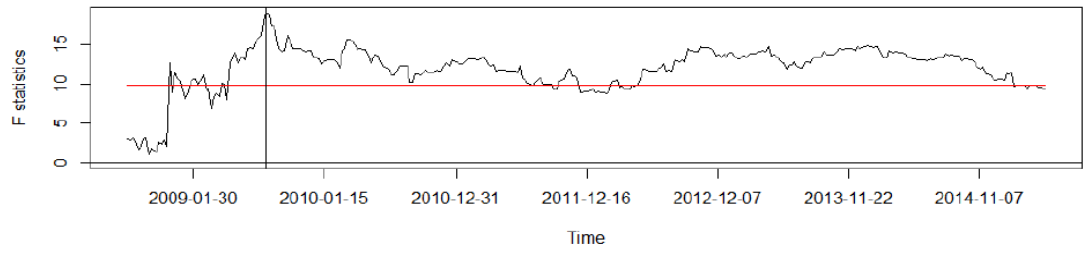
There are a number of points to be aware of with respect to the use of the Quandt-Andrews test. As noted in response to the first question above the test is an appropriate test for a structural break. However, the Quandt-Andrews test is a large sample test whose critical values are based on the properties of asymptotic distributions. Whether a sample of five years of weekly data is a sufficient sample size is an open question.

The Quandt-Andrews test requires pre and post-test periods representing *x*% of the data, which are excluded from the period examined for a structural break. The value of *x*% is set by the researcher/statistician, with larger values resulting in a more powerful test, but at the cost of a reduction in the period to be tested. CEG (2016 Nov) do not discuss this or state what value they used for the *x*%. Consequently it is not clear to us what was the actual period used in constructing the test. If for example the data period was five years (which is the period covered by the figures CEG presents) and *x*% was set at 15%, then 9 months of the first and last five years would be excluded in the structural break test. We infer that the value used for *x*% was likely to be 15%. This is a default value that is commonly used and appears to be consistent with the critical value that CEG used for the test statistic.

A puzzling feature of the structural break tests is that (CEG 2016 Nov) report that ENV, a firm in portfolio 5, was delisted in October 2014. However, the tests for a structural break for portfolio 5 extend beyond October 2014, see CEG Figures 26, 27, 28, 29, reproduced below. Given that portfolio 5 ceased to exist as of October 2014, we are puzzled as to how this test was done. The more so considering the need to exclude a period from the test at the end of the data series.

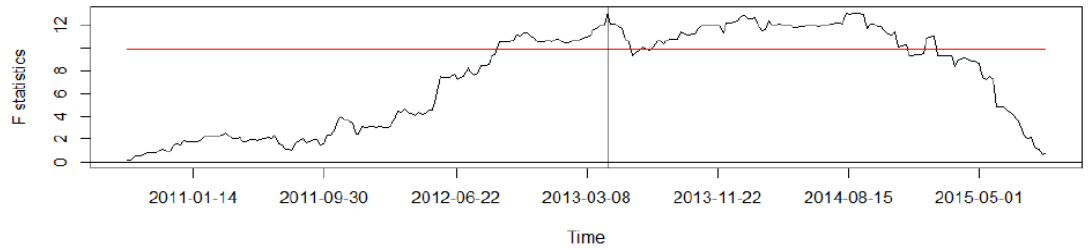
Figure 1: CEG's Structural Break Test Figures for Portfolio 5

Figure 26: Portfolio 5, equal weighted, breakpoint 1



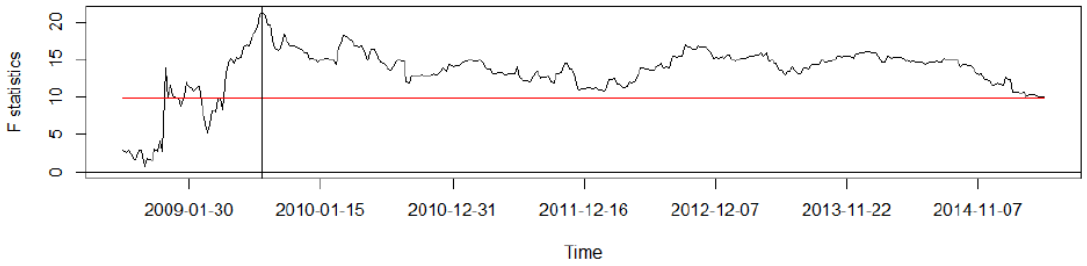
Bloomberg Data, CEG Analysis, the red line indicates 10% p-value for the supF test

Figure 27: Portfolio 5, equal weighted, breakpoint 2



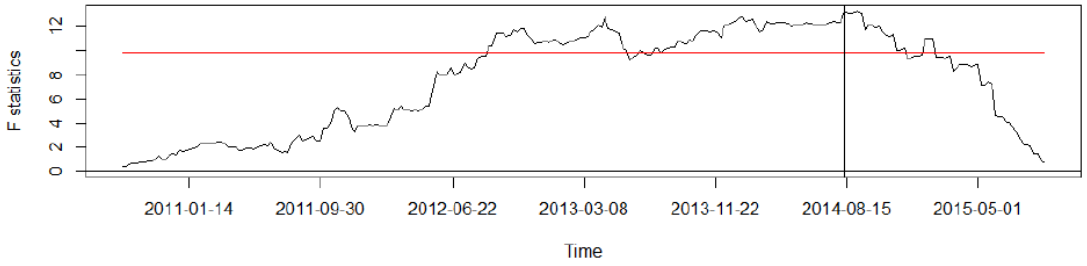
Bloomberg Data, CEG Analysis, the red line indicates 10% p-value for the supF test

Figure 28: Portfolio 5, value weighted, breakpoint 1



Bloomberg Data, CEG Analysis, the red line indicates 10% p-value for the supF test

Figure 29: Portfolio 5, value weighted, breakpoint 2



Bloomberg Data, CEG Analysis, the red line indicates 10% p-value for the supF test

In the figures above CEG (2016 Nov) are using a significance level of 10%, with the critical value for the F statistic indicated by the red-line. The more normal level for significance tests is 5%, or sometimes 1%. A result which is only significant at the 10% level is generally considered to provide quite weak evidence of a significant effect. At significance levels of 5% and 1% the red line would shift upwards substantially, greatly reducing the apparent incidence of F-statistics above the critical value. We note, however, that the maximum F statistics, identifying the breakpoints for portfolios 5 and 6, are significant at the 5% level.

The breakpoint test will be more reliable if the breakpoint detected is closer to the centre of the test sample. If it is near the ends of the sample it is less reliable. In the case of portfolio 6 see CEG, (2016 Nov) Figures 8, 9, 0 and 11, the break points are towards the ends of the test samples. This is also the case for portfolio 5 in Figures 26, 28 and 29.

In summary, we do not see the case for an increase in beta to be nearly as compelling as CEG (2016 Nov) claim. We are particularly dubious about the re-levering process. A more comprehensive picture could be obtained by also testing for structural breaks in the raw betas and re-levered betas, with tests conducted for both individual stocks and portfolios. A clear and detailed description of the precise data used in the leverage (gearing) calculation is required since this is the main driver of the results.

A.2. Houston Kemp, *The cost of equity and the low-beta bias*, November 2016. In this report, Houston Kemp (among other things):

i. Reviewed existing evidence (that is the Sharpe-Lintner CAPM theory, US studies and Australian studies) which indicate that estimates of the return required on a low-beta asset, delivered by the Sharpe-Lintner CAPM are biased downwards.

The Houston Kemp (2016 Nov) report makes a great deal of the apparent low returns from the CAPM for low beta stocks as opposed to returns subsequently realised and sets up unbiased forecasts of realised returns as the criteria for selecting a rate of return model. It is therefore appropriate to consider how such evidence may be interpreted. Interpretation may be conditional on the lens through which the evidence is viewed. Consider, for example, a study of the returns obtained by shareholders in regulated utilities relative to the equilibrium returns according to the CAPM. Further suppose that the study showed that the returns subsequently realised by shareholders were greater than those determined by use of the CAPM. We suggest that consumers would likely interpret this as the regulators being too benign in setting allowed returns, resulting in regulated utilities earning more than was justified. Conversely, we expect that regulated utilities would either argue that they had been super-efficient, or as in the current case, that the CAPM underestimated the required rate of return.

The lens of self-interest is a powerful one and as we have repeatedly said before, see for example Partington and Satchell (2016, p9):

> "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."

Abstracting from the issue of self-interest, the objective question is whether the benchmark for required returns is given by the CAPM, or by the returns subsequently realised. To put it another way is the bias in the CAPM, or in the realised returns. It is true that a substantial number of academics, presumably not motivated by self-interest,[2] have implicitly or explicitly concluded that realised returns are the appropriate benchmark. Thus, the evidence that returns to low beta stocks according to the CAPM are below returns subsequently realised has been interpreted by such academics as evidence of a downward bias in the CAPM. We note, however, that this is not a universal view.

Those who hold the view that CAPM returns are biased are likely influenced by the idea that markets are efficient and in equilibrium, hence realised returns are an appropriate benchmark. They also take as given that the method used in the analysis conducted by the researchers was correct. With respect to the former, the idea that markets are continuously efficient and in equilibrium is increasingly challenged by the proponents of behavioural finance and of course by practitioners who seek to profit by earning alpha (abnormal returns). As we discuss later divergence between equilibrium expected returns and realised returns is possible and may persist for extended periods. With respect to the research methods used, these have been challenged and the literature critical of the tests used in relation to asset pricing models continues to grow. In this respect, Lewellen, Nagel and Shanken's (2010) paper "A skeptical appraisal of asset pricing tests" has a particularly appropriate title. It is appropriate to be sceptical about the results of tests of asset pricing models.

Houston Kemp's (2016 Nov) own summary of selected papers, while predominantly rejecting the CAPM also shows that the CAPM is not rejected under some circumstances, for example for data drawn from prior periods and when a conditional CAPM is used. Their summary of the Australian studies shows that there is substantial variation in the estimate of the zero beta premium according to the sample size, the period studied and the method of portfolio

[2] In this case of academic publications, self-interest is in getting published, but many academics are also seekers after truth which may overcome a self-interest bias. It is not clear how self-interest might bias this particular literature, if at all.

formation. Indeed, the summary shows that the method of portfolio formation influences whether or not the CAPM is rejected.

The way portfolios are formed is important. A particular suggestion of Lewellen, Nagel and Shanken (2010) was that in tests of asset pricing models, portfolios should be sorted on the basis of alternative characteristics such as industry. This has recently been done for Australian firms DBP (2015), using a forecast error test of the type used by Houston Kemp (2016 Nov).The results suggested no bias in the CAPM in relation to portfolios sorted by industry. There was a "significant" result in relation to some industries, including utilities, but the incidence of "significant" results was not greater than that which would be expected based on chance alone. In other words, in terms of the error rate for the experiment, the results were not significant. When the regulatory authority's version of the CAPM was used in the tests there was no significant evidence of bias with respect to utilities.

We have discussed the problems of tests of asset pricing models such as the CAPM at length in prior reports so here we will be brief. There are substantial problems in both correctly conducting such tests and in the test statistics used. For examples of problems with test statistics see, Beaulieu, Dufour and Khalaf (2012), Lewellen Nagel and Shanken(2010) and Kan Robotti and Shanken (2013). In relation to the conduct of such studies and statistical issues we paraphrase the suggestions of Lewellen, Nagel and Shanken (2010), who in addition to suggesting sorting portfolios on differing characteristics also suggest using theory to place restrictions on risk premia, in particular they suggest that the zero beta rate should be close to the risk free rate. They further suggest using GLS rather than OLS in estimation although this is an imperfect solution, and using confidence intervals in preference to p values, or even standard errors, since the latter are typically biased or skewed.

Recently, in his presidential address to the American Finance Association, Professor Campbell Harvey (2017) begins with an example of a test of an asset pricing model based on ticker symbols. He uses this example to show how spurious significant results can be generated and then expands upon the theme of the inappropriate results that can be obtained from the standard approaches in finance to statistical testing. He suggests that we put hypothesis testing in financial economics on an entirely different basis to that traditionally used.

In the light of the two preceding paragraphs, it seems quite appropriate to not blindly accept the results of tests of asset pricing models. In particular it is appropriate to be sceptical about whether the tests determine if the models are true, or whether they are biased in one direction or another. Practitioners, however, cannot wait until all the testing issues are resolved. They have made their choice about the appropriate model. As we have repeatedly said, for example, Partington and Satchell (2016, p40):

> "…the CAPM has passed an important test. That test is the test of time. While academics are still debating the merits of the different asset pricing models, how they should be tested and what the appropriate test statistics are, the users of models have made up their mind about which model to use when estimating the cost of capital. The SLCAPM has had several decades of widespread practical use in estimating the cost of capital. None of the other models have passed the same test."

We agree with Houston Kemp (2016 Nov), that a substantial number of previous studies find that the estimates of return from the CAPM for low beta stocks are less than the returns subsequently realised. However, taking this evidence at face value, there is a considerable difference between CAPM estimates of the return required on a low-beta asset being lower than subsequent returns and a downward bias in CAPM estimates of required returns. Furthermore, it is quite clear to us that, if CAPM returns and subsequent realised returns differ, it does not necessarily require a beta adjustment upwards. Such a solution might be appropriate if it was unambiguously clear that there was a CAPM bias and it was due to downward bias in the beta. However, to the extent there is evidence for bias it is evident in alpha not beta. Furthermore, if the source of the higher returns was systematic outperformance of stocks relative to their required returns, different adjustments would be required, rather than adjustments to beta. This would include the subtraction of alpha from realised returns, as we outlined in our previous report to the ERA, Partington and Satchell (2016 ERA, p15), and which we quote below.

> "An alternative premise is that the results are a consequence of actual returns outperforming (underperforming) equilibrium returns for low (high) beta stocks. In the parlance of funds management such outperformance is expressed as alpha. Thus low beta stocks have positive alphas. In this case an estimate of the

> equilibrium return is obtained by subtracting alpha from the actual return. Whether the resulting return is then higher or lower than the regulated return is an open question and will depend upon the magnitude of alpha and beta."

Houston Kemp (2016, Nov, p36) comment on this as follows:

> "The advice of Partington and Satchell is that no matter how large an estimate of [the alpha] turns out to be, attribute the estimate to 'outperformance' and deduct the estimate from the sample mean of the series of realised returns. This is unusual advice."

This remark by Houston Kemp (2016 Nov) somewhat misstates our position as inspection of the two quotations makes clear. Furthermore "smart beta strategies" and many other strategies promoted by the fund management industry rely on a belief that divergence from equilibrium returns can be exploited to extract additional abnormal returns (alpha). Thus our advice is not so unusual.

