REPORT TO THE AER:

ALLOWED RATE OF RETURN

2018 GUIDELINE REVIEW

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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 Appendix 3. This report has been prepared in accordance with the guidance provided by the practice note. An expert witness compliance declaration can be found following the reference list at the end of our report.

Contents

The context of the report

The AER approached us with a request to participate in two expert evidence sessions where expert panels debated key issues in relation to the allowed rate of return. The transcript of these discussions is available on the AER website. The AER also requested us to prepare a report relating to a number of specific questions relevant to the determination of the allowed rate of return. The terms of reference relevant to this report are included as Appendix 1, and we use the specific questions as headings in the body of the report.

Risk

1. What is the systematic risk and overall riskiness 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 energy network services?

a. Consider and explain how the regulatory framework[1] affects (cashflow/revenue) risk for 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 energy network services? Explain if there would be any effect on the return on equity.

Given a monopoly position in the supply of regulated services and the relatively low price elasticity of demand[2] for the product being delivered, we would expect the risk (both systematic and unsystematic) of a benchmark efficient entity (BEE) to be low. The monopolistic aspect of the operations of a BEE are self-evident and there is plenty of evidence that price elasticity is relatively low. Table 1 provides a summary of research that has estimated the price elasticity of demand for electricity. With respect to the price elasticity of natural gas, for the US, Arora (2014, p2) states:

[1] For example:

- Provisions are in place to allow for reopening capital expenditure decisions for certain events (NER 6.6.5, 6A.7.1) once a regulatory decision has commenced.
- Cost pass-through mechanisms (NER 6.6.1, 6A.7.2–6A.7.3; NGR 97(1)(c)) are in place so businesses may apply to pass certain risks/costs to relevant users. This may include but would not be limited to insurance cap, insecure credit risk, retailer insolvency, natural disasters and terrorism events. For example see: AER, Final decision CitiPower distribution determinations 2016 to 2020 Attachment 15–Pass through events, May 2016, pp. 6–8.
- Revenue caps and expected demand based cost allowance mitigate demand risks.
- There is no stranding risk as RAB cannot be optimised.
- No inflation risk as inflation risk is carried by consumers via the CPI-X mechanism.

[2] The price elasticity of demand can be interpreted as the percentage change in quantity demanded as a consequence of a 1% change in price. For example, a price elasticity of demand of -0.4 would be interpreted as a reduction in demand of 0.4% for a 1% increase in price.

"*The price elasticity of demand results are more responsive than recent estimates, but are similar to earlier ones (reviewed in the next section). For example, the median long-run estimate through early 2013 is -0.24, with a short-run estimate of -0.11 when natural gas production is equated to consumption, and -0.13 when inventories are included in the calculation*"

A summary of estimates of the price elasticity of natural gas are provided in Table 2. In interpreting the elasticity values in Tables 1 and 2, any value greater than -1 is considered elastic demand and a value between -1 and zero is inelastic demand. A value of 0 would mean that there is no reduction of demand in response to a change in price. In the light of its monopolistic position and the low price elasticity of the product being delivered, a BEE inherently has low economic risks. In particular we would expect the revenue beta to be low. This is significant as the revenue beta is a key driver of the asset beta and hence the equity beta. With the latter depending on both the asset beta and leverage.

The supply of regulated services does entail some regulatory risk, in that the nature of regulation may change. However, the current regulatory system embeds arrangements that significantly reduce risks to the regulated businesses and hence to the equity in those regulated businesses. Some of these arrangements are covered in footnote 1 and are discussed more extensively in pages 29 to 33 of AER (February 2018, Allowed Rate of Return). These measures reduce both systematic and unsystematic risk. For example the measures that reduce demand risk, inflation risk and interest rate risk will all contribute to a reduction in systematic risk. This is synonymous with a reduction in beta and hence a reduction in the cost of equity.

The discussion above suggests that a BEE would have low risk and relatively stable cash flows. The low risk and stability of the cash flows is what allows a BEE to carry very high levels of debt relative to most companies and still retain an investment grade rating. The current arrangements in relation to the rate of return can effectively guarantee the payment of the historic cost of debt. This mitigates the risk of leverage and thus the cash flows to equity are likely to be relatively stable and of relatively low risk. Consistent with this, shares in regulated utilities are sometimes described as a bond proxy. We discuss the issue of bond proxies in more detail under question 8.

Table 1: Summary of Research Estimates of Price Elasticity for Electricity.

