

# REPORT TO THE AER

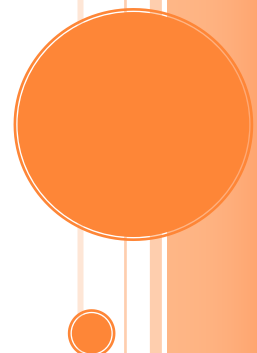
## RETURN OF EQUITY AND COMMENT ON SUBMISSIONS IN RELATION TO JGN

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AND

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REPORT DATED: MAY 2015.



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## EXPERT WITNESS COMPLIANCE DECLARATION

We have read “Expert witnesses in proceedings in the Federal Court of Australia” and 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

## BACKGROUND

We have been requested by the AER to provide the following service:

The service requested is a report on the return on equity, to be applied in the determination on JGN's 2015 to 2020 gas access arrangement, which contributes to the achievement of the allowed rate of return objective. In particular, Partington and Satchell will be required to:

- After having reviewed the key documents and other relevant material, provide a report setting out an overall view, with reasons, whether they consider it necessary to depart from any of the findings in:
  - Professor Michael McKenzie and Associate Professor Graham Partington, *Report to the AER – Advice on the Return on Equity [Part A1 –A5]*, October 2014; and
  - Associate Professor Graham Partington, *Report to the AER – Advice on the Return on Equity (Updated)*, April 2015;

### Documents for the advice

The expert advice will need to engage with the following two key documents:

- Professor Michael McKenzie and Associate Professor Graham Partington, *Report to the AER – Advice on the Return on Equity, [Part A1 –A5]*, October 2014
- Associate Professor Graham Partington, *Report to the AER – Advice on the Return on Equity (Updated)*, April 2015
- SFG – *Cost of Equity: Update report for JGN averaging period 19 January to 16 February*, 27 March 2015
- NERA –*Review of the literature in support of the Sharpe-Lintner CAPM, Black CAPM, and Fama-French three factor model*, March 2015
- SFG – *Foundation model approach of the AER to estimating the cost of equity*, 27 March 2015
- United Energy - *Submission on JGN draft decision - Historical MRP* - 27 March 2015
- United Energy - *Submission on JGN draft decision - ASX letter to UED* - 27 March 2015
- JGN Appendix 7.1 –*Return on equity response*, 27 February 2015.

The expert advice may also need to engage with other key documents, including:

- The revised proposals and other relevant material (including consultant reports) submitted by JGN.
- The AER's draft decisions (including consultant reports attached to the decisions) for JGN.
- The initial and revised proposals and other relevant material (including consultant reports) submitted by JGN.
- The AER's rate of return guideline and associated documents.

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

## INTRODUCTION

The key issues, in relation to the cost of equity, raised in the submissions for JGN are mostly issues that have been raised in relation to past determinations. These issues cover the use of the Sharpe-Lintner CAPM, Fama French model, the use of estimates of the zero beta return for the zero beta CAPM, the use of the dividend growth model and the assertion of an inverse relation between interest rates of government securities and the market risk premium. These issues have been extensively addressed by McKenzie and Partington, most recently in McKenzie and Partington (2014) and Partington (2015). There is nothing in the current submissions on the above issues that would lead us to depart from the findings in McKenzie and Partington (2014) and Partington (2015).

One issue that was raised in the JGN submissions (United Energy, 2015) and which was not addressed in McKenzie and Partington (2014) or in Partington (2015) was the claim that only arithmetic averages were relevant to the estimation of the market risk premium using historical excess returns. . However, that issue was addressed in McKenzie and Partington (2012). In that work it was shown that both arithmetic and geometric average returns were relevant to measuring the market risk premium, although a common practice is to use arithmetic averages.

Another issue, and one that we have not previously addressed, was raised in the United Energy (2015) submission. The issue is in relation to criticism of the published work of Brailsford, Handley and Maheswaren (2008). There is an attempt to cast doubt on the adjusted data series that Brailsford et.al. use in computing the market risk premium and also questioning of the validity of their claims about the source of the adjustment. There is also questioning of the value of peer review in published work. We find little merit in these criticisms

Two more issue that we have previously addressed, which were raised in the JGN submissions, are the use of the dividend growth model (DGM) and the use of relevered American utility betas. With respect to the use of the DGM we have examined this extensively in previous reports and we have acknowledged that the DGM has historically been used in estimating the cost of equity. However, we also point out the likely upward bias in cost of equity estimates of the DGM, see for example Partington (2015). There are several reasons for this upward bias, but one obvious one is the well known upward bias in analyst's forecasts. There has been no substantive refutation of this particular point, nor our general argument about the risk of upward bias in DGM estimates of the cost of capital. Consequently we do not spend time recapitulating these points in the current report.