In our discussion above we have canvassed the requirement that in measuring unbiasedness we need to have the right benchmark for the performance of the model. We have also pointed out that there are many other problems that beset such tests of asset pricing models. We conclude this section by considering Houston Kemp's (2016 Nov) emphasis on the importance of unbiasedness as a criterion for model selection.

Unbiasedness is a desirable property of statistical estimates, but it is not the only desirable property. Maurice Kendall, one of the great statisticians, makes this point very entertainingly in Hiawatha Designs an Experiment, Kendall (1959). The serious point that Kendall makes is that while unbiasedness is a desirable property, unbiased estimation can result in estimates that are so inaccurate as to completely miss the target.

Consider in this light Houston Kemp's (2016 Nov) first model, which sets the required return on equity to be a constant across all equities. This may deliver an unbiased estimate of subsequent realised returns in a given period. However, we expect that there would be very few, if any, academics or practitioners, who would consider that such a model for individual firms would register required returns upon the target.

ii. Stated that empirical tests indicate return on equity forecasts from the Sharpe-Lintner CAPM and the AER's implementation of the Sharpe-Lintner CAPM are biased downwards for low beta stocks.

Our comments in the preceding section are also relevant here. We would particularly like to see the results for portfolios sorted by industry. In a more technical vein we note that testing the CAPM unconditionally or conditionally is a non-linear test of parameters in the bi-variate distribution of returns for the benchmark efficient entity and the market.

Letμ_i, μ_m be the expected arithmetic rates of return on asset i and the market m respectively. Let β_i, r_f be the population beta of asset i with respect to the market m and the riskless rate of return, respectively. The CAPM states:

$$\mu_i - r_f = \beta_i(\mu_m - r_f)$$

And this is the restriction that needs testing.

The next step is to assume a bivariate distribution for realised excess returns on the stock and realised excess on the market. Following the approach of NERA (2015); we assume that (see, their equation 6, page 24),

$$z_{jt} = \alpha_j + \beta_j z_{mt} + \varepsilon_{jt} \quad \text{for j=1,...N.} \qquad (1)$$

Where:

N = the number of portfolios

α_j =The error with which the model measures the mean return to portfolio j;

β_j= the Beta of portfolio j;

z_{jt} = Excess return to portfolio j over the period t-1 to t

z_{mt} = Excess return to the market portfolio over the period t-1 to t

ε_{jt} is the idiosyncratic return to portfolio j over the period t-1 to t, typically assumed to be mean zero.

Under the assumption that the above model is the true model; then testing the CAPM is equivalent to testing if $\alpha_j = 0$. However, if the above model is not the true model testing if $\alpha_j =$

0 is not equivalent to testing the CAPM. Consultants to the regulated businesses, such as NERA, and others relax the above assumptions by moving to the zero-beta (Black) CAPM, which retains the above structure, but changes the definition of excess returns relative to the riskless rate to excess returns relative to a zero-beta portfolio. But this is just one of several possible alternatives and in some cases is based on unrealistic assumptions. In particular, as we have previously discussed, the results it throws up seem quite inconsistent with the only plausible assumptions that justify it, i.e. Brennan's model where borrowing and lending rates differ.

We turn now to Houston Kemp (2016 Nov) section 3.2, where they describe their approach. They argue that perfect foresight is not assumed in their test of whether the CAPM regulated return will be unbiased, but rather rationality is attributed to the regulator. For example:

> "That is, if the regulator is rational, its assessment of the *MRP* will be unbiased in the sense that it will use correctly all information available at time *t* -1 in forming its expectations. Rationality on the part of the regulator does not imply that the regulator has perfect foresight."

Houston and Kemp's (2016 Nov) argument that only regulator's rationality is required rests on several assumptions, which are as follows:

$E\left(z_{jt} - \hat{\beta}_{jt}\hat{z}_{mt}\right) = 0$; where E is the unconditional expectation. (Houston Kemp's equation (5)). The terms $\hat{\beta}_{jt}$ and $\hat{z}_{mt}$ are both forecasts of the stock beta and the market's expected excess return based on information known at time t-1. The t subscripts on variables without superscripts (here and below) indicate the possibility that the true values change with time.

The next step in Houston Kemp's analysis is to restate their equation 5 as follows:

$$E\left(z_{jt} - \hat{\beta}_{jt}\hat{z}_{mt}\right) = E(E_{t-1}\left(z_{jt} - \hat{\beta}_{jt}\hat{z}_{mt}\right)) = E\left(z_{jt} - \hat{\beta}_{jt}z_{mt}\right) = 0.$$

On the right hand side of this equation, the step where $E(E_{t-1}\left(\hat{\beta}_{jt}\hat{z}_{mt}\right)) = E\left(\hat{\beta}_{jt}z_{mt}\right)$ requires that $\hat{\beta}_{jt}$and $\hat{z}_{mt}$ are uncorrelated, since we are replacing one expectation by its true value, whilst leaving the other as an expectation.

In any case, the testing as carried out by Houston Kemp (2016 Nov) is equivalent to perfect foresight on the part of the regulator with regard to the expected MRP and also assumes the regulator's ability to generate unbiased estimators of the time-varying beta. This can be seen from the statistic used to test for bias $\sum(z_{jt} - \hat{\beta}_{jt} z_{mt})/T$ (see Houston Kemp 2016 Nov, page 23, equation (11)). While perfect foresight and unbiased estimation of beta might be desirable attributes for a regulator, it is an understatement to say that this is a very challenging to achieve. A better test of whether the CAPM forecasts are biased would be to compare forecasts with actuals; the difficulty here, of course, is we do not know the true beta, but a better basis for testing would be $\sum(z_{jt} - \hat{\beta}_{jt} \hat{z}_{mt})/T$.We return to these issues in part (g) below.

iii. Estimated in two ways the alpha of a benchmark efficient entity that, when added to a forecast delivered by the Sharpe-Lintner CAPM of the required return to equity, will ensure that the forecast of the return does not exhibit, in past data, significant bias.

Let us begin by considering the term significant bias, what this actually means is a statistically significant difference between the returns the CAPM delivers according to Houston Kemp's implementation and the returns subsequently realised. As we have discussed this may not be bias with respect to the CAPM's estimation of equilibrium returns. Furthermore, this work suffers from perfect foresight bias. As we explain in part (g) below, this will bias the tests to reject unbiasedness too often so the results in Houston Kemp's (2016 Nov) Table 1 need to be interpreted with caution. If as a rule of thumb, we were to double the standard errors, reported inside brackets in Table 1, all the significant forecast errors reported for both the SLCAPM and AERCAPM would become insignificant.

We also note that the results for the AER CAPM are somewhat arbitrary. Houston Kemp assume that the AER beta of 0.7 is a consequence of weighting the mid-point of the AER's range for 0.4 to 0.7, that is 0.55 and weighting it by two thirds, while placing a weight of one third on a value of one. Consequently in implementing Houston Kemp's (2016 Nov) estimates for what they call the AER CAPM they place a weight of two thirds on their unadjusted estimate of beta and a weight of one third on a beta of one. There is a potentially infinite set of weighting schemes that could be used to give the AER adjusted estimate of beta of 0.7. For example the AERs adjusted

beta of 0.7 could be obtained by a weight attached to any value within the AERs range for beta of 0.40 to 0.7 and a weight attached to a beta greater than 0.7.

Taking the Kemp Houston (2016 Nov) results at face value suggests that some low beta `portfolios have positive forecast errors. This leads us back to the discussion of appropriate benchmarks. Is a positive forecast error evidence of outperformance which does not require any regulatory adjustment to the CAPM, or it is evidence of downward bias in the CAPM estimates of required returns in equilibrium. We also point out that tests based on industry sorted portfolios could give, and have previously given, no evidence of significant bias.

iv. Estimated in two ways the weighted average of an OLS estimate of the equity beta of a benchmark efficient entity that, when used in a forecast delivered by the Sharpe-Lintner CAPM of the required return to equity, will ensure that the forecast of the return does not exhibit, in past data, significant bias

This work is subject to exactly the same criticism as made for the adjustment of alpha above. The difference is that this is a beta adjustment, which might be appropriate if bias in beta was causing any forecast error. However, we have not seen any convincing evidence that it is a bias in beta that is causing any forecast error.

v. Considers that the AER cannot state that it is implausible for the zero beta premium to be equal to or greater than the MRP using the work of Hong and Srear *(*2016) which shows that when investors do not share the same beliefs a weak or negative relation can appear in the data even in the absence of measurement problems.

We have studied the paper by Hong and Srear (2016) and note that in their model, when investors are well-informed/unconstrained for short-selling, then the CAPM holds. However, when short-selling is not allowed it is the high beta assets which are over-priced. The emphasis in this work and earlier work by Franzini and Pedersen (2014) is that the market distortions are

occurring at the high beta part of the market, distortions at the low-beta part of the market are a consequence of this. Whether the distortion is primarily in alpha or beta is unclear to us, because in the Hong and Srear paper there are multiple versions of the model presented. However, considering Franzini and Pedersen, Proposition 1, which we reproduce below, it is clear that there is an alpha bias, not a beta bias.

Proposition 1 (high beta is low alpha). (i) The equilibrium required return for any security s is

$$E_t(r^s_{t+1}) = r^f + \psi_t(1 - \beta_{st}) + \beta_{st}(E_t(r^m_{t+1}) - r^f)$$

Where:

ψ_t is the average Lagrange multiplier, measuring the tightness of funding constraints.

We see that this is the SLCAPM except there is an extra term, the alpha. A security's alpha with respect to the market is $\psi_t(1 - \beta_{st})$; the alpha is thus decreasing in the beta.

Whether the regulatory return should include this alpha is by no means clear; what we can say with confidence is that this theorem offers no theoretical justification for scaling beta in order to compute regulatory returns.

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

We would not agree that we have found evidence against the CAPM, but we have reported that many other researchers believe the evidence is against the CAPM. We have also agreed that much empirical work finds that low beta portfolios generate higher returns than predicted by the CAPM. We would agree that there are a substantial number of empirical studies, as reviewed by Houston and Kemp (2016 Nov) on the basis of which a substantial number of academics conclude that the evidence is against the CAPM. However, even within Houston Kemp's review there was some evidence in favour of the CAPM, although only in a small minority of the work. We conclude that none of these CAPM studies are definitive in

determining the direction of bias, if any, in the CAPM or in determining the meaning of the positive alphas found in such work.

a. HoustonKemp's material does not imply that an uplift is needed when using the Sharpe-Lintner CAPM to estimate the cost of equity for a benchmark efficient entity.

This issue arises throughout the previous responses and our response here is therefore brief. We find no evidence in Houston Kemp (2016 Nov), or elsewhere that any bias is due to a bias in the estimate of beta. There is some statistical and theoretical evidence that alpha may be positive for low beta portfolios, but this does not necessarily translate into a required uplift of regulatory returns.

b. Deviation from the Sharpe-Lintner CAPM may represent disequilibria in the capital markets

What we argue is that realisations may not match equilibrium expectations and that this can be persistent. Houston Kemp further (2016 Nov, p19-20) suggest that:

> "Deviations from the SL CAPM offer the opportunity to make a profit but, in general, only by bearing additional risk. For this reason, one cannot expect arbitrageurs on their own to eliminate any deviations from the model that occur."

The thrust of Houston Kemp's argument here and elsewhere is that, deviations from the CAPM are possible, even substantial deviations (p.37). This idea is repeated at several points and the argument is made that these deviations do not present arbitrage opportunities and that there are theoretical reasons why they can persist.

There is an apparent tension between the foregoing and the quotation below, Houston Kemp (2016 Nov), p 39-40):

> "Regardless of whether markets are in equilibrium or disequilibrium the cost for a company of raising equity will be the return that the company expects that it must deliver to equity-holders, that is, the expected return to the equity. If the market expects to receive a return of 15 per cent, then that will be the cost that

> a company will face in raising equity – regardless of whether investors require only 10 per cent. There are strong forces that will prevent expected and required returns from diverging for very long and so in general one would expect that the return that the company expects to deliver to equity-holders will also be the return that investors require. It is, however, the return that the company expects to deliver that will determine the cost that the company will face in raising equity and so it is far from clear that it matters whether the market is in equilibrium or disequilibrium.
>
> One way that it might matter would be if the market is currently in equilibrium but has been out of equilibrium for the preceding 40 years. It would matter, for example, if the return that investors require on equity has been in the past persistently below the expected return on equity year after year. Relying on historical data then would lead an analyst to overestimate the expected return on equity going forward. It is not credible, however, that the return that investors require on equity has been persistently below the expected return on equity – that is, that the market has been out of equilibrium – for a period of 40 years."

There is a similar argument on page 38 but to avoid repetition we refer the reader to it, rather than presenting the quotation.

The first quotation argues that there can be potentially profitable arbitrage opportunities from deviations from the CAPM that may persist. The second quotation argues that returns cannot be out of equilibrium over an extended period because arbitrage will equalise expected and required returns, and implies that if so historical returns data can be reliably used to measure expected returns. The second quotation also says that the cost of capital is determined by the expected return. This is wrong. It is the required return that determines the cost of capital.

We agree that in the absence of barriers to arbitrage there are strong forces that will equalise expected and required returns. We do not however agree with the implication that given equality between expected and required returns all will be well in using realised returns to measure expected returns period by period. Even if expected and required returns are equal, there can be persistent differences between realised returns and equilibrium expected returns.

Consider first what determines the equilibrium. The equilibrium condition is reached by the adjustment of prices such that expected and required returns are equal. In Houston Kemp's example the required return on the stock is 10% and the expected return is 15%. This looks like a great deal for investors, they only require 10% but they expect to get 15%. Consequently, buying pressure is likely to push up the price of the stock until it has risen to a level where at the higher price it now offers a 10% return. It is, thus, the required return that determines equilibrium expected returns and the cost of capital.

Now let us consider the persistence of realised returns diverging from equilibrium expected returns. Houston Kemp (2016 Nov, p.38) state:

> "It is also correct that for risky assets there is no guarantee that realised returns will match expected returns. It is unlikely, however, that the returns that investors require on assets will sit far below or far above the returns that investors can expect to earn on the assets for a prolonged period of time because, again, there are strong forces, should markets move away from equilibrium, which will propel markets back towards equilibrium."

The reality is that realised returns can diverge from equilibrium expected returns for extensive periods. For example, it has been commonly said with respect to capital markets that the twentieth century was the American Century. The argument is that for a large part of the twentieth century American investors consistently received unexpectedly good news in the form of positive abnormal returns.