Researcher	Year	Region	Sector	Elasticity	Comments
Bohi & Zimmerman	1984	U.S (various utilities)	Residential, industrial and commercial	Residential sector Short-run: -0.2 Long-run: -0.7	Difficult to report the price elasticity for either the commercial or industrial sectors.
Filippini	1999	Swiss (40 cities)	Aggregation	-0.3	Suggested TOU pricing for achieving electricity conservation, instead of general electricity price index increases.
Beenstock et al.	1999	Israel	Residential and industrial	Residential -0.21 to -0.58 Industrial -0.002 to -0.44	Compared dynamic regression models with OLS and maximum likelihood methods for estimating the demand.
NIEIR	2007	Australia	Residential, industrial and commercial	Residential: 0.25 industrial: 0.38 commercial: 0.35	The long-run price elasticity of electricity demand for each State of the Australia was also estimated.
King & Shatrawka	1994	England	Residential and industrial	Substitution elasticity Inter-day: 0.1 to 0.2 Intra-day: 0.01 to 0.02	Between 33 percent and 50 percent of participating customers responded to time-varying prices.
Patrick & Wolak	1997	England and Wales	Industrial and commercial	Water supply industry: -0.142 to -0.27	Price elasticities varied across industries; the most price elastic industry was the water supply industry.
King	2003	California	Residential	-0.1 to -0.4.	An average own-price

& Chatterjee			and commercial		elasticity of 0.3 was reported.
Reiss	2005	California	Residential	-0.39	Developed a model for evaluating the effects of alternative tariff designs on electricity use.
Faruqui & George	2005	California	Residential, industrial and commercial	Substitution elasticity: 0.09	Residential, commercial and industrial customers conclusively reduced peak-period energy use in response to time-varying prices.
Taylor et al.	2005	U.K.	Industrial	-0.05 to -0.26	Investigated RTP programs in the U.K.; larger load reductions were observed during higher priced hours, as industrial customers gained experience with hourly pricing.

Source: Fan S. and Hyndman R., (2010) *The price elasticity of demand in South Australia*, Working paper, Monash University.(Subsequently published in *Energy Policy,* 2013, 39:6, pp. 3709-3719.)

Table 2: Summary of Research Estimates of the Elasticity of Demand For Natural Gas

Research	Location	Estimation Method	Data	Income elasticity	Price elasticity	Weather elasticity
Bernstein & Griffin (2006)	Contiguous United States	Fixed effects	1977-2004 (annual)	S:0.26	L:-0.36 S:-0.12	S:0.18
Nilsen et al (2008)	12 European Countries	Shrinkage	1978-2002 (annual)	L:3.32 S:0.81	L:-0.10 S:-0.03	
Joutz et al (2008)	United States	Shrinkage	1980-2006 (monthly)		L:-0.18 S:-0.09	
Maruejols et al (2009)	Canada	LAIDS	1960-2007 (annual)	L:0.90	L:-0.50	
Bernstein & Madlener (2011)	12 OECD Countries	ARDL	1980-2008 (annual)	L:0.94 S:0.45	L:-0.51 S:-0.24	L:1.35 S:0.72
Bernstein & Madlener (2011)	United States	ARDL	1980-2008 (annual)	L:0.03 S:0.03	L:-0.16 S:-0.04	L:0.74 S:0.70
Payne et al (2011)	Illinois, US	ARDL	1970-2007 (annual)	L:0.02	L:-0.26 S:-0.19	L:0.63

Source: Arora V. (2014) Estimates of the price elasticities of natural gas supply and demand in the United States. MPRA Paper No 54232, Uni-Muenchen.

2. The Expert Joint Report concluded that the true systematic risk is likely to be stable over time for 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 energy network services over time.[3] Please explain if you agree with this statement and if correct what this implies for the estimation of equity beta.

We agree that the true systematic risk of a BEE is likely to be stable over time. Hence, it would be expected that the both the asset beta and the equity beta would be stable through time. The stability in beta is evident in AER (March 2018, Table 6) where quite similar estimates of beta arise in a comparison across 16 different studies covering varying sample periods, return measurement intervals and estimation methods. Nearly all of the beta estimates at the level of individual firms are encompassed by the range 0.4 to 0.7. For fixed portfolios most of the estimates are

[3] AER, Expert Joint Report, 21 April 2018, p. 51.

encompassed by the range 0.3 to 0.8. Even if the true value of beta is unchanged across studies and through time some sampling variation is to be expected in the estimated beta.