The use of overseas betas and the requirement to relever them for use in Australia, has also been addressed in previous reports. The three salient points are first, that if we consider utility betas world-wide we often find lower betas, sometimes much lower, than in the USA. Second, we point out that the relevering process is

problematic and also unnecessary. Third, we show how the betas from USA utilities can be used to estimate the cost of capital for Australian utilities without any need to relevel those betas. We also show that when this is done, the resulting estimates of the cost of capital are below the rate allowed by the AER. We refer the reader to Partington (2015) where the details are fully covered and hence we provide no further consideration of this issue in the current report.

The Queensland Council of Social Services (QCOSS, 2015) expresses a concern about the risk of cherry picking where multiple models are used. In response to this expression of concern Partington (2015, p. 17)) makes the following statement:

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

We observe that the above hypothesis continues to be well supported in the current JGN submissions.

Given that much of the material to be addressed here has had extensive prior consideration in past reports we do not reproduce all that material, but focus on summarising some of the main points that should be made.

## Use of the SL-CAPM

A key feature of the submissions is that the SL-CAPM should not be given a special role as a fundamental model in determination of the cost of capital. As we have previously argued, see for example, Partington (2015), the SL-CAPM has had a long history, over 50 years, and was and is the preeminent model for estimating the cost of equity. The SL-CAPM continues to be used extensively by companies in estimating their cost of capital, it continues to be a dominant feature of finance textbooks and it continues to be widely taught in university finance courses. In short the SL-CAPM has passed both the tests of time and usefulness and is the model that is fundamentally used in estimating the cost of capital.

It is true that the CAPM has come under extensive attack over its life, but reports of its death have always proved to be premature.<sup>1</sup> One line of attack on the CAPM has been to point to the limited success in fitting the CAPM to ex-post returns. A common result in such work is that the fitted relation between beta and realised

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<sup>1</sup> In response to claims of the death of the CAPM, Jagannathan and Wang (1993) wrote a well cited paper with the title: *The CAPM is Alive and Well*. Levy and Roll (2012) continued this theme in a paper with the title *A New Perspective on the Validity of the CAPM: Still Alive and Well*.

returns is flatter than would be expected based on the SL-CAPM. This is taken as evidence against the CAPM, but such research is difficult to do well. One challenge is to distinguish between the returns expected in equilibrium (ex-ante), which is what the CAPM is about, and the shocks to returns that drive the resulting realised returns (ex-post) away from their expected values. Another difficulty is that betas cannot be directly observed and have to be estimated. As a consequence of these and other issues there has been substantial work which cautions about methodological and statistical problems associated with such tests. One such piece of work is that of Lewellen, Nagel and Shanken (2010), which points to problems in tests of all asset pricing models and the Fama French model. .

NERA (2015, p.iv) comments on our prior discussion of Lewellen, Nagel and Shanken's (2010) work as follows:

*"We note that while Davis (2011), Handley (2014) and McKenzie and Partington (2014), in reports written for the AER, endorse the use of the SLCAPM and review, favourably, the work of Lewellen, Nagel and Shanken, the evidence that Lewellen, Nagel and Shanken provide indicates that the SLCAPM does not generate unbiased estimates of the cost of equity."*

Our point in relation to Lewellen, Nagel and Shanken (2010) is not that they find support for the CAPM, in their tests the CAPM performs poorly; the point is that the supposedly superior performance of other models reported in prior tests disappears. As Lewellen et. al . observe (p.189):

*"The third key result is that none of the models provides much improvement over the simple or consumption CAPM when performance is measured by the GLS  $R^2$  or  $q$ ."*

They further conclude on page 190 that:

*"Our basic conclusion is that asset pricing models should not be judged by their success in explaining average returns on size-B/M portfolios."*

This conclusion is a call to be sceptical about claims that models using size and book to market provide superior asset pricing models.