As a further example, it would hardly be considered that decades of negative real returns on equity was consistent with a market delivering equilibrium expected returns, but according to *The Economist* magazine website (*http://www.economist.com/blogs/buttonwood/2016/01/investing.*):

> "As of February 2013, the longest period of negative real returns from US equities was 16 years. But it was 19 years for global equities (and 37 for world ex-US), 22 for Britain, 51 for Japan, 55 for Germany and 66 for France."

The same source provides evidence that bonds have outperformed equities for several years. Again this is hardly consistent with an equity market that quickly returns to an equality between

expected and realised returns. In short, it is not difficult to find evidence consistent with sustained periods where realised returns clearly did not match expectations.

We list below three reasons why markets can fail to converge to equilibrium returns and why expected and realised returns may differ.

1. The equilibrium itself changes through time. This is implicit in Houston Kemp's (2016 Nov) equation 1, where they assume that β_{jt} is time-varying and in equation 2 where they have expectation of the market risk premium as time varying. Thus in adjusting to equilibrium we are constantly chasing a moving target.

2. The whole thrust of behavioural finance is that there are individual psychological processes that keep us away from rational equilibrium values. Furthermore, these processes are not necessarily self-correcting.

3. A sequence of economic shocks can result in realised returns that are substantially different from expectations. In this case there can be a persistent difference between realised returns and equilibrium returns.

c. Data cannot be used to assess the severity of the low-beta bias

First, we make the general point that the quality of the data and research method, together with the plausibility and consistency of the results of the data analysis all bear on the extent to which data provides good evidence. Our discussion at (d) below, where the interaction of theory and data are considered, is also relevant here. Next we consider a quotation from Houston Kemp, (2016 Nov. P39).

> "The justification that Partington and Satchell use for setting aside the evidence of a low-beta bias – that the evidence may reflect disequilibrium in the capital markets over a long period of time – is also made clear in the following statement:
>
> > 'It would be unwise to use the ability to forecast subsequent realised returns as the sole criterion for selecting an asset pricing model.

> Forecasting stock returns and determining equilibrium expected returns (asset pricing) are two different tasks.'
>
> The second sentence of the above is clearly untrue. Asset pricing models are models, in which an equilibrium is in general assumed to exist, that make predictions about the cross-section of mean returns – that is, expected returns. An expectation is a forecast. By evaluating whether the forecasts that a pricing model delivers are biased or unbiased one can assess whether estimates of the return on equity that the model delivers are likely to be biased or unbiased."

It is true that in general an equilibrium is assumed to exist in asset pricing models. However, in reality markets can have periods of disequilibrium and expectations are not always realised, even on average. Thus, when in forecasting mode, we are likely to be interested in models trying to forecast shocks to returns as well as their mean. Consequently, forecasting models can and do differ from asset pricing models.

The SLCAPM is a model of equilibrium returns where all relationships are contemporaneous. It thus gives the return that investors require as of a given date for the investments that are currently being made. That is not to say that the SLCAPM cannot be used for forecasting and it frequently is, but we need as an input what the excess returns on the market is expected to be in the next period. This is exogenous in the SLCAPM framework and so we have to resort to alternative procedures for estimating the excess return.

The emphasis on the work by Houston Kemp is on forecasting, but in-sample fit is also a sensible way to consider the validity of a model. We caution that any such statistical procedure, however well-done, is unlikely to be totally conclusive. Model selection, whether it be choice of model specification or choice of parametric values for a given model, should be based on a mix of empirical and theoretical considerations, as we discuss below. Also, as we discuss under A2 (i) the interpretation of the results from the analysis of data depend upon the lens through which the results are observed.

d. Reliance on theory will provide a better way of assessing the severity of the low beta bias.

What Houston and Kemp (2016 Nov, p42) claim that we say is quoted in their report as follows:

> 'Houston Kemp's answer is, let the data speak, but the data speaks in many tongues and does not provide one unambiguous answer, or even approximately similar answers … unless we resort to the underlying theory, how is judgement to be made?'

What we actually say is Partington and Satchell (2016, p42):

"Once again we strike the problem of how the reasonableness of the zero beta premium is to be determined. Unless we resort to the underlying theory, how is a judgement to be made? Houston Kemp's answer is, let the data speak, but the data speaks in many tongues and does not provide one unambiguous answer, or even approximately similar answers. Furthermore, the analysis of the data does not put beyond reasonable doubt the issue of whether any adjustment is necessary at all."

This clearly does not say that "sole reliance on theory" (Houston Kemp (2016 Nov, p42) is the way to make judgements. In general our belief is that theory and data are relevant to judgements. The context of the above statement was that consultants to the regulated business had provided substantially different estimates of the zero beta premium and they lay beyond the limits given by the Black CAPM. Our view, which is reflected in the above statement is that where the data gives substantially varying and ambiguous answers, considerable weight should be given to the theory in deciding the reasonableness of the results from the data. In research, it is well understood that a weighting should be given to the theory and priors, as well as to data. Harvey (2017) stresses the importance of priors and strongly argues against reliance on the statistical significance of p-values, particularly where they may be subject to p-hacking. He also provides a very clear example of the importance of theory in interpreting the validity of results, which we commend to the reader.

In situations where the empirical work is unconvincing and the theory is transparent, relatively ungameable and rigorous (such as the SLCAPM), we would be inclined to attach a higher weight

to the model. Houston Kemp (2016 Nov) naturally think well of their own empirical results, but they are far from definitive. We also suggest that a more complete study would have included the results for industry portfolios.

e. Satchell's comments appears to differ between his own research and reports written for the AER (and the ERA)

Houston and Kemp (2016 Nov) focus a great deal of discussion (pages 42 to 45) on a paper by Muijsson. Fishwick and Satchell, (MFS) titled "The low-beta anomaly and interest rates", which is a book chapter in *Risk-Based and Factor Investing*, ed. J. Emmanuel, 2016. Whilst one of the authors is flattered that his research is being studied with such enthusiasm, it has been misinterpreted by Houston Kemp. As indicated by the title of the paper, the research was about trying to explain an anomaly. It neither assumes, nor demonstrates, a downward bias in the CAPM.

As in this report, Partington and Satchell have repeatedly acknowledged that there is a substantial body of work that finds returns on low beta stocks have been higher than predicted by the CAPM. The question is what does this mean? The work by MFS is an attempt to address this question.

We first describe the essential ideas involved in MFS. The paper notes the presence of the low beta anomaly in some US industry data, but does not suggest that holders of such assets need to be compensated by regulators, nor that there is a downward bias in the CAPM. Rather MFS note that that there is a fundamental difference between a defensive stock (beta less than one) and an aggressive stock (beta greater than one) in terms of the impact on the stock price when interest rates change. We outline the argument of MFS below.

Noting that at time t, $\mu_i = \frac{E_t(P_{i,t+1})}{P_{i,t}} - 1$, where $E_t(P_{i,t+1})$ is the expectation held at time t of the price of asset i at time t+1, an amount that would take into account expected capital gains and dividends: Re-arranging, using the SLCAPM gives us

$$P_{i,t} = \frac{E_t(P_{i,t+1})}{1+r_f+\beta_i(\mu_m - r_f)}$$

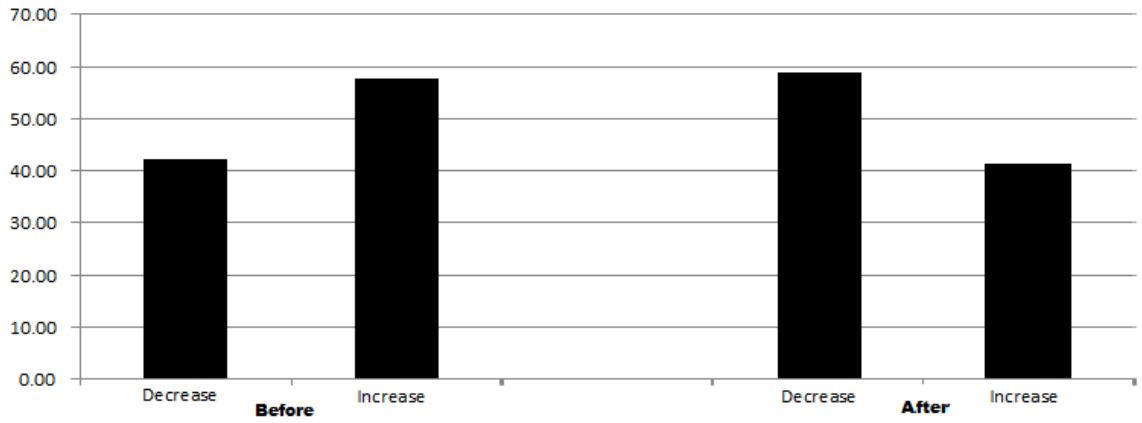
Suppose we were to consider a change in the market expected rate of return and a simultaneous change in the riskless rate of return. We denote these changes by $d\mu_m$and dr_f respectively. Let the change in the price be dP_{it}. Then,

$$dP_{it} = \frac{dP_{it}}{dr_f} dr_f + \frac{dP_{it}}{d\mu_m} d\mu_m$$

$$dP_{it} = \frac{-E_t(P_{i,t+1})}{(1 + r_f + \beta_i(\mu_m - r_f))^2} \left(dr_f + \beta_i(d\mu_m - dr_f)\right)$$

Since the term to the left of the brackets is unambiguously negative we can see that a total change in the risk premium $(d\mu_m - dr_f)$ that is positive, say 2% with an asset with a beta of 0.5 will decrease prices as long as the associated interest rate fall is less than 1%. There is a difference in the response across portfolio types: as high beta portfolios are equivalent to portfolios long the market and short bonds (borrowing) while low beta portfolios are equivalent to portfolios that are long the market and are long on bonds (lending). These portfolios carry different sensitivities to the interest rate. By being long on the riskless bond, low beta portfolios see an increase in their relative return in times of interest decreases, while high beta portfolios see a decrease under similar conditions. We note that in the US, there were, on average more falls in the interest rate than rises after 1983 which is often the period considered to be important for the good performance of low beta portfolios and the under-performance of high beta portfolios, see Figure 2 below, reproduced from MFS.

Figure 2: Count of Interest Rate Changes before and after 1983



Source: MFS

Concluding, the purpose of MFS was to see how interest rate changes in the US might be able to explain the low-beta anomaly in the US. As such, it was reasonably successful. How the sensitivity to interest rates of low/high beta industry portfolios in the US, translates to a downward bias in the CAPM and leads to implications for Australian regulated prices is a curious leap of ideas by Houston Kemp (2016 Nov).

Houston Kemp (2016 Nov), also argue that there is inconsistency in Satchell's work in that Partington and Satchell (2016 ERA) state that studies based on industry portfolios support the CAPM, whilst the results in MFS are contrary to this. We first point out that, that MFS used the Fama-French (1997) 43 industry scheme, of which 5 industries were involved in what Houston Kemp refer to as low beta-bias. We point this out because the different studies use different industry classifications. Turning to the alleged contradictory material, we reproduce the relevant section from our report Partington and Satchell (2016, ERA, p21). The first paragraph refers to results of a study of the CAPM applied to Australian industries.

> "The results in Tables 7 and 8 generally are supportive of the SL CAPM. Across the 104 tests in the two tables significant bias is only observed with respect to 3 industries. These are retailing, pharmaceuticals and utilities, which provide six results significant at the 5% level. With the exception of retailing, these results are only significant for Method B. In short there is very little evidence of significant bias and the number of significant results is approximately the number expected by chance. With a type 1 error of 5% we would expect 5.2 of the 104 hypotheses to be rejected even if the null is true. Thus finding only 6 rejections suggests to us that the SL CAPM is supported by these testing procedures.
>
> The results above are buttressed by Da, Guo and Jagannathan (2008) who in an unpublished version of a subsequently published paper (2012) show the same result for US portfolios. They examine the performance of the SL CAPM on the 10 Fama and French industry portfolios. They find that cross-sectionally the SL CAPM explains approximately 50% of the average returns on the 10 industry portfolios. The inclusion of two additional factors - SMB and HML (SMB in particular) - improves the adjusted R-square to be more than 83%. However, such higher R-square is accompanied by negative risk premia for the additional factors. When

> they use time-series regressions, they find that during 1932-2007, the SL CAPM explains return variation slightly better than Fama-French three-factor model does. Thus the evidence for the viability of the SL CAPM as an appropriate model for time series regressions is supported, at the industry level, not just by the Australian results above, but also by results for the USA."

Clearly Partington and Satchell's (2016, ERA) statements are based on an Australian study, supported by a US study. The results for US industries differ between Da, Guo and Jaganathan (2008) and MFS for several reasons. First, they use very different industry classifications based on different time periods. Second, the studies differ in their purpose and use different research methods. The purpose of MFS was not to test the CAPM or compare it with other asset pricing models. The purpose was to examine an anomaly with a view to explaining it. The title of the proposed book by MFS that Houston Kemp reports: *The Low Beta Anomaly and Other Mysteries,* clearly shows that MFS do not believe the results they find are a consequence of failure of the CAPM. If they were there would be no mystery.

f. differences between expected and realised returns are a problem when testing asset pricing models and the use of work by Isakov (1999)

As we state in Partington and Satchell (2016 ERA) the point in mentioning Isakov's work was not to endorse it as a method of testing the CAPM, but rather to illustrate the problem in testing asset pricing models when realised returns are inconsistent with expectations. Isakov's concern was dealing with switches between positive and negative excess returns on the market. Clearly, investors do not invest in equities with the expectation of a negative market risk premium. Consequently, when the excess return on the market is negative expectations and realisations diverge. Therefore, if the sample used to test the CAPM covers periods when the excess returns on the market are predominantly negative it would be no surprise to find a negative relationship between beta and equity returns.[3] This would have little to do with the validity of the CAPM, rather it would be a result of divergence between expected returns and realised returns. When returns are generally negative high beta stocks are expected to do worse that low beta stocks, but investors did not invest with the expectation of negative returns.

[3] We have seen the case of a researcher who has done this and who presented a paper claiming the evidence is against the CAPM.

The foregoing is just an illustration of the problems that arise because of a divergence between expected and required returns. The issue, which recurs throughout our responses, is whether the divergence between CAPM returns and the realised returns to low beta stocks is due to the CAPM underestimating equilibrium returns, or realised returns being systematically higher than expected returns over an extended period.

g. The use of the sample mean forecast error to test whether forecasts of the return required on equity generated by the Sharpe-Lintner CAPM assumes perfect foresight with respect to the realised excess return on the market

The issue of the forecasting test is also discussed at A2 (ii) above. Houston Kemp (2016 Nov, p23) use the following statistic to test rationality$\sum(z_{jt} - \hat{\beta}_{jt} z_{mt})/T$. This seems inappropriate. A better basis would be $\sum(z_{jt} - \hat{\beta}_{jt} \hat{z}_{mt})/T$. This does not assume that we know z_{mt} at time t-1 and assuming that we do is precisely what economists call perfect foresight. What are the consequences of this assumption? Although the results will be model-dependent, we can say that perfect foresight will reduce variability in most cases, so that when we come to assess the unbiasedness of the forecast of the regulator this reduction in volatility will lead to rejecting unbiasedness too often. Thus it casts into doubt the validity of the empirical work in section 3 of Houston and Kemp. We feel that Houston Kemp's argument would be stronger if they were to do this correctly (i.e. based on $\sum(z_{jt} - \hat{\beta}_{jt} \hat{z}_{mt})/T$.) and we are a little surprised that they have not done so.