It is because of the stability in beta that we have previously suggested that historic estimates of beta, including from companies that are now delisted, can be used to inform current estimates of beta. This was a view which seemed to have considerable acceptance in the expert evidence session. However, it was suggested that estimates more distant in time might receive less weight than more recent estimates. This is a sensible suggestion and the issue then becomes the choice of an appropriate weighting scheme. The implication of a stable beta is that more distant estimates do not need to be heavily down weighted relative to more current estimates.

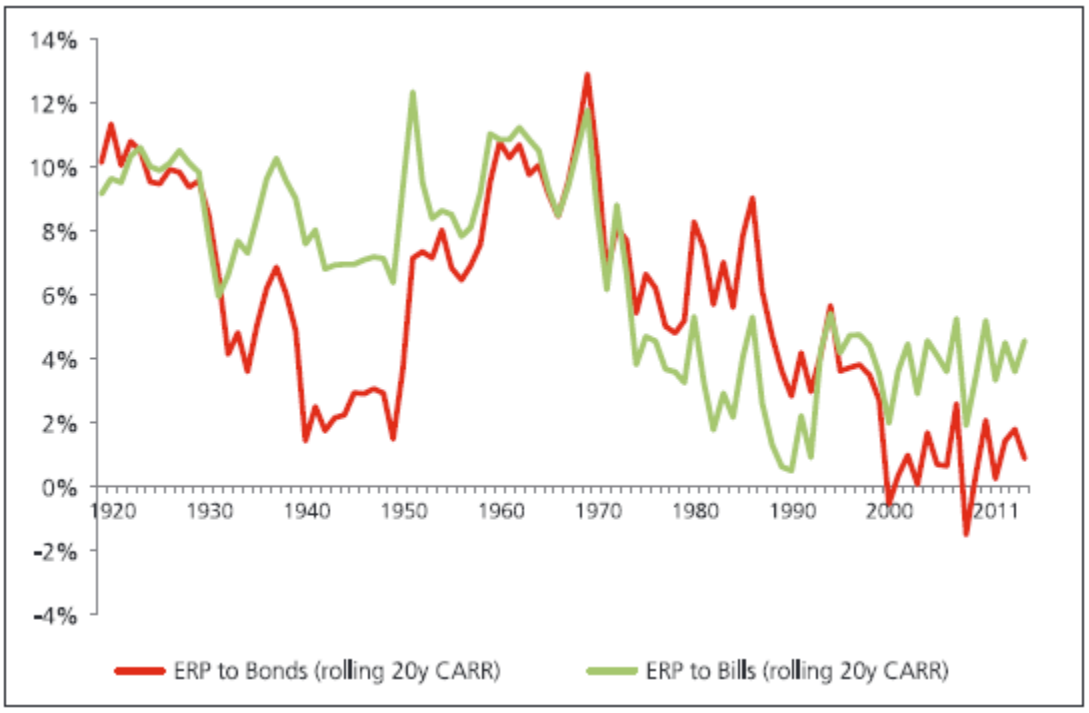
While we expect both assets betas and equity betas for a BEE to be relatively stable over time this does not mean that betas can never change. In the case of the equity beta for example, changes in the level of leverage can change beta. However, the assumption is that the BEE has a 60% level of leverage and this has not changed, so changes in equity beta due to shifts in leverage are ruled out. Changes in the overall market as reflected in changes in the market index are another reason why beta might change. For example, the Australian equity market may have become more global with time, a trend that has been noted in many markets as a consequence of globalisation. This would mean that for a domestic energy business the correlation of returns with the market could be falling leading to a reduction in beta.

The standard SL-CAPM is a single period model, and thus beta is assumed to be constant. However, it is interesting to note that a changing beta can be accommodated in the Conditional CAPM. The SL-CAPM is a special case of a more general Conditional CAPM. We discuss the Conditional CAPM in more detail at question 10 b.

Over time, variation in the required level of compensation for bearing systematic risk can arise not only if beta changes, but also if the market risk premium changes. The underlying causes of changes in the equity risk premium are usually attributed to demography and economics. For example, an aging population may increase risk aversion which will increase the equity risk premium. Increased per capita wealth will induce decreases in risk aversion lowering the equity risk premium. Uncertainty about economic outcomes will increase the equity risk premium. In previous reports we have argued that the historic trend in the market risk premium is likely to have been a decline over time.