We should also respond to a further comment by NERA (2015, p34):

*"What McKenzie and Partington do not explain is that Da, Guo and Jagannathan do not suggest that the SL CAPM be used in the same way that the AER has been using the model. To construct estimates of beta that can be used in project evaluation, unadjusted common or garden estimates of beta have to be adjusted... Thus the evidence that Da, Guo and Jagannathan provide is not relevant to assessing estimates of the cost of equity provided by the empirical version of the SL CAPM that the AER employs"*

In order to provide the context we reproduce the original text in McKenzie and Partington (2014, p9):



*“Further, recent work suggests that the evidence against the CAPM may not be as robust as previously thought. For example, Ray, Savin and Tiwari (2009) show that the statistical evidence for rejecting the CAPM is weaker than previously thought when more appropriate statistical tests are used. More importantly, Da, Guo and Jagannathan (2012) argue that the empirical evidence against the capital asset pricing model (CAPM) based on stock returns does not invalidate its use for estimating the cost of capital for projects in making capital budgeting decisions. Their argument is that stocks are backed not only by projects in place, but also by the options to modify current projects and even undertake new ones. Consequently, the expected returns on equity need not satisfy the CAPM even when expected returns of projects do. Thus, their findings justify the continued use of the CAPM irrespective as to one’s interpretation of the empirical literature on asset pricing.”*

Our point here was to illustrate the increasing body of work that was finding in favour of continued use of the CAPM. As Da, Guo and Jagannathan (2012, p218) conclude:

*“In this paper we provide an alternative explanation for the continued use of the CAPM by finance professionals.”*

We agree with NERA that Da, Guo and Jagannathan (2012) use option adjusted measures of return and beta. This is an interesting idea, but at its current stage of development we would not recommend its adoption by the AER.

The classic critique of the empirical testing of the CAPM is that of Roll (1977) who argues that the relevant testable hypothesis for the CAPM is not whether there is a particular linear relation between returns and beta, but rather whether the market portfolio is a mean variance efficient portfolio. If so the CAPM follows tautologically. Roll’s critique put a temporary halt to the cottage industry of trying to fit the CAPM to realised returns, but it soon resumed.

Despite the difficulties in testing the CAPM, referred to above, it would be fair to say that a substantial weight of academic opinion takes the evidence to be against the CAPM. However, this is by no means a universal view and it is worthwhile quoting the abstract from Levy and Roll (2012):

*“The Capital Asset Pricing Model (CAPM) has far-reaching practical implications for both investors and corporate managers. The model implies that the market portfolio is mean-variance efficient, and thus advocates passive investment. It also provides the most widely used measure of risk, beta, which is used to calculate the cost of capital and excess return (alpha). Most academic studies empirically reject the CAPM, leaving the lack of a better alternative as the only uneasy justification for using the model. Here we take a reverse-engineering approach for testing the model and show that with slight variations in the empirically estimated parameters, well*

*within their estimation-error bounds, the CAPM perfectly holds. Thus, in contrast to the widely held belief, the CAPM cannot be empirically rejected.”*

We note that the results of Levy and Roll are consistent with both the zero beta CAPM and the standard SL-CAPM if there is a riskless asset. It will doubtless be argued that the Levy and Roll result directly supports the zero beta CAPM. However the problem with the zero beta CAPM lies in estimating the zero beta return, which as we point out below is an intractable problem.

A single study is unlikely to be definitive, but the Levy and Roll (2012) study has claim to considerable weight, not only are the authors leading academics, but the paper was also the Harry M. Markowitz Award Winner. The selection committee for this award was, Harry Markowitz, Robert Merton, Myron Scholes and William Sharpe, all top finance academics, all experts in asset pricing models, and all Nobel Prize winners.

### Estimation Problems in the Zero Beta CAPM

An alternative CAPM to the SL-CAPM is the model the consultants have called the Black CAPM, or alternatively the zero beta CAPM. This model has received extensive consideration in prior reports by consultants to the regulated businesses. It has also had attention in reports commissioned by the AER such as McKenzie and Partington (2012b). We should be clear that our major concern with the zero beta CAPM lies in its implementation. In particular, the empirical estimation of the return on the zero beta portfolio is highly problematic and, as we show below, there are also problems estimating beta using the zero beta CAPM.

The point has previously been made that the range of choice for zero beta portfolios can be infinite and we have repeatedly made the point that what you get for the zero beta return depends very much on what you choose to do in your estimation process, see for example, McKenzie and Partington (2014) and Partington (2015). The widely different results reported by the consultants provide clear evidence of this and the most recent estimate advocated by SFG hardly seems reasonable as a substitute for the risk free rate, since it exceeds the rate on BBB debt.