Why CAPM tests are biased towards positive alphas for low beta stocks

In Partington and Satchell (2016 ERA) we derive a result which shows that of estimates of alpha and beta are negatively correlated. In other words in CAPM tests the results for low beta stocks would be biased towards positive alphas. We concluded (p.18):

> "However, from the foregoing analysis, firms with high estimated betas would be expected to have low (negative) estimated alphas and stocks with low estimated betas should have high (positive) estimated alphas. This will happen in time-series regression when the SLCAPM holds and when the true model is Sharpe's Market Model. This has absolutely nothing to do with a beta bias of any kind."

Houston Kemp (2016 Nov) advance two arguments against the importance of this result. One argument (p. 41) is as follows:

“Intuition suggests, however, that the finance profession will not have overlooked, over a period of nearly 50 years, the potential explanation for the low-beta bias that Partington and Satchell outline”.

This shows an unjustified faith in the omniscience of the academic finance profession. Debate on appropriate test for asset pricing models is still continuing several decades after modern empirical testing began. So it seems reasonable to conclude that substantive statistical questions can remain unresolved, or even unexamined, for many years.

We would argue that the financial profession has failed to understand, over decades, the implication of beta-sorting portfolios as Houston Kemp (2017) have done throughout their report, see their data description on page 25, which we quote;

> “We form value-weighted portfolios on the basis of past beta estimates in the following way. At the end of December each year we use data for the prior five years to estimate the betas of all stocks relative to the market portfolio, dropping those that do not have a full 60 months of data. We then place the stocks into 10 portfolios on the basis of the estimates and record the returns to these portfolios for each month of the following year. So, for example, we compute beta estimates using data from January 1969 to December 1973 for stocks that are in the top 500 by market capitalisation at the end of December 1973. We allocate these stocks to 10 portfolios on the basis of these estimates and then record the returns to the portfolios for each month of 1974. Next, we compute beta estimates using data from January 1970 to December 1974 for stocks that are in the top 500 by market capitalisation at the end of December 1974, allocate these stocks to 10 portfolios on the basis of the estimates and then record the returns to the portfolios for each month”.

What is the impact of such an exercise? A full analysis would take pages of rather complex algebra; we shall simplify to demonstrate the essence of the argument. Suppose, instead of deciles we had just two portfolios, high and low beta. Suppose also, that that portfolios formed

on high/low beta in the past have high/low beta today. This assumption is very likely to be true, the more so when beta is estimated today on a either a rolling, or expanding window, basis,

We would the wish to compute the expected value of $\hat{\alpha}$, given that $\hat{\beta}$ >c for the top portfolio and given that $\hat{\beta} \leq$c for the bottom portfolio. These are truncated distributions and, assuming bivariate normality we can compute these two expectations. Formulae for truncated moments of the normal distribution can be found at:
https://people.sc.fsu.edu/~jburkardt/presentations/truncated_normal.pdf

To ease notation, call X=$\hat{\alpha}$, Y=$\hat{\beta}$ and we wish to compute E(X/Y>c)

First, we compute E(X/Y) = $\mu_x + \beta(Y - \mu_y) = \mu_x - \beta\mu_y + \beta E(Y)$

So E(X/Y > c) = $\mu_x - \beta\mu_y + \beta E(Y > c)$

From Burkardt, section 3.6, page 25, we see that $E(Y > c) = \mu_y + \sigma_y \frac{\phi(d)}{1-\Phi(d)}$ where d=$\frac{c-\mu_y}{\sigma_y}$ and $\phi(d)$ and $\Phi(d)$are the standard normal density and distribution functions evaluated at d.

Thus, E(X/Y > c) = $\mu_x - \beta\mu_y + \beta(\mu_y + \sigma_y \frac{\phi(d)}{1-\Phi(d)}) = \mu_x + \beta\sigma_y \frac{\phi(d)}{1-\Phi(d)}$.

By similar arguments,

E(X/Y $\leq$ c) = $\mu_x - \beta\sigma_y \frac{\phi(d)}{\Phi(d)}$

Translating this back to estimated alphas and betas, it is agreed by both parties (ourselves and Houston Kemp) that the covariance between the estimated intercept and slope divided by the variance of the estimated slope $\beta < 0$, and that the validity of the SLCAPM is based on $\mu_x = 0$ (the true value of the intercept).

If the SLCAPM is true then, E(estimated intercept/high values of estimated beta)= $\beta\sigma_y \frac{\phi(d)}{1-\Phi(d)}$ <0

If the SLCAPM is true then, E(estimated intercept/low values of estimated beta)= $-\beta\sigma_y \frac{\phi(d)}{\Phi(d)} > 0$

This suggests, to us at least, that sorting into high/low beta portfolios creates negative and positive alphas respectively and has very little to do with any need to compensate utility companies.

The second, more substantial criticism raised by Houston Kemp (2016 Nov, p.40) is that we made an error in the derivation of the covariance between alpha and beta. We are grateful to Houston Kemp for pointing out this error and the corrected derivation is as follows:

For a linear regression, if we have $y = X\theta + V$ where y is $(n \text{ x } 1)$, X is $(n \text{ x } k)$, θ is $(k \text{ x } 1)$ and V is $(n \text{ x } 1)$ where $V \sim (0,\ \sigma^2 I_n)$. The above notation means that the estimators are distributed with mean vector 0 and covariance matrix $\sigma^2 I_n$ where I_n is an n by n diagonal matrix with one's down the diagonal.

Under classical assumptions, it is well-known that

$\hat{\theta} \sim (\theta, \sigma^2\ (X'X)^{-1})$

In particular, if $X = \begin{pmatrix} 1 & X_1 \\ 1 & X_n \end{pmatrix}$ $\theta = \begin{pmatrix} \alpha \\ \beta \end{pmatrix}$

$\hat{\theta} \sim \left(\begin{pmatrix} \alpha \\ \beta \end{pmatrix}, \sigma^2 \begin{pmatrix} \sum X_{i,}^2 & -n\bar{X} \\ -n\bar{X}, & n \end{pmatrix} \right) \frac{1}{\sum (X_i - \bar{X})^2}$ where $\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$

This tells us that $cov(\hat{\alpha}, \hat{\beta}) = \frac{-\sigma^2\ \bar{X}}{\sum (X_i - \bar{X})^2}$.

In the context of the Sharpe Index Model described as equation (1) in this report, we note that $\bar{X} = \frac{\sum_{i=1}^{n} (z_{mi})}{n}$; that is, it is the mean excess market return and so we find that $\hat{\alpha}$ and $\hat{\beta}$ are negatively correlated if excess market returns are positive on average in the sample. We would expect the latter condition to hold on average, although there may be periods when it does not hold.

Houston Kemp (2017, Nov) also point out that the covariance between alpha and beta will tend to zero as n tends to infinity. This point is correct (which we failed to note) and is connected to the reason that the central limit theorem involves the rescaling of estimators. However, this point, although correct, is irrelevant as we will demonstrate.

Consider the correlation between$\widehat{\alpha},\ \text{and}\ \hat{\beta}$. This equals, from the above

$\frac{\frac{-\sigma^2\,\bar{X}}{\sum(X_i-\bar{X})^2}}{\sqrt{\frac{\sigma^2}{\sum(X_i-\bar{X})^2}\ \frac{-\sigma^2\,\sum X_i^2/n}{\sum(X_i-\bar{X})^2}}}=\frac{-\bar{X}}{\frac{\sum X_i^2}{n}}$ which is negative as long as the mean excess market return is positive and is less than one in absolute value by the Cauchy-Schwartz inequality. Furthermore this does not disappear as n tends to infinity but converges in probability to$\frac{-E(X)}{\sqrt{E}(X^2)}$. We re-write this as $\frac{-E(X)}{\sqrt{(E^2(X))+V(x)}}$. Here V(X) is the variance of X. If we divide top and bottom by sd(X), the standard deviation of X and noting that SR(X) is the Sharpe ratio of X, we end up with$\frac{-SR(x)}{\sqrt{1+(SR(X))^2}}$. A crude approximation for the Sharpe ratio of the Australian market would be about 0.4, giving a negative correlation between alpha and beta of 0.37

A3. Frontier Economics, *An equity beta estimate for Australian energy network businesses*, December 2016. In this report, Frontier Economics (among other things):

Noted that a comparison of 10-year estimate of the equity beta to 5-year estimates, and rolling 5-year estimates of the portfolio-level betas, for the 4 comparator firms generally indicates that equity beta has increased since the 2013 Rate of Return Guideline.

With regard to Frontier's (2016 Dec) results, particularly in relation to the effect of re-levering, there are many similarities with the work of CEG (2016, Nov) discussed above. Consequently we view the evidence in favour of an increase in beta as no stronger than CEG's evidence. A key weakness, relative to the CEG analysis, is that in Frontier's analysis there is no formal statistical testing of the hypothesis that beta has increased. We therefore conclude that Frontier's analysis makes a rather weak case that beta has increased in recent times.

Frontier (2016 Dec) suggest that evidence based on beta estimates over the most recent five year period are not reliable. They state Frontier (2016 Dec, paragraph 57):

> "We begin by considering beta estimates over the most recent five-year period. Although our view is that a sample of five years and four comparator firms is too small to produce reliable estimates, we report these results:
>
> a. To provide an indication of the direction of movement in equity beta estimates since the 2013 Guideline; and
>
> b. To provide a point of comparison with the ERA's recent approach, which was to rely almost exclusively on estimates from the most recent 5-year period for the four domestic utilities."

Despite this concern about reliability, Frontier use this sample that "is too small to produce reliable estimates" to conclude, Frontier (2016 Dec, para 60):

> "It is clear that these recent re-levered equity beta estimates are materially higher than the best statistical estimate of 0.5 adopted by the AER in its decisions since the Rate of Return Guideline."

Based on Frontier's (2016 Dec) own concerns about the reliability of these estimates and the lack of statistical testing, this evidence is less than compelling. Similar comments apply to the rolling window estimates that Frontier subsequently presents. This is because the estimates at the end of the rolling window period rely on the sample of four comparator firms over five years.

Unlike CEG, Frontier (2016 Dec) does provide confidence intervals for its beta estimate, although they appear to contain a typographical error. All tables have values for the confidence interval upper bounds lower than the confidence interval lower bounds; see Tables 1, 2 and 3. In interpreting the confidence intervals we take the higher value reported to be the upper bound and the lower value reported to be the lower bound. We then compare the confidence intervals in Frontier's Table 1 (for betas based on the last five years of data) and the confidence intervals in Frontier's Table 2 (for betas based ten years of data for the same four firms). With the exception of AST the confidence intervals for the firms overlap. The confidence intervals for the portfolios, both equally weighted and value weighted, also overlap. This does not necessarily mean that that there is no significant difference between the estimates, but it does mean that it is not at all clear that that five year estimates represent a recent increase in beta relative to a more reliable estimate (in Frontier's judgement) taken over a ten year period. Formal statistical testing is necessary and we suggest testing for a structural break.

We also note that for the ten year sample the portfolio estimates for the re-levered betas of the equally weighted portfolios, at 0.49 for the raw beta and at 0.52 for the re-levered beta, are very close to the base estimate of 0.5 adopted by the AER. The corresponding figures for the value weighted portfolios, at 0.54 and 0.57, are somewhat higher. This probably reflects a greater weighting given to APA, which has a raw beta substantially greater than the other three firms in the portfolio.

In addition to the static portfolios detailed in Frontier's (2016 Dec) Tables 1 and 2, Frontier also undertakes estimates of beta for rolling estimation windows. Frontier presents Figure 3, reproduced below, which relates to the rolling 5 year weekly value weighted portfolio estimates

with 95% confidence intervals. We analyse this figure as it is presented, but repeat that the appropriate test for a significant change in beta is to test for a structural break.

Our first comment, with respect to Figure 3 is that a more complete picture could be obtained by also examining the results for the equally weighted portfolio and equally weighted and value weighted portfolios for the raw betas. We predict that in these cases, from 2008 onwards, that the estimated betas would be lower than the betas shown in Frontier's Figure3.

Frontier (2016 Dec, para 64) argue that Figure 3 shows that "…the starting point estimate of 0.5 that the AER adopted from its guidelines does not fall within the 95% confidence interval for the most recent estimate." We have superimposed the blue line on Frontier's Figure 3 at a beta of 0.5. It is clear that this line cuts through the lower confidence bound approaching the 2010 to 2015 period, after which time the beta estimates become increasingly reliant on a smaller and smaller sample of firms ending up with the four firms in Frontier's Table 1. Thus, while Frontier's statement is correct, this is substantially because the rolling window portfolio becomes more and more like the portfolio in Table 1. This result is also based on the re-levering process of which we are critical. It would be more compelling if the equally weighted portfolio and portfolios for raw betas told the same story, but these results are absent.