A recent report sponsored by Challenger Limited, Bianchi, Drew and Walk (2015), focuses on the equity risk premium and presents an interesting chart which we reproduce below as Figure 1. The analysis is based on realised equity risk premium data from Dimson, Marsh and Staunton (2015). The chart shows rolling 20 year annualised equity risk premiums from 1920 onwards. It is evident that there has been a distinct downward trend in the 20 year rolling average from about 1970 onwards. There are two possibilities that might explain this. One is that investors had been expecting a higher equilibrium risk premium and have experienced significant disappointment. The other is that the equilibrium risk premium has been trending down. This latter explanation is consistent with our prior beliefs, but we cannot rule out the former explanation.

Figure 1: 20 Year Rolling Annualised Market Risk Premium



Source: Bianchi, Drew and Walk (2015).

3. The Joint Expert Report noted that experts agreed that technological risk does not need to be considered separately in estimating equity beta.[4] Explain if technology risk should be reflected in the rate of return and return on equity for 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 energy network services?

To the extent that technological risk is systematic it will be reflected in the equity beta, without the need to undertake additional analysis. To the extent technological risk is unsystematic it will be reflected in the expected cash flow to the business and thus will be directly factored into the share price. We have previously made the case that many technological risks can be readily diversified away by portfolio investors and in such cases there is little or no contribution to systematic risk. For example, if the use of roof-top solar power is considered a threat to demand for a BEE, a portfolio investor can diversify this risk by investing in the businesses supplying roof-top solar equipment. We further note that technological change is not necessarily negative for a BEE. For example, the transition from petrol to electric cars is likely to create a large demand for the distribution of electricity to charging points.

With respect to expected cash flows it is axiomatic that if the current equilibrium expected rate of return is applied to the market value of an asset, then the cash flow so derived is the equilibrium expected cash flow, with no further adjustments required for unsystematic risk. Thus, to the extent that the RAB appropriately proxies for the market value of the assets and the allowed rate of return is equal to the equilibrium expected rate of return, no further adjustment to the allowed cash flow to compensate for unsystematic risk is required.[5] However, the AER would need to make judgements about cost to be allowed in order to compute a net cash flow for a regulated business that matches the allowed cash flow. For example, if there is compelling evidence of the risk of asset stranding due to technology change, this implies a shorter economic life for the asset and it would be appropriate to increase the allowed depreciation charge.

[4] AER, Expert Joint Report, 21 April 2018, p. 43.

[5] The relation breaks down because, in computing the allowed rate of return, the trailing average cost of debt is used rather than the current cost of debt. As a consequence the debt component of the allowed rate of return does not reflect the equilibrium required return on debt.

4. In the expert evidence sessions, experts largely agreed that systematic risk should be compensated through the rate of return and non-systematic risks compensated via the expected cashflows. However, there was discussion on how potentially catastrophic risk such as natural disasters should be compensated. Taking into account both the nature of this risk and clauses in the regulatory framework that allow certain expenditures to be re-opened and events/costs to be passed to the user,[6] please consider and explain if this risk should be compensated through the rate of return.

The fundamental principle here is that an asset's systematic risk determines the required rate of return. Unsystematic risk affects the value of the asset through reducing the expected cash flow. Discounting the expected cash flow at the required rate of return gives the market value of the asset. Thus, as at question 3 above, applying the required rate of return to the market value of the assets provides the appropriate compensation for systematic risks and the cash flow so derived is the expected cash flow.

Natural disasters, such as a major bushfire, would normally be regarded as unsystematic risks and thus would require no compensation via the rate of the return. Catastrophic events, such as the Christchurch earthquake, may also be unsystematic risks, but their effects may be so severe as to require regulatory relief. This type of event is likely to be best handled on a case by case basis. Regulatory provisions allowing revision of allowed expenditures and cost pass throughs appear to be an appropriate way to handle such events. We note, however, there should not be a presumption that the regulator will automatically allow the costs of serious adverse events to be passed on to the consumer, as this would transfer risk from the business to the consumers. Conceptually, catastrophic events should be allowed for in investors' estimation of the expected cash flow. As low probability events, they would typically have a small impact on the magnitude of the expected cash flow. Nonetheless low probability events can occur and if they are negative

[6] For example:

- Provisions are in place to allow for reopening capital expenditure decisions for certain events (NER 6.6.5, 6A.7.1) once a regulatory decision has commenced.
- Cost pass-through mechanisms (NER 6.6.1, 6A.7.2–6A.7.3; NGR 97(1)(c)) are in place so businesses may apply to pass certain risks/costs to relevant users. This may include but would not be limited to insurance cap, insecure credit risk, retailer insolvency, natural disasters and terrorism events. For example see: AER, Final decision CitiPower distribution determinations 2016 to 2020 Attachment 15– Pass through events, May 2016, pp. 6–8.
- Revenue caps and expected demand based cost allowance mitigate demand risks.

events they can have serious consequences for the business. A diversified investor, however, would be relatively unexposed to the bad outcome for individual firms.