In the discussion below we try to avoid re-ploughing ground previously well covered and instead address issues with little or no previous coverage. This further consideration reinforces our view that it would not be appropriate to use estimates of the zero beta return in relation to determination of the allowed rate of return for regulated businesses.

In considering the merits of using the zero-beta CAPM, we note that it differs conceptually from the conventional Sharpe-Lintner SL-CAPM. Moreover these differences are not merely scholarly distinctions. It is clear that the differences matter for the determination of the benchmark rate of return to which a risk

premium is added, but it is less well appreciated that they also matter for the effective calculation of beta.

To recap as to how the SL CAPM works in practice: we pick a broad index of the market, say the ASX200, and assume that this is the market portfolio. We also assume the existence of a riskless asset, usually taken to be government treasury bills, or bonds, of an appropriate maturity. The combination of the riskless asset and the frontier of efficient portfolios defines the market portfolio, which is assumed to be the index of choice. This procedure has clear limitations, but it is straight-forward to make operational and it is so because of two-fund separation, which means that every optimal portfolio is a linear combination of these two funds, the government security and the chosen index.

The argument against this approach is usually based upon the view that a riskless asset fails to exist, or that investor's ability to trade it is restricted in some way. Two common reasons militating against the existence of a risk free asset are uncertain future inflation and the presence of sovereign risk. In the current global climate, the latter may be regarded as more serious; the former can be addressed by the use of index-linked government debt. The use of index linked government bonds might have some merit. If index linked government bonds were used as the estimate of the risk free rate the result would be an even lower estimate of the risk free rate than is currently used.

However, the SL-CAPM market risk premium measured from nominal returns is, to a close approximation, independent of inflation, since it depends on the difference between the return on the market and the risk free rate. Expected inflation is a component of both the market risk premium and the risk free rate and so cancels out when the risk free rate is subtracted from the return on the market. The advantage for empirical estimation is that both the return on the market and the return on the stock can be written in excess returns form (the excess return over the risk free rate). Thus the effect of inflation is neutralised.

A difficulty of the zero-beta CAPM is that empirical estimation has to be undertaken in actual returns for the market and the stock. This is because the zero beta return cannot be observed. The use of actual returns means that the measurement of beta will be influenced by the presence of inflation. It is straightforward to demonstrate that as inflation gets large beta will be biased upwards towards one. This is another reason why we do not advocate the use of the zero-beta CAPM.

We now address the issue as to whether Australian debt is subject to sovereign risk. The extant ratings will give us some information on this subject, although they are also open to criticism, they are currently AAA or equivalent with all three major rating agencies. The most important feature we would argue is that Australia manages its own currency and can meet any issues about payment of coupons and

repayments of principal by printing money; this is something that is not available to Greece, for example. Whilst there may still be issues of long-term sovereign default risk, they are probably very long-term and not sufficient justification to resort to the zero-beta CAPM.

Turning to the details as how to estimate the zero beta return from the zero-beta CAPM; there are at least three different approaches considered in the literature which can be described as , cross-sectional, time-series single asset, and time-series multiple assets. In all cases, the methods estimate a single parameter, the mean of a zero-beta asset. We are, in effect, replacing a very reliable and observable series of treasury rates by a single estimate, which is poorly estimated at best as we shall discuss next.

The first approach, the cross-sectional approach, leads to serious errors in variable problems which are hard to fix without applying some form of grouping and that even so will be prone to large finite-sample biases. The time-series methods are much better founded in statistical theory and we shall discuss these in more detail. To do this we will need a little algebra.

In a single equation context, the SL-CAPM regression (Sharpe's market model) using excess returns takes the form:

$$r_t = \alpha + \beta r_{mt} + V_t \quad (1)$$

Here  $r_t$  is the excess rate of return of the asset and  $r_{mt}, V_t$  are the excess market rate of return and idiosyncratic returns respectively.

The ordinary least squares estimator (OLS) of (1) will be unbiased and efficient if the characteristics of the error term and estimator follow the Gauss-Markov assumptions. Under a correct CAPM specification, one should find that the intercept term  $\alpha$  is insignificant. It is for these reasons, inter alia, that this form of the regression is widely used.