Frontier (2016 Dec, para 65) also claim:

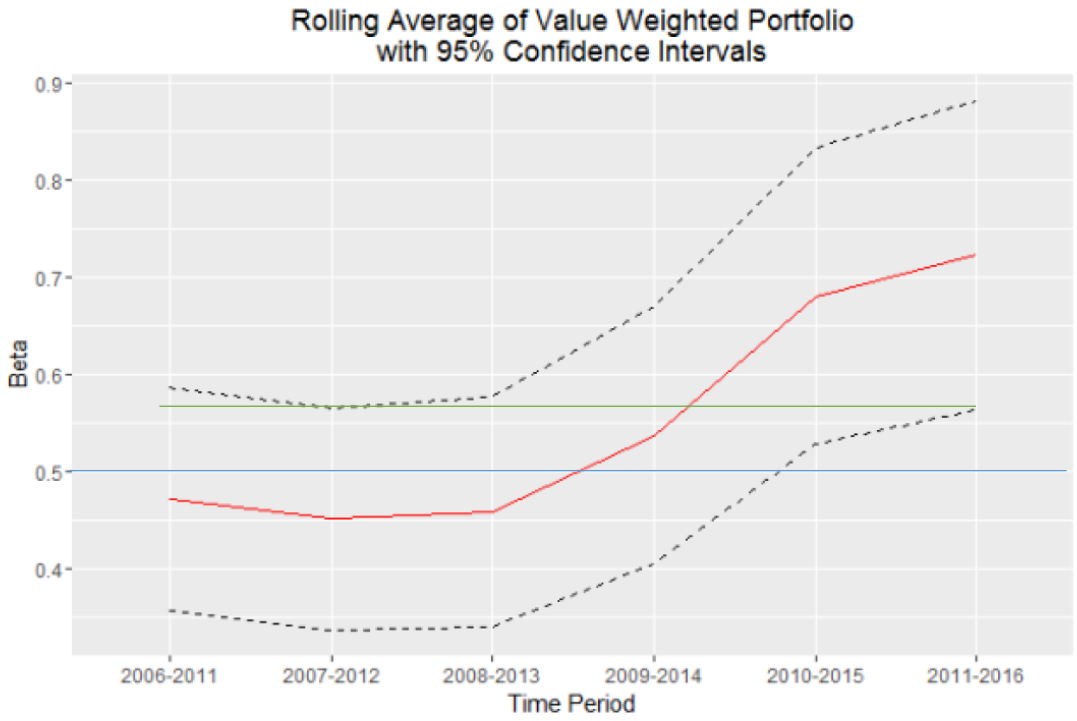
> "Moreover, there is little or no overlap between the bottom of the current confidence interval and the top of the interval around the time of the Guideline. This suggests that the estimates have increased significantly since the time of the Guideline."

In order to check this statement, we have superimposed the horizontal green line on Frontier's (2016 Dec) Figure 3. The green line sits just above the lower confidence bound for of the current (2011-2016) portfolio. The line is briefly coincident with the upper confidence bound about the 2007 to 2012 portfolio, but otherwise it is below the upper confidence interval. On this basis, the appropriate observation is that the bottom of the current confidence interval, in general, is below the upper confidence interval over the period studied. Thus there is no compelling evidence of a significant increase in beta.

It is evident from Figure 3 that a beta of 0.7, as used by the AER to set allowed returns, is very close to the estimated value for the current (2011-2016) portfolio. Consequently the value of 0.7 is well within the confidence interval. Indeed the AER could use a beta as low as 0.57 and this would still be within the confidence intervals of Figure 3 for the current portfolio.

Figure 3: Frontier's rolling window estimates of beta

Figure 3: Rolling average of the value-weighted portfolio, showing 95% confidence intervals



Source: Datastream, Frontier Economics calculations.

Turning to Frontier's (2016 Dec) results on infrastructure betas, it is by no means clear to us that infrastructure betas shed much light on utility betas. Our priors are that the infrastructure companies have more risk and thus would have higher betas than regulated utilities. It is, therefore, no surprise that this is the result that Frontier obtains. In relation to infrastructure betas, the last sentence of Frontier's report (p24) begins: "Thus, if this evidence is to be given any weight,…" We suggest that it be given negligible weight.

A4. APA VTS, *Victorian transmission system access arrangement submission*, 3 January 2017. In this report, APA VTS (among other things):

Noted that the Wright approach involves a number of additional assumptions that APA VTS does not make in its proposed implementation of the Sharpe-Lintner CAPM. And noted that the AER's (and its advisors') reasons for rejecting the Wright approach is based on these additional assumptions which are not relevant to the derivation and/or application of the Sharpe-Lintner CAPM

APA VTS (2017) support their case that they do not use the Wright approach by presenting a list of assumptions in a table numbered 7.3, which we reproduce below. The table attempts to lay out the assumptions under the Wright approach, the APA VTS approach and the AER approach.

Table 3: APA VTS Table of Assumptions

Table 7-3 – Approaches to estimating return on equity

	Wright approach (used by UK regulators)	SL CAPM (used by APA VTS)	AER foundation model
Risk free rate	Point estimate for r_f	Point estimate for r_f	Point estimate for r_f
Expected return on market	Point estimate for $E(r_M)$	Point estimate for $E(r_M)$	-
Market risk premium (MRP = $E(r_M) - r_f$)	Point estimate for $E(r_M)$ minus point estimate for r_f	Point estimate for $E(r_M)$ minus point estimate for r_f	MRP is treated as a single parameter Estimated as a long term average of difference between return on the market and the risk free rate
Relationship between r_f and MRP	r_f and MRP are inversely related	No assumption	No inverse relationship between r_f and MRP
Real return on equity	Relatively constant over time	No assumption	-
Return on market	Stable over time	No assumption	-
MRP	Varies over time	No assumption	Constant over time
Risk free rate	Varies over time	No assumption	Varies over time

The key aspect of Wright approach is the assumption of a constant real rate of return on the market. Variation in the nominal market rate of return is thus a consequence of changes in the rate of inflation and provided that inflation is not too volatile, the nominal rate of return will be relatively stable. It is also the case that under the Wright approach, other things equal, there is an inverse relation between the risk free rate and the market risk premium. To this extent APA VTS (2017) have correctly set out these assumptions of the Wright approach. APA VTS do not

use the real rate of return on the market, or the expected rate of inflation in deriving the required return on the market. To this extent they are correct in stating that they have not adopted the Wright approach. However, as we explain below, APA VTS do assume stability of the market rate of return over time and also that there is an inverse relation between the market rate of return and the interest rate.

As listed in their Table 7.3, APA VTS (2017) argues for a point estimate for the risk free rate, which it takes to be the currently known value for r_f and a point estimate for the value of the current expected return on the market E(r_m) and then taking the difference E(r_m) - r_f as the market risk premium, MRP. In theory this is a reasonable proposition for APA VTS to make. However, problems arise in the difficult business of practically determining the value for E(r_m). APA VTS state, p.159, "APA VTS is not aware of any expectations data which might be suitable for directly estimating the expected return on the Australian market for risky financial assets." and as a consequence they argue for the use of the historic average of the return on the market.

With respect to implementation of the SLCAPM, therefore, APA VTS (2017) argue for application of SLCAPM parameters consistent with the single period and forward looking nature of the SLCAPM. In stark contrast to this, however, APA VTS's first port of call with respect to estimation of E(r_m) is to use the long run average of past values for the return on the market. They justify this choice with reference to ERA tests of the stationarity of the long run market return series.[4]

We note that APA VTS (2017) also support the outcome of their use of the long run historic average return on the market with a selection of recent estimates from DGM models. However, as we have regularly suggested to the AER, DGM estimates are not particularly reliable and widely varying values can be obtained depending on the model and inputs chosen. For example, according to Fenebris (see market-risk-premia.com) as at the end of March 2017, the expected Australian market return based on the DGM was 6.8%, which is considerably lower than the estimates quoted by APV VTS, including the AER's own estimate of 9.49% to 10.81% as at September 2016.

In short, in relation to the 10% expected market return proposed by APA VTS (2017) there is heavy reliance on the long run historic average for the return on the market. Thus, contrary to

[4] We note some reservations about the ERA analysis in Partington and Satchell (2017).

table 7.3, where APA VTS state that they make no assumption on the return on the market, in implementing their estimate of the MRP as a long run average, APA VTS are assuming stability of the return on the market over time. This is the same as the assumption listed for the Wright approach. Under the APA VTS approach an inverse relation between the equity risk premium and the interest rate arises as a consequence of assuming stability in the market return. If the market return is stable, then by definition, the MRP will tend to narrow as the risk free rate rises and will tend to widen as the risk free rate falls. Thus, again contrary to table 7.3, APA VTS implicitly assume an inverse relation between the equity risk premium and the interest rate, which is also a feature of the Wright approach.

As we explain in our last equity report Partington and Satchell (2017), the issue is whether the market return, or the market risk premium is considered exogenous. As we point out in that report practitioners tend to regard the market risk premium as exogenous. APV VTS (2017), however are arguing that the return on the market is exogenous and are relying on the long run average to estimate the current value for that return. We consider that the resulting estimate of the market risk premium, provided by APA VTS, is implausible. Firstly because their use of a long run average market return imposes an inverse relation between the return on the market and interest rates and as we have argued in previous reports this seems very unlikely.[5] Second, currently the ASX VIX index, a measure of market volatility, has been trading at an implied standard deviation of returns on the market of around 12% per annum. This is a particularly low level of volatility as a value of about 20% per annum, would be considered a normal level of volatility. APA VTS are proposing a value for the market risk premium of 7.76% (computed as 10% - 2.24%). Relative to the evidence of history and the evidence of surveys this is a relatively high market risk premium. It seems an unlikely outcome to have a relatively high market risk premium when market volatility is particularly low.

[5] We note that on some occasions it is possible that the market risk premium may rise as interest rates fall, but this is most unlikely to be a systematic outcome.

A5. AusNet Services, Gas Access Arrangement review 2018–2022: Access Arrangement information, 16 December 2016. In this submission, AusNet Services

Proposed a longer (8 month) equity averaging period than the 20 business day period set out in the Rate of Return Guideline. This is to account for sudden market movements while still allowing fundamental changes in equity markets, and protection from the 'lottery' effect of an ex-ante short sample period selection.

The issue here is that the allowed rate of return, in particular the cost of equity, is set as at a particular date. Abstracting from measurement problems, the return allowed at the given date is the cost of capital at that date and the government bond yield at that date is the appropriate rate to use as the risk free rate. However, the cost of capital can change through time if the risk free rate changes. Thus, at a date subsequent to the date on which the regulated rate of return was set the cost of capital may have moved up or down. Consequently, a regulated entity might consider itself unfortunate if it happened to have the regulated return set at a date when the government bond rate (risk free rate proxy) was at a low point, conversely consumers might consider a regulated entity as fortunate (and themselves as unfortunate) if the regulated return was set at a date when the government bond rate was at a high point.

Changing interest rates involve swings and roundabouts, since there is the potential for regulated businesses to lose from interest rate movements, but there also is the opportunity to gain. On average it might be expected that such effects would balance out, but from a present value perspective there is a natural aversion to losses in the current period and a preference for gains. Particularly in the current low interest rate environment it is understandable that regulated businesses are concerned about the risk of an allowed rate of return on equity set with a particularly low risk free rate.

The current approach of resetting the regulated return every five years helps overcome a persistent divergence between the regulated return previously allowed and the subsequent cost of capital. However, it does not redress gains or losses arising from a divergence between the allowed return and the cost of capital over the regulatory period. One solution to this problem

would be more frequent updating of the allowed return. This, however, creates other problems. First, it would decrease the stability in prices. Whereas stability in prices has been considered a desirable regulatory outcome. Second it would increase regulatory costs for both the regulator and the regulated entities. This latter effect, however, is mitigated if the process for adjusting the regulatory return was a purely mechanical process. This would eliminate the scope for debate on the method for determining the allowed return adjustment, or the magnitude of the inputs to the calculation. In other words, any adjustment would be by automatic application of a formula.

The AER's transition to a trailing average cost of debt involves partial updating for the changing cost of debt each year. In principle this might be extended to updating the risk free rate in determining the cost of equity. Unless, however, this adjustment was by automatic application of a formula, it would likely generate extensive submissions on the cost of equity. The benefits of updating the risk free rate and hence the cost of equity would also need to be weighed against the potential decrease in stability for revenue and prices.

The current guideline of using a 20 day averaging period for the risk free rate has the objective of mitigating the effect of potential abnormal bond yields on particular days. In this respect 20 days should be a sufficiently long averaging period. The 20 day averaging period, however, does not address substantial changes in rates subsequent to the averaging period. For example, over the twelve months prior to May 2017 the ten year bond rate has varied from 1.82% to 2.98%. The consequence is that the allowed cost of equity set in July and August 2016 would be about 1% lower than if the allowed cost had been set in January 2016 or in January to March 2017. While a regulated business subject to a July or August 2016 rate setting received an allowed rate of return commensurate with market conditions at the time, ex-post it is apparent that they were unfortunate that July or August was the date at which their rate was set. In contrast, regulated businesses subject to a January 2016 rate setting were subject to a beneficial outcome. Such effects could be offset by periodic updating as discussed above, or by a longer averaging period.

Periodic updating of the risk free rate going forward would create greater uncertainty for regulated businesses in respect to the allowed cost of equity and hence greater uncertainty in revenue. The regulated businesses would also be exposed to the risk that the interest rate might

fall below the level observed at the original date for setting the regulated return. The foregoing uncertainties might lead to an aversion by the regulated businesses to periodic updating. The preference of the regulated businesses, however, might also be conditional on the term structure of interest rates. Where a downward sloping term structure predicts falling interest rates regulated businesses would probably be averse to periodic updating. Where an upward term structure appeared to be driven by more than a liquidity premium, thus predicting rising interest rates, regulated businesses might well favour periodic updating.

The alternative to periodic updating, that is a longer averaging period, is potentially open to gaming. Thus a prospective, rather than retrospective, averaging period is preferable in order that the rates to be averaged are not known in advance. However, when the regulated business nominates the averaging period, even with a prospective averaging period, gaming is still possible. This is because the regulated businesses can observe the term structure of interest rates and they can also observe estimates of the probability of a bond rate rise derived from the prices of derivative securities. Thus, when regulated businesses assess that bond yields are more likely to rise they will argue for a longer averaging period and when they assess that bond yields are more likely to fall they will argue for a shorter averaging period. Therefore, in accepting a proposal to diverge from the 20 day averaging period the AER should be convinced that there are good reasons for the length of the averaging period being proposed and that the proposal is not just an attempt to game the system. It would be appropriate for the AER to determine whether these conditions are met on a case by case basis and exercise regulatory discretion in relation to extending the averaging period beyond 20 days. In the current case the argument by AusNet (2016) for an extended period amounts to little more than a statement that the current process is a lottery and no justification is offered for the particular choice of eight months as the averaging period. In our opinion more justification is required.

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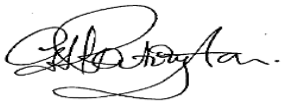
Expert Witness Compliance Declaration

We have read the Federal Court expert evidence practice notes, which are attached as an appendix. 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

Terms of Reference

The Australian Competition and Consumer Commission (ACCC) / Australian Energy Regulator (AER) seeks an expert in corporate finance, specifically, the cost of capital. This is to provide an assessment of the return on equity for regulatory determinations and access arrangements occurring over 2017.