5 In the Expert Joint Report, Mr David Johnstone challenged the standard Sharpe-Lintner CAPM approach for estimating the required rate of return which references the degree of systematic risk (captured in the equity beta parameter).[7] With regard to this please explain:

a. If the Sharpe-Lintner CAPM framework (via the equity beta parameter) is appropriate for reflecting and compensating for the systematic risk 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 energy network services?

The Sharpe-Lintner CAPM framework (via the equity beta parameter) seems to be the best approach to reflect the systematic risk of a BEE. This is for a number of reasons that we have discussed before. The SL-CAPM has stood the test of time and it is the only asset pricing model in extensive practical use for estimating the cost of equity. The model is based on traded returns so the data is relatively reliable. Estimation of parameters (beta, alpha and residual volatility) are very straightforward as is hypothesis testing. Both estimates and tests have simple properties and the estimates are compatible with a theory of economic equilibrium. The use of the CAPM is also relatively resistant to gaming.

The market factor is the only factor that is priced in the SL-CAPM. However, there has been much research that purports to extend the range of factors that should be included in asset pricing models. In some cases this research has concluded that the market factor has no role to play. However, there has been escalation of criticism of the "factor zoo" and an increasing level of questioning of which, if any, of the factors really explain the cross-section of returns. In this context it is interesting to observe that recent research by Harvey and Liu (2018) concludes that the "… *market factor is by far the most* important *factor*…" (Abstract) and that "*Despite the discovery of hundreds of factors to compete with the original factor proposed by Sharpe (1964), our analysis of value weighted individual stocks identifies one dominant factor - the one proposed by Sharpe. The economic contribution of additional factors is small. Interestingly, the market*

[7] AER, Expert Joint Report, 21 April 2018, p. 22 & 39.

factor is the dominant factor used in the practice of corporate finance (see, Graham and Harvey, 2001) yet this factor has long been out of favor in asset pricing research." (P.5).

> *b. If non market-based data (for example, annual report information) can be used to estimate systematic risk and if this be consistent the Sharpe-Lintner CAPM and preferable to the use of market based data for estimating equity beta?*

There is a cash flow version of the CAPM, where the risk adjustment is made to the cash flow and discounting is done at the risk free rate. This model is entirely consistent with the SL-CAPM. Brealey, Myers, Partington and Robinson (2000, p.265-266) provide a simple derivation of this model that we reproduce below almost verbatim:

For an expected cash flow next period of C_1 and a required return of r, we know from our present value formula that 1 + r equals the expected dollar payoff on the asset divided by its present value (PV):

$$1 + r = \frac{C_1}{\text{PV}}$$

The capital asset pricing model also tells us that given the equity beta (β), the expected market return r_m and the risk free rate r_f, then 1 + r equals:

$$1 + r = 1 + r_f + \beta(r_m - r_f)$$

Therefore,

$$\frac{C_1}{\text{PV}} = 1 + r_f + \beta(r_m - r_f)$$

By definition beta is the covariance between the asset return and the market return divided by the market variance. Taking this relation and substituting for r gives:

$$\beta = \frac{\text{cov}(\tilde{r}, \tilde{r}_m)}{\sigma_m^2} = \frac{\text{cov}(\tilde{C}_1 / PV - 1, \tilde{r}_m)}{\sigma_m^2}$$

Where the tides (~) denote random variables and σ_m^2 is the variance of the market return.

The quantity $\tilde{C}_1$ is the future cash flow and is, therefore, uncertain. But PV is the asset's present value: It is not unknown and, therefore, does not "covary" with r_m, it is a constant. The –1 is also a constant and drops out of the covariance. Therefore, we can rewrite the expression for beta as

$$\beta = \frac{\text{cov}(\tilde{C}_1, \tilde{r}_m)}{\text{PV}\,\sigma_m^2}$$

Substituting this εξπρεσσιον back into our equation for C_1/PV gives

$$\frac{C_1}{\text{PV}} = 1 + r_f + \frac{\text{cov}(\tilde{C}_1, \tilde{r}_m)}{\text{PV}} \times \frac{r_m - r_f}{\sigma_m^2}$$