When we move to a zero-beta framework, we replace excess returns by raw returns  $R_t, R_{mt}$  and assume a relationship;

$$R_t = \alpha + \beta R_{mt} + V_t \quad (2)$$

In this framework:  $\alpha = (1 - \beta)\mu_z$ . Where  $\mu_z$  is the expected rate of return of the zero-beta asset and  $\beta$  is the parameter to be estimated in order to enable us to compute the cost of equity. Thus:

$$\mu_i = (1 - \beta)\mu_z + \beta\mu_m \quad (3)$$

Where  $\mu_i$  is the expected rate of return of the asset and  $\mu_m$  is the expected rate of return of the market.

We have described the single asset case, the multiple asset case is similar but technically more complex; in both cases we have to use a non-linear relation. If we compare (2) and (3) we see that in the single-asset case,

$$\mu_z = \frac{\alpha}{1-\beta}. \quad (4)$$

It is our contention that estimates of  $\mu_z$  are very inaccurate. To understand why, let us make the assumption that  $V_t$  are normally distributed. It is well-known that estimators of  $\alpha$  and  $\beta$  will then be normally distributed and hence the estimator of  $\mu_z$  is distributed as the ratio of two normals, known as a Fieller distribution. It is known, see Cedilnik et al (2004) that the mean of this distribution does not exist and so its distribution has very fat tails. In particular, this will translate into very poor estimates of  $\mu_z$ . We can see intuitively from (4) that the closer is  $\beta$  to one the more inaccurate the estimate of the zero beta return is likely to be.

What then is the basis of the consultants claims that the zero-beta CAPM has widespread acceptance? In our experience of consulting over 30 years with literally hundreds of firms involved in investing using quantitative methods and experience and observation of corporates, including our survey of Australian corporate practice, (see Truong Partington and Peat, 2008) we have encountered widespread use of the SL-CAPM, but we have never met any practitioner who has used the zero-beta CAPM. The above argument about estimation may explain why the zero-beta CAPM is preferred by regulated businesses. It is a model that is likely to be so inaccurate that it is quite possible to throw up a favourable result.

## Fama French Model

In previous analysis, such as Partington (2015), we have pointed to many of the problems of the Fama and French Model (FF Model). We have also highlighted Fama and French's (2014) most recent work where the book to market factor is no longer significant in a model with additional factors. We noted their observation that this might be a sample specific result, a point reiterated by SFG, apparently as a defence of the FF model. We also note the statement of NERA (2105, p43):

*“The implicit suggestion that Handley and McKenzie and Partington are making is that Fama and French have abandoned their three-factor model and are ready to accept the use of the SLCAPM. This is not the case. What Fama and French (2014) find is that one can improve upon their three-factor model – by replacing the HML factor with a CMA factor and a RMW factor – not by using the SL CAPM in its place.”*

We do not implicitly conclude from the latest Fama and French work that they are ready to accept the use of the SL-CAPM. What we have previously concluded explicitly is that the AER should not use the Fama and French Model. There are several reasons for this (see Mckenzie and Partington, 2014, and Partington, 2015).

In our opinion the latest work from Fama and French simply points to unresolved questions about the role of the book to market factor. There is no clear theoretical reason for its inclusion in the original FF model and now there is empirical uncertainty about whether it is even necessary in a new model that has at least some theoretical basis. With the original Fama and French model under revision by its originators, this does not seem to be an appropriate time for the AER to adopt the FF model and follow a path that other regulators have avoided.

In the discussion below we focus on the problem of the definition and measurement of the factor portfolios in the FF model. It is a point that would be agreed by most parties that a suitable model should have certain desirable characteristics that would make its use appropriate in the regulatory context. A fundamental characteristic would be that fair-minded consultants, working independently, should arrive at the same, or rather similar, answers using the same model. We accept that some variation is inevitable due to estimation error, but ambiguity and opportunities for the exercise of discretion and choice should be minimised. This protects all parties from potential acts of manipulation to further particular parties' commercial interests. With this principle firmly in mind, we now address the suitability of the FF model.

This model considers three factors, Size, Value and the Market and computes multivariate exposures (betas) based on time-series analysis. Whilst the presence of the market factor (once there is agreement on choice of index) is not a point of contention, the choice of the portfolios to mimic the other two factors is a problem. Turning to Value, there are literally hundreds of ways of constructing the Value factor-mimicking portfolios. We shall not attempt to list them all here but they include the ranking of firms by some firm characteristic such as book value to market capitalisation, but there are many other value characteristics currently in use in the industry for the purposes of ranking.<sup>2</sup> Furthermore, it is often the case that the ranking will involve a different universe than the one that makes up constituents of the agreed market portfolio. Then, once a ranking has been established one constructs a long portfolio and a short portfolio and takes the long-short combination as the Value factor-mimicking portfolio. Again, there is variation; we could take top-third bottom third or top fifth bottom fifth; the combinations are endless. We could make the two portfolios equally-weighted, capitalisation weighted or characteristic-weighted. Finally, to avoid excessive portfolio turnover we could include a legion of rules to stop individual shares "flipping" from one portfolio to the other too frequently.