The AER is responsible for the economic regulation of electricity networks and gas pipelines in Australia.[6] In undertaking this role, the AER sets the allowed revenues or prices for these monopoly service providers[7] over a fixed period determined in advance (usually 5 years),[8] in accordance with the relevant legislation.[9] As part of determining the total revenues or prices that a service provider may earn, the AER applies a 'building block' framework that includes a return on capital building block, which is derived from a regulated rate of return.[10]

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

1. The overarching requirement is that the rate of return on capital must be consistent with the relevant legislation; the NEL, NGL, NER and NGR (see above 'Legal requirements for the allowed rate of return'). Specific to the return on equity, the NER and NGR require:
    a. The return on equity for a regulatory control period must be estimated such that it contributes to the achievement of the allowed rate of return objective.[11]
    b. In estimating the return on equity, regard must be had to the prevailing conditions in the market for equity funds.[12]

6 Excludes Western Australia and the Northern Territory.

7 A list of these service providers can be find at: https://www.aer.gov.au/networks-pipelines/service-providers-assets

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

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

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

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

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

    a. the returns on equity and debt for a benchmark efficient entity[13]

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

    where:

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

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

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

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

        v. $WACC_{vanilla}$ is updated annually as a result of the estimated return on debt being updated annually.[14]

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

The AER is currently considering regulatory proposals by the following regulated businesses:

- AusNet Services' gas distribution services
- Multinet's gas distribution services

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

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

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

- Australian Gas Networks' (Albury and Victoria) gas distribution services
- APA Gasnet (or APA Victorian Transmission System)

All of these service providers, except for Australian Gas Networks, have proposed the AER depart from its rate of return guideline in some form.

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

- Draft decision for AusNet Services' gas distribution services, Multinet's gas distribution services, Australian Gas Networks' (Albury and Victoria) gas distribution services and APA Gasnet (or APA Victorian Transmission System)

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

Services required

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

The request in Part A is for a capped-price contract. The material relevant to this consultancy is set out below.

Part A.

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

    for the purpose of estimating the forward-looking return on equity of a regulated 'pure-play' Australian energy[15] network[16] business, which is the return that is just sufficient to induce investors to invest in the business.[17]

[15] Being a gas or electricity business.

The AER, without intending to directly or by implication provide a view of the relative importance of the expert reports and relevant material, wishes to highlight the reports listed in items A1 to A3 below. While the authors of those reports have expressed numerous views, under A1 to A3, some of their specific views are noted. These issues must be specifically addressed in the consultant's report.

In responding to these issues and reports, the consultant may comment on their assumptions, methodological choices and findings. The consultant is required to discuss the scope of any potential empirical work with the AER. This is not intended to restrict the consultant in any way or direct his review.

In addition to these, the consultant should review and address all relevant issues that support its overall conclusion.

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

A1. CEG, *Replication and extension of Henry's beta analysis*, November 2016.
In this report, CEG (among other things) :

i. Updated the analysis in its September 2016 report to include data up to October 2016 and made similar conclusions as its September 2016 report.
ii. Considered that a comparison of Henry's estimates and its own updated estimates indicated a rising beta and structural breaks in the re-levered equity beta.
iii. Applied the Quandt-Andrews test (using asset betas) that also supported structural breaks in the re-levered equity beta and a rising beta.

A2. HoustonKemp, *The cost of equity and the low-beta bias*, November 2016.
In this report, HoustonKemp (among other things):

16 Being a transmission or distribution network.
17 Given a 60:40 debt to equity ratio.

i. Reviewed existing evidence (that is the Sharpe-Lintner CAPM theory, US studies and Australian studies) which indicate that estimates of the return required on a low-beta asset, delivered by the Sharpe-Lintner CAPM are biased downwards.

ii. Stated that empirical tests indicate return on equity forecasts from the Sharpe-Lintner CAPM and the AER's implementation of the Sharpe-Lintner CAPM are biased downwards for low beta stocks.

iii. Estimated in two ways the alpha of a benchmark efficient entity that, when added to a forecast delivered by the Sharpe-Lintner CAPM of the required return to equity, will ensure that the forecast of the return does not exhibit, in past data, significant bias.

iv. Estimated in two ways the weighted average of an OLS estimate of the equity beta of a benchmark efficient entity that, when used in a forecast delivered by the Sharpe-Lintner CAPM of the required return to equity, will ensure that the forecast of the return does not exhibit, in past data, significant bias

v. Considers that the AER cannot state that it is implausible for the zero beta premium to be equal to or greater than the MRP using the work of Hong and Srear *(*2016) which shows that when investors do not share the same beliefs a weak or negative relation can appear in the data even in the absence of measurement problems.

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

   a. HoustonKemp's material does not imply that an uplift is needed when using the Sharpe-Lintner CAPM to estimate the cost of equity for a benchmark efficient entity.
   b. Deviation from the Sharpe-Lintner CAPM may represent disequilibria in the capital markets
   c. Data cannot be used to assess the severity of the low-beta bias
   d. Reliance on theory will provide a better way of assessing the severity of the low beta bias
   e. Satchell's comments appears to differ between his own research and reports written for the AER (and the ERA)
   f. differences between expected and realised returns are a problem when testing asset pricing models and the use of work by Isakov (1999)
   g. The use of the sample mean forecast error to test whether forecasts of the return required on equity generated by the

Sharpe-Lintner CAPM assumes perfect foresight with respect to the realised excess return on the market

A3. Frontier Economics, *An equity beta estimate for Australian energy network businesses*, December 2016. In this report, Frontier Economics (among other things):

i. Noted that a comparison of 10-year estimate of the equity beta to 5-year estimates, and rolling 5-year estimates of the portfolio-level betas, for the 4 comparator firms generally indicates that equity beta has increased since the 2013 Rate of Return Guideline.

A4. APA VTS, *Victorian transmission system access arrangement submission*, 3 January 2017. In this report, APA VTS (among other things):

i. Noted that the Wright approach involves a number of additional assumptions that APA VTS does not make in its proposed implementation of the Sharpe-Lintner CAPM. And noted that the AER's (and its advisors') reasons for rejecting the Wright approach is based on these additional assumptions which are not relevant to the derivation and/or application of the Sharpe-Lintner CAPM

A5. AusNet Services, Gas Access Arrangement review 2018–2022: Access Arrangement information, 16 December 2016. In this submission, AusNet Services

i. Proposed a longer (8 month) equity averaging period than the 20 business day period set out in the Rate of Return Guideline. This is to account for sudden market movements while still allowing fundamental changes in equity markets, and protection from the 'lottery' effect of an ex-ante short sample period selection.

Merits and judicial review

The regulatory determinations made by the AER under the NER and NGR are subject to merits review by the Australian Competition Tribunal and judicial review in the Federal

Court of Australia. Accordingly, the consultant's services and the consultant's final report must be performed to the following standards:

- To a professional standard which is robust, transparent, well-reasoned and defendable.
- Conform with the updated expert evidence practice note issued by the Federal Court of Australia in October 2016, including the Expert Witness Code of Conduct[18]

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

Relevant material

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

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

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

The expert advice may also need to engage with the final decision by the Tribunal on the appeal of a number of the AER's recent decisions. This was determined on 26 February 2016.[19]

[18] http://www.fedcourt.gov.au/law-and-practice/practice-documents/practice-notes/gpn-expt

Table 1 Previous expert advice provided to the AER

Professor Michael McKenzie and Associate Professor Graham Partington (McKenzie and Partington)—*Report to the AER: Part A return on equity*, October 2014
Associate Professor John Handley (John Handley)—*Advice on the return on equity*, October 2014
Graham Partington—Report to the AER: Return on equity (Updated), April 2015
Associate Professor Graham Partington and Professor Stephen Satchell (Partington and Satchell)—Report to the AER: Return on equity and comment on submissions in relation to JGN, May 2015
John Handley—Further advice on return on equity, April 2015
John Handley—*Advice on the rate of return for the 2015 AER energy network determination for Jemena Gas Networks*, May 2015
Partington and Satchell—*Report to the AER: Analysis of criticisms of 2015 determinations*, October 2015
Partington and Satchell–*Report to the AER: Cost of equity issues 2016 electricity and gas determinations*, April 2016

Table 2 AER rate of return guideline

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

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

Initial proposal from APTPPL for Roma to Brisbane pipeline – chapter 7
Revised regulatory proposal for AusNet Services (electricity transmission network)– chapter 6

[19] http://www.judgments.fedcourt.gov.au/judgments/Judgments/tribunals/acompt/2016/2016acompt0001

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

Initial proposal from AusNet Services (electricity transmission network) – chapter 10

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

Table 5 New expert reports

Frontier (Sep 2016)	Frontier, The market risk premium, September 2016
CEG (Sep 2016)	CEG, Replication and extension of Henry's beta analysis, September 2016

Table 6 Previously-submitted expert reports

CEG (2015a) (attached)	CEG, Measuring risk free rates and expected inflation, April 2015
Frontier (2015a)	Frontier (Kumareswaran & Sood), Review of the AER's conceptual analysis of equity beta, June 2015
Frontier (2015b)	Frontier, Key issues in estimating the return on equity for the benchmark efficient firm, June 2015
Frontier (2015c)	Frontier, An updated estimate of the required rate of return, AGN, June 2015
Frontier (2015d)	Frontier, Cost of equity estimates over time, Report prepared for Ergon Energy, June 2015
Frontier (2015d)	Frontier, Cost of equity estimates over time – excel model, June 2015

Grant Samuel (2015)	Grant Samuel & Associates Pty Ltd, Australian Energy Regulator – Draft Decision, January 2015
HounstonKemp (2015)	HoustonKemp, Implications for Jemena Gas Networks (NSW) of increasing competition in the consumer energy market, February 2015
Incenta (2015)	Incenta Economic Consulting, Further update on the required return on equity from independent expert reports, February 2015
Knecht (2015)	Knecht (Nevada State Controller) , Witness statement (on equity models) 19 June 2015
Malko (2015)	Malko Energy Consulting, Statement of Dr J Robert Malko, June 16 2015
NERA (2015a)	NERA, The cost of equity: Response to the AER's final decisions for the NSW and ACT electricity distributors and JGN, June 2015
NERA (2015b)	NERA, The relation between the MRP and the risk free rate: Evidence from independent expert reports, April 2015
NERA (2015c)	NERA, Further assessment of the Historical MRP: Response to the AER's final decisions for the NSW and ACT electricity distributors, June 2015
NERA (2015d)	NERA, Energy Regulation Insights: European regulators' WACC decisions risk undermining investment decisions (issue 41) February 2015
NERA (2015e)	NERA, Historical estimates of the market risk premium, February 2015
NERA (2015f)	NERA, Empirical Performance of Sharpe-Lintner and Black CAPMs, February 2015
NERA (2015g)	NERA, Review of the Literature in Support of the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French Three-Factor Model, March 2015

RBA (2015a)	RBA, RBA Governor's speech: The world economy and Australia, 21 April 2015, New York, USA
RBA (2015b)	RBA, Firm's Investment decisions and interest rates, Lane and Rosewall, RBA Bulletin, June 2015
RBA (2015c)	RBA, Low inflation in a world of monetary stimulus, speech by Philip Lowe, 5 March 2015
RBA (2015d)	RBA, Opening statement to House of Representatives Standing Committee on Economics, speech by Glenn Stevens, 13 February 2015
RBA (2015e)	RBA, Global and domestic influences on the Australian bond market, speech by Guy Debelle, 16 March 2015
SFG (2015c)	SFG, The required return on equity for the benchmark efficient entity, 25 February 2015
SFG (2015d)	SFG, Using the Fama-French model to estimate the required return on equity, 13 February 2015
SFG (2015e)	SFG, Beta and the Black Capital Asset Pricing Model, 13 February 2015
SFG (2015f)	SFG, Share prices, the dividend discount model and the cost of equity for the market and a benchmark energy network, 13 February 2015
SFG (2015g)	SFG, The foundation model approach of the Australian Energy Regulator to estimating the cost of equity, 27 March 2015
Frontier (2016a)	Frontier, Estimating the equity beta for the benchmark efficient entity, January 2016
Frontier (2016b)	Frontier, The relationship between government bond yields and the market risk premium, January 2016
Frontier (2016c)	Frontier, The required return on equity under a foundation model approach, January 2016

Frontier (2016d)	Frontier, An updated estimate of the required return on equity: Report for Australian Gas Networks, January 2016
Frontier (2016e)	Frontier, Response to submissions on the relevance of the TransGrid sale: Report prepared for Jemena Electricity Networks, ActewAGL Distribution, and United Energy, February 2016
HoustonKemp (2016a)	HoustonKemp, The cost of equity: Response to the AER's draft decisions, January 2016
HoustonKemp (2016b)	HoustonKemp, Australian Gas Networks – AER Gas Price Review, A second report for Johnson Winter & Slattery, 4 February 2016
CEG	CEG, Replication and extension of Henry's beta analysis, November 2016 (see part 1 of Multinet's Rate of Return supporting documents)
Frontier (2016)	Frontier, The Market risk premium, September 2016 (see part 1 of Multinet's Rate of Return supporting documents)

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

Legal requirements for the allowed rate of return

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

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

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

Requirements of the law

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

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

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

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

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

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

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

Equivalent provisions apply under the NGL.

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

Requirements of the rules

Under the NER, the allowed rate of return is to be determined such that it achieves the allowed rate of return objective.[20]

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

The NER require that the allowed rate of return for a regulatory year must be:[21]

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

In determining the allowed rate of return, the NER also require that regard must be had to:[22]

- relevant estimation methods, financial models, market data and other evidence
- the desirability of using an approach that leads to the consistent application of any estimates of financial parameters that are relevant to the estimates of, and that are common to, the return on equity and the return on debt
- any interrelationships between estimates of financial parameters that are relevant.

There are also provisions in the NER that refer specifically to the return on equity, the return on debt and the value of imputation credits.[23]

Equivalent provisions apply under the NGR.[24]

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20 NER, clauses 6.5.2(b) and 6A.6.2(b).
21 NER, clauses 6.5.2(d) and 6A.6.2(d). The value of imputation credits is referred to in clause 6.5.3 and 6A.6.4 of the NER and rule 87A of the NGR.
22 NER, clauses 6.5.2(e) and 6A.6.2(e).
23 See NER, clause 6A.6.2 and clause 6.5.2.

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

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

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

Context for the determination of the allowed rate of return

Better regulation rate of return guideline

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

The Better Regulation program involved the publication of several guidelines. The Rate of Return Guideline (the Guideline) was developed through extensive consultation with service providers, consumer representatives and other stakeholders and sets out the AER's approach to determining the allowed rate of return in accordance with the relevant legislation.[25] An explanatory statement (including appendices to the explanatory statement) accompanies the Guideline, and sets out the AER's reasons for the positions it reached in the Guideline.[26]

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

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[24] See NGR, rule 87.
[25] AER, *Rate of return guideline*, December 2013.
[26] AER, *Explanatory statement—Rate of return guideline*, December 2013; AER, *Explanatory statement—Rate of return guideline—Appendices*, December 2013.