The expression $(r_m - r_f)/\sigma^2$ is the expected risk premium on the market per unit of variance. It is often known as the market price of risk and is written as λ. Thus

$$\frac{C_1}{\text{PV}} = 1 + r_f + \frac{\lambda\text{cov}(\tilde{C}_1, \tilde{r}_m)}{\text{PV}}$$

Multiplying through by PV and rearranging gives

$$\text{PV} = \frac{C_1 - \lambda\text{cov}(\tilde{C}_1, \tilde{r}_m)}{1 + r_f}$$

This gives the CAPM expressed in terms of cash flows and is known as the certainty-equivalent form of the capital asset pricing model. This model is closely related to the work of David Johnstone and as shown above beta can in principle be calculated as:

$$\beta = \frac{\text{cov}(\tilde{C}_1, \tilde{r}_m)}{\text{PV}\,\sigma_m^2}$$

While the certainty equivalent form of the CAPM has some conceptual attractions, the direct estimation of beta from cash flows is problematic. Cash flow data for companies is typically only available on an annual basis. Thus there is only likely to be one data point per year. Consequently, two or three decades of data would be required in order to directly estimate a cash flow beta. While the beta of a BEE is expected to be stable, assuming that beta would be unchanged over say 30 years would be a very strong assumption. We are not aware of any work that has tried to

estimate cash flow betas of this type and we suspect that there would be many difficulties to overcome if this were to be attempted.

There is an alternative approach to estimating so called cash flow betas, which has been used in regulatory submissions (see Oxera 2011). The approach attempts to estimate the covariance of equity returns with news about market wide cash flows and with news about the market discount rate. This provides estimates of so called cash flow betas and discount rate betas. However, these cash flow betas are not the same as the equity beta. They should not therefore be confused with the cash flow beta as defined above, which is the same as the equity beta.

Our conclusion about work with cash flow betas is that it is probably best described as experimental. Given the current state of the experiments we would not recommend the use of cash flow betas in determining the allowed rate of return.

Equity beta

6. Please explain you view on the best estimate of an equity beta to be applied in a Sharpe-Lintner CAPM for 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 energy network services, including your view on the AER's:

a. Previously applied methods of empirical estimation of equity beta from listed Australian energy network businesses

The previously obtained estimates from Henry (2014) and the AER (2017) are appropriate. It is also clear as discussed at question 2 that the estimates of beta have been quite stable. The use of LAD regression can be criticised on the grounds that while OLS regression is theoretically consistent with the CAPM beta, the LAD regression is not. The use of LAD regression is motivated by concern about the possible impact of outliers. However, the LAD estimates and the OLS estimates are not so dissimilar that the impact of outliers is a serious concern. We note that the use of leverage adjustments in the beta estimates should be viewed with caution and we discuss this further under question 9c.

b. Empirical estimation of industry/sector betas for various Australian sectors/industries

The utilities industry would probably be the industry that most closely resembles the energy network businesses as the industry classification includes these businesses. However, we do not

have sufficient knowledge of the utility industry to make strong claims in regard to its appropriateness as a comparator for a BEE. Neither is it clear to us whether the estimates from the utility industry are substantially driven by the weight of the network businesses in that industry. It is clear from the AER's estimate of industry betas AER (March 2018, Table 5) that the utility industry has beta that lies close to the bottom end of the range of industry betas, as we would expect to be the case for the network businesses. Consistent with the beta estimates for the energy network businesses nine of the ten yearly estimates of the utility betas lie in the range 0.4 to 0.7. The lowest utility industry beta value of 0.13 appears anomalous. Excluding this value gives a mean estimate of 0.61.

c. Role provided to the Black CAPM in the AER's 2013 rate of return guideline. Please also explain if the AER should have regard to the theory of the Black CAPM (and the associated possibility of market imperfections) as it did in its April 2015 and subsequent regulatory determinations when selecting a point estimate for the equity beta.

The issue of the use of the Black CAPM recurs in question 10 b, which also involves the issue of low beta bias. Here we focus on the use of the Black CAPM and in our response to question 10 b we focus on the issue of low beta bias.