It should be quite clear from the above discussion that Value is too ambiguous a variable to include in this exercise. The multiplicity of construction procedures

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<sup>2</sup> We should be clear here that the purpose of industry in constructing such factor mimicking portfolios is not to estimate the cost of capital, but rather to investigate investment performance.

makes it easy to generate results favourable to particular interests. It should be said that Size is less subject to potential manipulation although, even here, there are still possibilities such as using the logarithm of market capitalisation rather than market capitalisation, choices concerning the treatment of closely-held shares, and also where the size cut off is set in determining the long and short portfolios.

The last point about the use of these variables concerns one of interpretation. Are the returns attributable to Value or Size risk premia, behavioural anomalies, sources of out-performance or some other explanation? There appears to be no consensus regarding the answer. If they were unambiguously risk premia, and they could be measured unambiguously, one could make a case to use the FF model in a regulatory context. It does not appear to us that either of these conditions is close to being satisfied.

### The Use of Multiple Models

Problems in the use of multiple models and the problems with the specific models proposed by regulated entities have been extensively discussed in McKenzie and Partington (2014) and Partington (2015). Here we add some comments in relation to the SFG consulting report; 27 March 2015, much of its content is summarised by paragraph 134, page 27:

*“...we outline a specific computation of the cost of equity that:*

*(a) Uses four estimation models in order to mitigate estimation error; and*

*(b) Uses models that specifically address the empirical limitations of the Sharpe-Lintner CAPM.”*

This is the central claim of the SFG report and it is worth investigating its validity. We shall denote the weighted estimator of the cost of equity that is presented by SFG as the hybrid estimator. We first note that a portfolio (weighted sum whose weights add up to one) of estimators will provide a worse estimator under a number of conditions. These conditions can often occur in practical circumstances. We use the term "worse" to mean larger mean square error (MSE), which is a standard metric to use when there is a possibility of bias in the estimators. We remind readers that  $MSE = \text{Squared Bias} + \text{Variance}$ .

Typical conditions that may well lead to increased MSE are when the weights are chosen non-optimally, when the individual estimators are strongly positively correlated and/or when one or more of the estimators are biased and highly volatile. Of course, if it is the case that an individual estimator has an infinite mean, it is a straightforward consequence that the MSE will be infinite. Whilst we suspect that this might be the case for the zero-beta approach (see the section of this report on estimation problems in the zero beta CAPM), we do not require this condition for the above criticisms to be valid.

Whilst it would take considerably more research to assess the accuracy of the hybrid estimator proposed for the cost of equity by SFG and JGN, it seems to us that the three conditions we mention above occur here. We particularly believe, for reasons addressed earlier in this report that the zero-beta estimator gives a biased estimator. One piece of evidence in support of this is the unreasonably high values previously presented by the consultants for the zero-beta parameter. We have argued above that there is the possibility of bias in the FF model. We have also previously argued, for example Partington (2015), that estimates from the DGM are likely to be upward biased. There is some evidence on bias in relation to the SL-CAPM beta, which we discuss next.

There is considerable evidence that, historically, low beta assets outperform; that is if we fit a time-series regression to a portfolio of such assets, we find evidence of a positive intercept (alpha). This has a number of explanations and one among many interpretations is that the betas of the assets are biased downwards. However, there are numerous other explanations that do not imply a bias in beta. In a study using US data, Muijsson, Fishwick, and Satchell (2014), beta is estimated in a number of different ways, for both low and high beta portfolios, conditioning on various information such as interest rate and market movements. What Muijsson et. al. find is that, whilst alpha moves a great deal from information set to information set, beta for a given portfolio remains remarkably constant. Whilst this is not conclusive and might not apply to the Australian context, it does suggest that it may not be bias in beta that explains non- zero alphas, but that it has more to do with economic conditions.