The Guideline sets out the approach the AER proposes to use to estimate the returns on equity and debt for a benchmark efficient entity.[27] The Guideline also sets out the approach the AER proposes to use to estimate the value of imputation credits under the Australian tax system. The value of imputation credits mostly impacts on the separate corporate income tax building block. However, the rate of return must be set on a nominal vanilla basis consistent with the estimate of the value of imputation credits.

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

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

Return on equity approach

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

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

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

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

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

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

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

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

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

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

Return on debt approach

The rate of return guideline sets out the AER's proposed approach for estimating the return on debt. The AER's proposed approach is to adopt a 'full transition'. That is, start with an on-the-day[28] rate for the frist regulatory year and gradually transition into a trailing average[29] approach over 10 years.

AER regulatory determinations / access arrangements recently finalised

The AER finalised regulatory determinations for a number of service providers in 2015:

- TransGrid, TasNetworks (formerly Transcend), Directlink, Ausgrid, Endeavour Energy, Essential Energy, ActewAGL and Jemena Gas Networks (JGN) were finalised across April and June 2015
- SA Power Networks (SAPN),

[28] The 'on-the-day' approach estimates the allowed return on debt based on prevailing interest rates at the start of the regulatory control period (electricity) or access arrangement period (gas). At the next determinations (electricity) or access arrangement decision (gas), the allowed return on debt is reset based on prevailing interest rates at the start of the new regulatory control period (electricity) or access arrangement period (gas)

[29] The 'trailing average' approach estimates the allowed return on debt based on interest rates averaged over a moving historical period. Each year, prevailing interest rates from each new year are added to the trailing average, and interest rates from the last year of the trialing average 'fall out' of the trailing average.

- Energex and Ergon (QLD Electricity distribution network service providers [DNSP]) were finalised in October 2015.

A number of these service providers[30] appealed the AER's final decision on the rate of return (including the return on equity) to the Australian Competition Tribunal (Tribunal). The Tribunal's February 2016 decision[31] found no error with the AER's approach for the return on equity.[32]

The AER also finalised regulatory determinations / access arrangements for the following service providers in May 2016 following the submission of revised regulatory proposals in January 2016 (published on the AER's website):

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

These service providers[33] have appealed the AER's final decision to the Tribunal, although they have not appealed the return on equity.

AER regulatory determinations / access arrangements under consideration

The AER is currently considering determinations/access arrangements from the following service providers:

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

31 Effectively for appeals from the following service providers: ActewAGL, Ausgrid, Endeavour Energy, Essential Energy, Jemena Gas Networks. SAPN's appeal on the AER's rate of return decision did not include the return on equity.

32 http://www.judgments.fedcourt.gov.au/judgments/Judgments/tribunals/acompt/2016/2016acompt0001

33 United Energy Distribution, CitiPower, Powercor, JEN, AusNet Services (distribution), ActewAGL (ACT gas distribution),

- AusNet Services (VIC electricity transmission network) – The AER released its draft decision in July 2016 maintaining its Guideline approach for the return on equity (and other rate of return parameters).[34] AusNet Services submitted its revised proposal in September 2016 which, similar to its October 2015 proposal, continued to depart from the Guideline for the return on equity.[35]
- Roma to Brisbane pipeline (gas transmission) – The AER received regulatory proposal from APTPPL (for the Roma to Brisbane pipeline) in September 2016.[36] APTPPL claims application of the Guideline for the return on equity but appears to depart on many aspects.
- Powerlink[37] and TasNetworks[38] – The AER released draft decisions for the two service providers in September 2016[39] and expects revised proposals in December 2016. These service providers adopted the Guideline in their proposals, subject to the outcome of the current appeal of a number of the AER's final decisions to the Tribunal.

[34] https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/ausnet-services-determination-2017%E2%80%932022/draft-decision

[35] https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/ausnet-services-determination-2017%E2%80%932022/revised-proposal

[36] https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/roma-wallumbilla-to-brisbane-pipeline-access-arrangement-2017-22

[37] QLD electricity transmission network

[38] TAS electricity distribution network.

[39] https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/tasnetworks-formerly-aurora-energy-2017-2019/draft-decision; https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/powerlink-determination-2017-2022/draft-decision

Appendix 2

CURRICULUM VITAE GRAHAM PARTINGTON

PERSONAL

Name: Graham Harold Partington

Address: Codrington Building (H69),

Finance Discipline, School of Business,

University of Sydney

NSW 2006

Australia

Telephone: +61 (0)2 9036-9429

Email: Graham.Partington@sydney.edu.au

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).

PUBLICATIONS

Books

R. Brealey, S. Myers, G. Partington and D. Robinson, 2000, *Principles of Corporate Finance*, Australian Edition, McGraw-Hill (1st printing 2000, 2nd printing 2000.)

C.A. Martin, J. McKinnon, R. Hines, G. Harrison and G. Partington, 1983, *An Introduction to Accounting*, McGraw-Hill (1st edition, 1983, 2nd edition, 1988, 3rd edition 1990.)

Contributions and Chapters in Books

G. Partington, 2011, Valuation and Project Selection when the Market and Face Value of Dividends Differ, Reprinted in *Asset Management Tools and Strategies,* Bloomsbury Press.

G. Partington, 2009, Valuation and Project Selection when the Market and Face Value of Dividends Differ, in *Qfinance the Ultimate Resource*, Bloomsbury Press.

G. Partington, 2007, Dividend Imputation Credits and Valuation, in *Business Tax Reform*, Australian Tax Research Foundation.

R. J. Coombes, M. Craig-Lees, M. McGrath, P. O'Sullivan, G. Partington and J. M. Wood, 1991, *Business Studies Book Two*, Social Science Press.

R. J. Coombes, M. Craig-Lees, M. McGrath, P. O'Sullivan, G. Partington and J. M. Wood, 1990, *Business Studies Book One,* Social Science Press.

E. Carew, 1985, *The Language of Money,* George Allen and Unwin.

Refereed Journals

PUBLISHED

N. Pricha, S. Foley, G. Partington, and J. Svec, (2016) Underwritten Dividend Reinvestment Plans and Conflicts of Interest, *Journal of Business Finance and Accounting*, **43:9 & 10**, pp. 1361-84.

A. Ainsworth, G. Partington, G. Warren, 2016, The Impact of Dividend Imputation on Share prices, The Cost of Capital and Corporate Behaviour, *JASSA The Finsia Journal of Applied Finance,* 1, pp 41- 49

A. Ainsworth, K. Fong, D. Gallagher, and G. Partington, 2015, Institutional Trading Around the Ex-Dividend Day*, Australian Journal of Management,* **41:2**, pp.299-323.

M. Kim and G. Partington, 2015, The Dynamic Prediction of Financial Distress of Australian Firms, Australian Journal of Management, **40:1**, pp.135-60.

A. Jun and G. Partington, 2014, Taxes, International Clienteles and the Value of ADR Dividends, *Journal of Business Finance & Accounting*, **41:9 & 10**, pp. 1337–1360.

H. Dang and G. Partington, 2014, Rating Migrations: The Effect of History and Time, *Abacus*, **50:2**, pp. 174-202

Hodgkinson L and G. Partington, 2013, Capital Gains Tax Managed Funds and the Value of Dividends: the Case of New Zealand, *British Accounting Review*, **45:4**, pp.271-283.

Partington G**.,** 2013, Death Where is Thy Sting? A Response to Dempsey's Despatching of the CAPM, Abacus, **49:S1**, pp. 69-72

Yao J., G. Partington and M. Stevenson, 2013, Predicting the Directional Change in Consumer Sentiment, Australian Journal of Management, **38:1**, pp. 67-80

A. Jun, D. Gallagher and G. Partington, 2011, An Examination of Institutional Dividend Clienteles: Evidence from Australian Institutional Portfolio Holdings, *Journal of Business Finance and Accounting,* **38:1-2,** pp. 198–224.

M. Dempsey, M. McKenzie and G. Partington, 2010, The Problem of Pre-Tax Valuations: A Note, *Journal of Applied Research in Accounting and Finance*, **5:2**, pp. 10-13.

G. Partington, Discussion of an International Analysis of Dividend Payment Behaviour, 2009, *Journal of Business Finance and Accounting,* **36:3-4**, pp. 523-529.

G. Truong, G. Partington and M. Peat, 2008, Cost of Capital Estimation and Capital Budgeting Practice in Australia, *Australian Journal of Management,* **33:1,** pp. 95- 122.

M. Dempsey and G. Partington, 2008, The Cost of Capital Equations under the Australian Imputation Tax System, *Accounting and Finance,* **48:3**, pp. 439-460.

H. Chu and G. Partington, 2008, The Market Valuation of Cash Dividends: The Case of the CRA Bonus Issue, *International Review of Finance,* **8:1-2**, pp. 1-20.

L. Hodgkinson and G. Partington, 2008, The Motivation for Takeovers in the UK, *Journal of Business Finance and Accounting*, **35:1-2**, pp. 102-126

Jun, V. Alaganar, G. Partington and M. Stevenson, 2008, Price and Volume Behaviour around the Ex-dividend Day: Evidence on the Value of Dividends from ADRs and their Underlying Australian Stocks*, International Review of Finance*, **8:1-2**, pp. 21-55.

Truong and G. Partington, 2008, The Relation between Franking Credits and the Market Risk Premium: A Comment, *Accounting and Finance*, **48:1**, pp. 153-158.

B. Wong, G. Partington, M. Stevenson and V. Torbey, 2007, Surviving Chapter 11 Bankruptcies: Duration and Payoff? *Abacus*, **43:1**, pp.363-387.

G. Partington, 2006, Discussion of Dargenidou, Mcleay and Raonic (Expected Earnings Growth and the Cost of Capital: An Analysis of Accounting Regime Change in the European Financial Market) *Abacus* **42:3-4,** pp. 415-425.

S. Armitage, L. Hodgkinson and G. Partington, 2006, The Market Value of UK Dividends from Shares with Differing Entitlements, *Journal of Business Finance and Accounting*, **33:1**, pp 150-174.

G. Partington, M Stevenson and J. Yao, 2005, Run length and the Predictability of Stock Price Reversals. *Accounting and Finance*, **45:4**, pp. 653-671.

G. Partington, P Russell, M. Stevenson and V. Torbey, 2001, Predicting Return Outcomes for the Shareholders of Companies Entering Chapter 11 Bankruptcy, *Managerial Finance,* **27:4,** pp.78-96.

G. Partington and M. Stevenson, 2001, The Probability and Timing of Price Reversals in the Property Market, *Managerial and Decision Economics,* **22:7,** pp.389-398.

H. Chu and G. Partington, 2001, Dangers in Data Adjustment: The Case of Rights Issues and Returns, *Accounting and Finance,* **41:2,** pp.143-168.

G. Partington and S. Walker, 2001, A Note on Transactions Costs and the Interpretation of Dividend Drop-off Ratios, *Accounting and Finance,* **41:2**, pp. 229-241.

S. Walker and G. Partington, 2000, A Market Valuation for Optus Pre-listing: A Case Note, *Accounting Research Journal*, **13:2,** pp. 90-94. (This paper won the award for Best Paper: Education Notes.)

S. Walker and G. Partington, 1999, The Value of Dividends: Evidence from Cum-dividend Trading in the Ex-dividend Period, *Accounting and Finance*, **39:3,** pp. 275-296. (This paper won the Peter Brownell Manuscript Award).

G. Hobbes, G. Partington and M. Stevenson, 1996, Earnings Dividends and Returns: A Theoretical Model, *Research in Finance,* Supplement 2, pp. 221-244.

G. Partington, 1989, Variables Influencing Dividend Policy in Australia: Survey Results, *Journal of Business Finance and Accounting* **16:2,** pp.165-182.

C.A. Martin, J. L. McKinnon and G. Partington, 1986, Funds Statements and the Two Entity Test: A Response, *Abacus*, **22:1**, pp. 39-44.

G. Partington, 1985, Dividend Policy and its Relationship to Investment and Financing Policies: Empirical Evidence, *Journal of Business Finance and Accounting,* **12:4**, pp. 531-542.

G. Partington, 1984, Dividend Policy and Target Payout Ratios, *Accounting and Finance*, **24:2**, pp. 63-74.

G. Partington, 1984, Teaching Process Costing, *Issues in Accounting Education,* **2:1**, pp. 75-90.

C.A. Martin, J. L. McKinnon and G. Partington, 1983, Clarifying Funds Statements: The Two Entity Test *Accounting and Finance,* **23:1**, pp. 79-87.

R. H. Chenhall and G. Partington, 1983, Dividends Distortion and Double Taxation, *Abacus*, **19:1**, pp. 3-13.

G. Partington, 1981, Financial Decisions the Cost(s) of Capital and the Capital Asset Pricing Model, *Journal of Business Finance and Accounting,* **8:1**, pp. 97-112.

G. Partington, 1979, Process Costing: A Comment, **15:1**, *Abacus,* June pp.60-66.

G. Partington, 1979, The Tax Deductibility of Interest Payments and the Weighted Average Cost of Capital: A Comment, *Journal of Business Finance and Accounting*, **6:1**, pp.95-100.

Conference Papers

E. Lai, A. Ainsworth, M. McKenzie, and G. Partington, 2014, *The Value of Dividends: Evidence from Short-Sales*, Proceedings of the European Financial Management Association 2014 Annual Meetings, Rome, June.

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.

H. Dang and G. Partington, 2008, *Rating History and the Rating Dynamics of Fallen Angels, Rising Stars, and Big Rating Jumpers*, Risk Management Conference: Credit and Financial Risk Management 40 Years after the Altman Z-score Model, Florence.

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.

G. Truong and G. Partington, 2006, *The Value of Imputation Tax Credits and Their Impact on the Cost of Capital*, Accounting and Finance Association of Australia and New Zealand Conference, Wellington.

A. Jun, D. Gallagher and G. Partington, 2006, *An Examination of Institutional Dividend Clienteles: Evidence from Australian Institutional Portfolio Holdings*, Accounting and Finance Association of Australia and New Zealand Conference, Wellington.

G. Partington and M. Stevenson, 2006, *A Distress Prediction Tool*, New Directions in Employment and Financial Security: Rethinking Employee Entitlements and Employee Buyouts. Workplace Relations Centre and Members Equity Workshop, Sydney.

H. Chu and G. Partington, 2005, *The Market Valuation of Cash Dividends: The Case of the CRA Bonus Issue*, The European Financial Management Association Annual Meeting, Milan.

G. Truong, G. Partington and M. Peat, 2005, *Cost of Capital Estimation and Capital Budgeting Practice in Australia*, Accounting and Finance Association of Australia and New Zealand Conference, Melbourne,.