In the 2013 guideline and subsequent regulatory decisions the AER used the theory of the Black CAPM to inform their estimate of the equity beta. This was in part related to the claims of low beta bias in respect to the SL-CAPM. For example the AER (2013, p.12) Guideline Appendix states. "*For example, using the Black CAPM theory to inform our equity beta estimate may mitigate possible low beta bias.*" The theory of the Black CAPM produces a higher intercept (the return on the zero beta asset) and a lower slope than the SL-CAPM and as a result provides higher estimates of returns for low beta stocks. This theoretical implications of the Black CAPM and the empirical evidence of a security market line with a higher intercept and flatter slope than predicted by the SL-CAPM led the AER to adopt an estimate of an equity beta of 0.7. This estimate was at the top of the range of possible estimates of beta adopted by the AER. In our opinion this was an interpretation of the theory and empirical evidence that was likely to lead to acceptance of a rather generous estimate of beta.

There are a number of reasons why the Black CAPM should be totally disregarded, many of which we have discussed in our previous reports. It assumes either that a riskless asset does not exist,

or that that you cannot borrow, but you can lend at the risk free rate. It also assumes that unlimited short selling of stocks is possible, which as we recall, Black himself agreed was not plausible. Given the degree of approximation involved in all the assumptions that may apply in calculations of the rate of return, the assumption of no riskless asset, in particular, has little merit. The presence of liquid traded government debt and relatively low levels of inflation together with the presence of Treasury Indexed Bonds makes the assumption of the existence of a riskless asset one of the more innocuous assumptions in the use of the CAPM. Turning to the assumption that you can lend but not borrow at the risk free rate, the notion that there may be a difference between borrowing and lending rates seems plausible, but this would lead us to the Brennan model, not the Black model.

Even if we were to ignore the problematic nature of these assumption, the properties of the estimates used tend to guarantee very volatile and unreliable estimates of the zero beta return, see Partington and Satchell (2016). In this respect the AER correctly concluded in the 2013 guideline that, with respect to the Black CAPM, there were major implementation problems and the robustness of estimates of the zero beta return was poor. We also note that we are not aware of any use of the Black CAPM in estimating the cost of capital in practice.

7. Some experts observed that the estimates for the 3 remaining firms have increased since 2013 in the Joint Expert Report.[8] Please explain what factors would contribute to observations of increasing equity beta (for example, economic environment, changes in interest rates, etc)? Explain if these observations are likely to reflect a genuine change in the underlying systematic risk 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 energy network services.

We have previously reviewed some of the expert reports that claimed evidence of an increase in beta. That increase in beta was principally driven by changes in leverage and the resulting effect of the leverage adjustment. The first issue therefore is how much reliance can be placed on the leverage adjustment. We have repeatedly questioned how much reliance can be placed on this adjustment. The second issue arises from the declining sample size. With such a small number of firms being considered, changes in beta may be driven by the individual characteristics of the firm, rather than market wide, or industry wide changes. The question then becomes are any estimates

[8] AER, Expert Joint Report, 21 April 2018, p. 52.

of changes in beta due to firm specific effects as opposed to industry wide changes. For example we understand that the vast majority of APA's activities are involved in unregulated assets. The question that naturally arises is to what extent are any changes in APA's beta, or APA's leverage, due to unregulated as opposed to regulated activities.

8. Utilities and other low beta stocks are sometimes called bond proxies.

a. Consider and explain if the AER's comparator firms can be classified as bond proxies

Bond proxies are shares that are considered to have bond like characteristics. In particular they have stable revenue streams. There is also an expectation of substantial stable dividends. Their attraction to investors is that they provide low risk income, but provide higher yields than bonds. There is also the attractive prospect that the income stream may grow over time. Utility shares are often suggested as being able to provide a bond-like revenue stream and therefore make good bond proxies. There is little doubt that the AER comparator firms can be considered as bond proxies. Indeed the Commonwealth Bank suggest investments in electricity power lines and gas pipelines as being the types of asset held by bond proxy companies, and specifically mentions APA Group as an example of a bond proxy.[9] Various web-sites also suggest AST or SKI as examples of bond proxies.[10]

The implication of being a bond proxy is that investors may be willing to accept relatively low returns on stocks that have strong bond proxy characteristics. If so bond proxies would be expected to trade at a modest return premium over corporate bonds. However, bond proxies are equities and hence have equity risk. For example companies may change their dividend payouts and individual stock prices are influenced by whether the market is rising or falling.

Market pundits caution about the risk of interest rate rises. The argument is that bond proxies have done particularly well with substantial price appreciation in the period of low interest rates, but the warnings are that prices are expected to fall as interest rates rise.[11] This is entirely rational in terms of changes in required rates of return on equity as given by the CAPM. This is discussed

[9] https://www.commbank.com.au/guidance/retirement/what-you-need-to-know-about-bond-proxies-201610.html Viewed 6 May 2018.