We would expect the zero-beta CAPM and SL-CAPM estimators to be positively correlated since they are largely based on the same data. The estimates of the Fama-French model may have lower correlation with the other two models as it contains extra variables but with its high degree of specification uncertainty and variable definition issues, it seems to us quite inappropriate to attach a weight of 37.5% as in SFG, 27 March 2015, Table 6.

### Arithmetic or Geometric Returns?

Essentially there are two issues here. The first issue, as Blume (1974) shows, is that given that an estimate of returns will be measured with some error, even if it is an unbiased estimator, compounding that return to get an estimate of returns for some longer period results in a biased estimate for that longer period. To quote Blume (1974, p.634):

*“In practice, one does not know the population statistic and therefore must make an estimate. Some might be tempted to estimate the expected N-period relative by raising the arithmetic average of the T one-period relatives to the Nth power. As long as N exceeds one, this procedure will yield an upward biased estimate. Others would take the geometric mean of the T observations and raise this number to the Nth power to*



*derive an estimate of the expected N-period relative. This estimate is downward biased if N is less than T.”*

Thus, if an estimate of the arithmetic average annual return is compounded over say five years that will give an upward biased estimate of the five year return. Annual returns are commonly used in many financial calculations. However, it seems to be a matter for the AER to determine whether it views the regulated return it is setting as an annual return, or a return to be earned over five years, or some other period.

The second issue is whether it is better, when estimating expected returns from historic data, to use a geometric average or an arithmetic average. A simple example, commonly used, illustrates the difference between the two measures. Assume that you invest \$100 and it shrinks to \$50 by the end of the first year, this equates to a negative 50% return. In the second year the invested amount grows to \$100 and thus gives a positive 100% return for that year. The actual portfolio return over the two year period is 0% and this is the geometric average, however, the arithmetic average return is 25%,  $[(-0.50 + 1.00)/2]$ .

So which of these estimates is a better measure of expected returns? Jacquier, Kane and Marcus (2003) claim that academics tend to use the arithmetic return and that practitioners tend to use the geometric return. A more rigorous answer is that the choice depends upon what is assumed to be the distribution of returns through time. Assuming returns over time follow independent identical distributions with a finite variance, then it is widely accepted that the arithmetic average is the appropriate estimator of expected returns. Otherwise, the geometric average has a role to play. It has long been well understood that returns do not conform to the assumption of independent identical distributions, see for example Akgiray (1989). The literature has therefore suggested a weighted sum of the arithmetic and geometric averages. be used in estimating the expected return. Unfortunately, there is no generally accepted optimal weighting scheme. In our opinion the use of arithmetic averages alone is likely to result in an upward biased estimate of expected returns and the use of geometric averages alone is likely to result in a downward biased estimate. There is therefore merit in the conclusion of McKenzie and Partington (2012) that:

*“The widespread current practice is to use unadjusted geometric and arithmetic averages. Given the current state of knowledge, we see no strong case to depart from this common practice and recommend the use of both of these metrics, tempered by an understanding of their inherent biases.”*

## Interest Rates and the Market Risk Premium

On pages 3 and 4 of the SFG report dated 27 March 2015, the authors note the very low level of Australian Bond yields and they also note that there should a corresponding rise in the market risk premium. We have previously commented on

the argument of inverse relation between the market risk premium and interest rates, most recently in Partington (2015), and have found this argument to have little merit.

It is worth clarifying the remarks by SFG. The SL-CAPM informs us that,

$$\mu_i = (1 - \beta)r + \beta\mu_m$$

where  $r$  is the 10 year nominal government bond rate. A 1% fall in this rate will reduce the cost of capital by  $(1 - \beta)\%$ . If the stock is defensive with  $\beta < 1$ , such as a utility company, the cost of capital will fall. If  $\beta = .65$ , for example, the cost of capital will fall by 35 basis points.

The argument that appears to be posed in Section 4.1, page 7, seems to be saying that  $\mu_m$  should not be thought of as independent of  $r$  (the bond rate) but depends upon it. In particular a fall in the bond rate leads to a rise in the expected rate of return on equity, technically speaking,  $\mu_m$  is a decreasing function of  $r$ . The difficulty here is that it is not clear whether this is believed to be true because it is what has tended to happen in the past on average (so that the estimated correlation or cross-autocorrelation is negative over some sample) or because there are some implicit assumptions about how the economy works in equilibrium, or because of comparative statics with respect to some formula or model.