A. McAdam, and G. Partington, 2005, *Does the Choice of Share Price Matter when Examining Takeovers?* Accounting and Finance Association of Australia and New Zealand Conference, Melbourne.

A. Jun, , V. Alaganar, G. Partington and M. Stevenson, 2004, *Price and Volume Behaviour around the Ex-dividend Day: Evidence on the Value of Dividends from ADRs and their Underlying Australian Stocks*, Accounting and Finance Association of Australia and New Zealand Conference, Alice Springs.

M. Dempsey and G. Partington, 2004, *The Cost of Capital Equations Under the Australian Imputation Tax System*, Accounting Association of Australia and New Zealand Conference, Alice Springs,.

S. Armitage, L. Hodgkinson and G. Partington, 2002, *The Value of Dividends to a Marginal Investor, Evidence using Contemporaneous Trading Data,* British Accounting Association Conference, Jersey.

H. Chu and G. Partington, 2001, *The Value of Dividends: Evidence from a New Method*, Accounting Association of Australia and New Zealand Conference, Auckland.

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

H. Chu and G. Partington, 2001, *The Value of Dividends Implicit in Rights Prices*, Australasian Finance and Banking Conference, Sydney.

L. Hodgkinson and G. Partington, 2000, *The Motivation for Takeovers in the UK*, British Accounting Association Conference, Exeter.

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.

S. Walker and G. Partington, 1999, *Optus: A Market Valuation Pre-listing*, Accounting Association of Australia and New Zealand Conference, Cairns.

H. Chu and G. Partington, 1999, *Dangers in Data Adjustment: The Case of Rights Issues*, Australasian Finance and Banking Conference, Sydney.

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.

S. Walker and G. Partington, 1997, *The Ex-Dividend Drop-off: Evidence from Cum-dividend Trading in the Ex-dividend Period*, Accounting Association of Australia and New Zealand Conference, Hobart.

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.

G. Partington and E. Hutson, 1994, *Share Prices, Takeover Outcome sand the Volume of Trades*, Australasian Finance and Banking Conference, Sydney.

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.

G. Partington, M. Peat and M. Stevenson, 1991, *Estimating the Probability and Timing of Financial Distress,* Australian Institute of Bankers Conference, Melbourne.

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.

G. Partington, 1983, *Why Firms Use Payout Targets: A Comparative Study of Dividend Policy,* Accounting Association of Australia and New Zealand Conference, Brisbane.

Unpublished Working Papers

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.

H. Chu and G. Partington, 2001, *The Market Valuation of Cash Paid into Australian Companies: Evidence from Ex-Rights Day Share Price Behaviou,*.

G. Partington, 1993, *Miller Modigliani and Ohlson: A Note on Old Models in New Clothes,*.

Submissions to Government Inquiries and the Accounting Research Foundation

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 Life Fellow

COLLEGE Trinity College, Cambridge University

DATE OF BIRTH 22nd February 1949

CAREER 1971-73 - School Teacher

1973-74 - Computer Executive

1974-76 - Research Officer

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

1978-79 - Lecturer (Statistics Department) at LSE

1979-80 - Lecturer (Economics Department) at LSE

1980-86 - Lecturer, University of Essex

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

1986-89 - Assistant Lecturer, University of Cambridge

1989-2000 - University Lecturer at the University of Cambridge

1991-93 - Reader, Birkbeck College

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

2010-2012 - Visiting Professor, Sydney University.

2011 The Emeritus Reader of Financial Econometrics, Cambridge University.

2012- 2014 -Visiting Lecturer ,RHUL, London University

2013 -Professor, Sydney University

2014 - Fellow (Title E), Trinity College

CURRENT RESEARCH

I am working on a number of topics in the broad areas of econometrics, finance, risk measurement and utility theory. I have an interest in both theoretical and empirical problems. Many of my

research problems are motivated by practical investment issues. My current research looks at alternative methods of portfolio construction and risk management, as well as work on non-linear dynamic models. I am active in researching the UK mortgage and housing markets.

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

JOURNAL AFFILIATIONS

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

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

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

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

SUBMITTED PUBLICATIONS

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

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

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

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

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

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

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

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

Econometrica.

FORTHCOMING PUBLICATIONS

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

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

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

2015 Publications

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

2014 Publications

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

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

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

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

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

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

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International Investors' Exposure to Risk in Emerging Markets, (with B. Eftekhari) (1999), Cambridge Discussion Paper in Accounting and Finance AF20, and in *Journal of Financial Research*, Spring 1999, 22:1, pp. 83-106.

Empirical Factors in Emerging Markets, (with S. Hwang) (1999), *Emerging Markets Quarterly,* Winter, 3:4, pp. 7-27.

Does the Behaviour of the Asset Tell Us Anything About the Option Pricing Formula - A Cautionary Tale, (with L.C. Rogers) (2000), *Applied Financial Economics*, 10: pp. 37-39.

On the Volatility of Measures of Financial Risk: An Investigation Using Returns from European Markets, (with B. Eftekhari and C. Pedersen) (2000), *European Journal of Finance*, 6:1, p. 38.

Formulation of Long/Short Portfolio Risk Based on Orthant Probabilities, (with M. Lundin) (2000), published as The Long and the Short of it, *Risk Magazine*, August, pp. 94-98.

A Demystification of the Black-Littermann Model, (with A. Scowcroft) (2000), *Journal of Asset Management*, 1/2, pp. 144-161.

Small Sample Analysis of Performance Measures in the Asymmetric Response Function Model, (with C. Pedersen) (2000), 1999 IFR Discussion Paper, and in *Journal of Financial and Quantitative Analysis*, 35/3, pp. 425-450

Using a Model of Integrated Risk to Assess U.K. Asset Allocation, (with D. Damant and S. Hwang) (2000), *Applied Mathematical Finance* 7:2, pp. 127-152.

Market Risk and the Concept of Fundamental Volatility: Measuring Volatility across Asset and Derivative Markets and Testing for the Impact of Derivatives Markets on Financial Markets, *Journal of Banking and Finance*, Vol. 24(5), 759-785. (With S. Hwang) 2000.

BOOK CHAPTERS

Finite Sample Properties of Cointegration Estimators with Applications to Testing, (with G. Ellison), 1988, published in R. Bergstrom's Festschrift, published in *Models, Methods and Applications of Econometrics*, edited by P.C.B. Phillips, 1993, 176-200, Blackwell.

On Apprenticeship Qualifications and Labour Mobility (with A. Booth) in refereed book. *The Skills Gap,* edited by A. Booth and D. Snower, 1996, 285-302, CUP.

Daily Stock Returns in European Stock Markets Non-linearity, Predictability, and Transaction Costs (with A. Timmermann), *Non-Linear Dynamics in Economics*, edited by W.A. Barnett, A.P. Kirman and M. Salmon, CUP, 369-392, 1996.

Investor Preference and the Correlation Dimension, (with A. Timmermann), *Chaos and Non-Linear Dynamics in the Financial Markets*, edited by L. Trippi, 1996, Irwin.

Non-Normality of Returns in Emerging Markets: A Comparison of Mean-Variance Versus Mean-Lower Partial Moment Asset Pricing Models, (with B. Eftekhari), in refereed book *Research in International Business and Finance, Supplement 1*, edited by J. Doukas and L. Lang, 1996, 267-277, JAI Press.

Mean Variance Analysis, Trading Rates and Emerging Markets, (with P. Matheussen) in *Advanced Trading Rules*, edited by E. Acar and S.E. Satchell, 1997, 41-50, Butterworth and Heinemann.

The Portfolio Distribution of Directional Strategies (with E. Acar) in *Advanced Trading Rules* edited by E. Acar and S.E. Satchell, 1997, Butterworth and Heinemann.

Regime Switching Models and Forecasting High Frequency FX, (with R. Daccó), in *Nonlinear Modelling of High Frequency Financial Time Series*, edited by C. Dunis and B. Zhou, 1998, 177-201, John Wiley and Sons.

Modelling Intraday Equity Prices and Volatility Using Information Arrivals - A Comparative Study of Different Choices of Informational Proxies, (with S. Lin and J. Knight) edited by P. Lequeux, (forthcoming in Financial *Markets: Tick-by-Tick*, 1998, 27-64, John Wiley & Sons Ltd).

Hashing Garch (with G. Christodoulakis), in *Forecasting Financial Volatility*, edited by J. Knight and S. Satchell, 1998, 168-192, Butterworth and Heinemann.

Implied Volatility Forecasting, (with S. Hwang), in *Forecasting Financial Volatility* edited by J. Knight, S. Satchell, 1998, 193-225, Butterworth and Heinemann.

GARCH Processes, Some Difficulties and a Suggested Remedy, (with J. Knight), *Forecasting Financial Volatility*, edited by J. Knight and S. Satchell, 1998, pp.321-346, Butterworth and Heinemann.

GARCH Predictions and Predictions of Options Prices Proccesses Applied to UK Stocks, (with J. Knight), *Forecasting Financial Volatility*, edited by J. Knight and S. Satchell, 1998, pp.226-244, Butterworth and Heinemann.

Choosing the Right Measure of Risk: A Survey, *The Current State of Economic Science*, (with C. Pedersen), edited by S.B. Dahiya, 1998.

An Assessment of the Economic Value of Non-Linear Foreign Exchange Rate Forecasts, with A. Timmermann, published in *Journal of Forecasting*, 14, 1995, 447-497, reprinted in *Economic Forecasting* edited by T.C. Mills, Edward Elgar (1999).

A Data Matrix to Investigate Independence, Over-reaction and/or Shock Persistence in Financial Data, (with R. Daccó), *Decisions Technologies for Computational Finance - Proceedings of the Fifth International Conference, Computational Finance* edited by A.P.N. Refenes. Kluwer Academic Publishers, 1999 pp. 49-60.

BOOKS AND UNPUBLISHED PAPERS

A) BOOKS

Advanced Statistical Methods in Social Sciences, Francis Pinter (with Dr. N. Schofield, M. Chatterjii, and P. Whiteley), 1986.

Advanced Trading Rules, Theory and Practice (edited with E. Acar), 1997, Butterworth and Heinemann.

Forecasting Financial Volatility (edited with J. Knight), 1998, Butterworth and Heinemann.,2nd edition,2004. 3rd edition, Elsevier, 2007

Returns Distributions in Finance (edited with J. Knight), 2001, Butterworth and Heinemann.

Managing Downside Risk (edited with F. Sortino), 2001, Butterworth and Heinemann..

Performance Measurement (edited with J. Knight), 2002, Butterworth and Heinemann.

Advances in Portfolio Construction and Implementation *(edited with A. Scowcroft), 2003. Butterworth and Heinemann*

Linear Factor Models in Finance (edited with J. Knight) (Butterworth Heinemann, 2004).

Forecasting Expected Returns (Elsevier, 2007).

Risk Model Validation (Edited with G. Christodoulakis) (Elsevier, 2007).

Collecting and High Net Worth Investment, (Elsevier, 2009).

Optimizing the Optimizers, (Elsevier, 2009).

B) PAPERS (PAST)

Are Stock Prices Driven by the Volume of Trade? Empirical Analysis of the FT30, FT100 and Certain British Shares over 1988-1990, (with Y. Yoon), 1991.

Variance Bounds Tests Using Options Data, (M. Ncube and P. Seabright), 1992.

The Use of High-Low Volatility Estimators in Option Pricing, (with A. Timmermann), 1992.

Misspecification in Measurement of the Correlation Dimension, (with Y. Yoon), 1992.

Can We Hedge the FT30? (with C. Rogers and Y. Yoon), 1992.

Estimation of Stationary Stochastic Processes via the Empirical Characteristic Function, (with J. Knight), 1993.

Modelling U.K. Mortgage Defaults Using a Hazard Approach Based on American Options, (with M. Ncube), 1994.

Elliptical Distributions and Models of Garch Volatility, 1994.

Estimating the Mean-Generalized - Gini CAPM, 1995.

The Distribution of the Maximum Drawdown for a Continuous Time Random Walk (with E. Acar and J. Knight), 1995.

Analytical Properties of Rebalancing Strategies in TAA Models, (with M. Leigh), 1995.

The Effects of Serial Correlation on Normality Tests, (with Y. Yoon), 1996.

Index Futures Pricing with Stochastic Interest Rates: Empirical Evidence from FT-SE 100 Index Futures, (with Y. Yoon), 1996.

Forecasting the Single and Multiple Hazard. The Use of the Weibull Distribution with Application to Arrears Mortgages Facing Repossession Risk, (with Y. Shin), 1996.

Tactical Style Allocation: Applications of the Markov Switching Model to Value-Growth Investment and Tactical Asset Allocation, (with Y. Yoon), 1997.

Modelling Mortgage Population Dynamics, (with R.L. Kosowski), 1997.

Evolving Systems of Financial Asset Returns: AutoRegressive Conditional Beta , Working Paper. (With G. Christoulakis) 2000

Bayesian Analysis of the Black-Scholes Option Price. DAE Working Paper No. 0102, University of Cambridge. (With T. Darsinos) 2001.

Bayesian Forecasting of Options Prices: A Natural Framework for Pooling Historical and Implied Volatility Information, DAE Working Paper No. 0116, University of Cambridge. (With T. Darsinos) 2001.

The Implied Distribution for Stocks of Companies with Warrants and/or Executive Stock Options, DAE Working Paper No. 0217, University of Cambridge. (With T. Darsinos) 2002.

On the Valuation of Warrants and Executive Stock Options: Pricing Formulae for Firms with Multiple Warrants/Executive Options, DAE Working Paper No. 0218, University of Cambridge. (With T. Darsinos) 2002.

Reconciling Grinblatt and Titman's Positive Period Weighting Performance Measure with Loss Aversion: An application to UK active managers, Mimeo, University of Cambridge. (With N. Farah) 2002.

The Asset Allocation Decision in a Loss Aversion World, Financial Econometric Research Centre working paper WP01-7, Cass Business School. (With S. Hwang) 2001.

Returns to Moving Average Trading Rules: Interpreting Realized Returns as Conventional Rates of Return (with G. Kuo).

On the Use of Revenues to Assess Organizational Risk (with R. Lewin).

Improving the Estimates of the Risk Premia – Application in the UK Financial Market, DAE Working Paper No. 0109, University of Cambridge. (With M. Pitsillis) 2001

Ex-Ante versus Ex-Post Excess Returns, mimeo. (with D. Robertson) 2001.

The Impact of Technical Analysis of Asset Price Dynamics, DAE Working Paper No. 0219, University of Cambridge. (With J-H Yang) 2002.

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[40] should, at the earliest opportunity, be provided with:

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

[40] 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.

(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.

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[41]

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

[41] 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[42] 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

[42] 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.