If we consider a simple example of mean-variance analysis with a riskless asset, it is straightforward to show that a fall in interest rates leads to a fall in the expected rate of return of the market portfolio, which in this context, coincides with the Markowitz portfolio. This result tells us that negative correlation between interest rates and the expected rate of return is clearly not a feature of all models. We do not dispute that there exist models where this phenomenon may occur; however we are not convinced that the claims for a negative relationship have a compelling quality about them. Furthermore, if a change in interest rates were offset by a change in the market risk premium, thus holding the expected return on equity constant, then holding expected cash flow constant the value of the market would be independent of interest rate changes. This is a proposition that few would accept.

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# CURRICULUM VITAE

## PERSONAL

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## HIGHER EDUCATION AND EMPLOYMENT

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

My current position is Associate Professor of Finance and Chair of the Finance Discipline at the University of Sydney. I was also head of the postgraduate research program in finance. Concurrent with my position at the University of Sydney I was also the Education Director for the Capital Markets Co-operative Research Centre PhD program. In a career stretching back more than thirty years I have held Associate Professorships in finance at The University of Technology Sydney and The University of British Columbia. I have also held academic positions at Macquarie University and the University of Bangor I have had extensive teaching and research responsibilities in finance and accounting as well as being head, or deputy head of University Departments and Schools. I have been a major force in the design of several undergraduate and masters degrees in finance and also PhD programs.

I have written in excess of forty 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 (1<sup>st</sup> printing 2000, 2<sup>nd</sup> printing 2000.)

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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 28<sup>th</sup> 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*, 20<sup>th</sup> 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.

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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.

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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.

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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, Gwynog.
- 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

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

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, 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.

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Miscellaneous

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

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

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

## MEMBERSHIPS

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

American Finance Association (Current))

American Accounting Association (1978–1992)

European Accounting Association (1984–1987)

Australian Institute of Bankers (1993–1997)

Royal Forestry Society (1978-1984)



## CURRICULUM VITAE

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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 Model of 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*  
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#### 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](https://doi.org/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>.  
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A General Theory of Smoothing and Anti-Smoothing (with M.Mackenzie and W.Wongwachara) in *Journal of Empirical Finance, vol 28, pp 215-219.(A)*

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

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

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

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

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

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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.

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

Sequential Variable Selection as Bayesian Pragmatism in Linear Factor Models (with John Knight, Jessica Qi Zhang) in *Journal of Mathematical Finance* ,PP. 230-236, Pub. Date: March 29, 2013  
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### 2005 PUBLICATIONS

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## BOOKS AND UNPUBLISHED PAPERS

### A) BOOKS

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### B) PAPERS (PAST)

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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 the DAE Working Paper Series. (with Contreras, P.). 2003

#### PAPERS (CURRENT)

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

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

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

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'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 forty 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\$960,000

CIFR Grant Graham Partington, Steve Satchell, Richard Philip, Amy Kwan

Measuring market quality: current limitations and new metrics \$140,000 total

CIFR Grant: Identifying Asset Price Bubbles in Australian Listed Securities

\$122,000 total

### Popular Articles

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

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

Weekly columns on Investment Techniques:

Equity switch programme (Vol. 6, page 7)

Making money out of chaos (Vol. 7, page 6)

Where random walks trips up (Vol. 8, page 7)

Ignorance can be profitable (Vol. 9, page 7)

Making money from market volatility (Vol. 10, page 7)

High-low prices in options trading (Vol. 11, page 7)

Can heavy trading be profitable? (Vol. 12, page 7)

Economic variables show stock returns (Vol. 13, page 7)

No mean return on shares (Vol. 14, page 9)

Do option prices augur a crash? (Vol. 15, page 9)

Puzzles in closed-end fund prices (Vol. 16, page 9)

Capital asset pricing model challenged (Vol. 17, page 9)

How dividends affect share prices (Vol. 18, page 9)

The relationship between price and volume (Vol. 19, page 9)

How persistent are financial market shocks? (Vol. 22, page 9)

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

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

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

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

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

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

Contribution to discussion *British Actuarial Journal*, 1998.

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

Research discussed in *Observer* (26<sup>th</sup> April 1998, page 11).

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

Interviewed on Bloomberg TV (27<sup>th</sup> 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, Bitarisk.

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 3<sup>rd</sup>);

Macquarie Bank (April 7<sup>th</sup>),

CRMC Sydney (April 8<sup>th</sup>);

Sydney Q group, April 15<sup>th</sup>.

## 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.