[10] See for example: https://www.kiscapital.com/bond-proxies-rock-hard-place/, and http://vertium.com.au/wp-content/uploads/2018/04/Vertium-Asset-Management-Blog-post-Defensives-20180411.pdf. Viewed 6 May 2018.

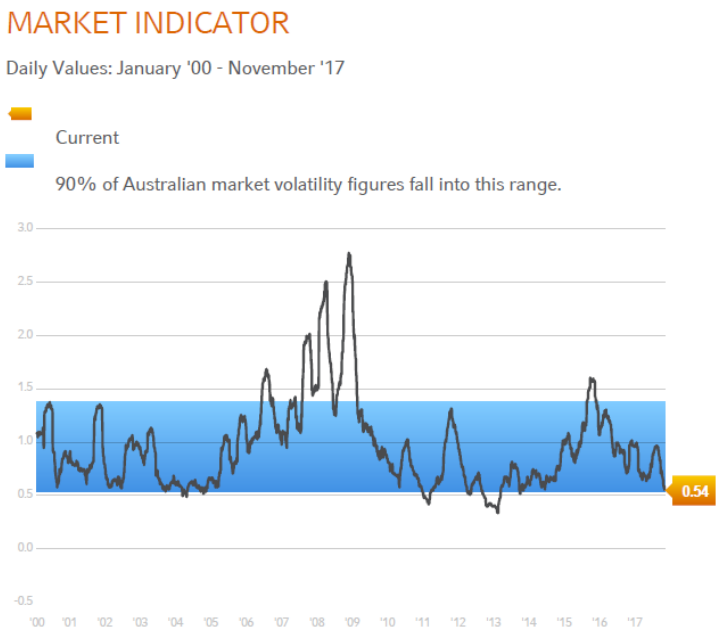
[11] However, in the answer to question 8b we present an argument that this risk may be lessened for the regulated businesses

further in question 11. Of course the prices of bond proxies are likely to be affected by general market movements and the risk this poses will depend upon the equity beta. Such equity betas would be expected to be relatively low, but somewhat above the betas of say investment grade debt.

The equity beta can be used to provide a further perspective on the characteristics of bond proxies. According to the CAPM, every efficiently priced asset can be interpreted as equivalent to a portfolio that is a linear combination of the market and a riskless bond. The proportion of invested in the market is equal to the beta of the asset. Based on Henry's (2014) work the betas of the comparator stocks is estimated to be relatively low. Thus, regulated energy companies, with betas of, say 0.5, can be thought of as a 50 per cent investment in the market index and 50 per cent investment in a government bond. Thus, one way we can think about the risk of a bond proxy relates*, inter alia*, to the beta of the asset and also to the volatility of an investment in the market index. With respect to market volatility we reproduce, as Figure 2, a volatility chart prepared by Russell Investments. From Figure 2 we can see that the volatility of the Australian equity market has been following a downward trend since 2015 and reaches a low point where the chart ends in November 2017. At the time of writing (May 2018) the ASX 200 Volatility Index (VIX) had been in the range 11% to 12.5%, which is low by historical standards. Low volatility in the market implies increased stability in the market index component of returns for bond proxies. This low risk from the market has made bond proxies even more bond like, but this may change in the future.

Figure 2: Volatility Indicator for the Australian Equity Market

Australian Market Volatility



Source: https://russellinvestments.com/au/support/tools/economic-dashboard/australian-market

b. Explain if and how does the interest rate environment to date, and a changing interest rate environment, affect the movement and return of bond proxies relative to the market index and each other?

Several of the issues raised in this question have been addressed in the response to question 8 a above, so our response here will be relatively brief. Falling interest rates are expected to raise the price of bond proxies in particular and low beta stocks in general. The recent past has been such an environment and bond proxies have increased in price. In particular APA, SKI and AST have shown strong growth in price over the last five years. As interest rates rise such price increases may well reverse. However there is a countervailing argument that is well put by Teh (2018, p3): "*On a technical note, the bond experts will recognise that SKI's cash flows resemble a variable interest rate security. If you believe interest rates are going to rise in the future, then SKI future cash flows will also rise. Given SKI owns monopoly assets, the regulator sets its cash flows based on a return on capital that is largely influenced by interest rates. The valuations of variable interest rate securities simply should not change that much from interest rate movements*." This argument has some merit but probably overstates the case for immunisation against interest rate movements. Immunisation is likely to be less effective because of the switch to a trailing average

in determining the regulated return. This switch weakens the link between current interest rates and the allowed rate of return on the debt financed portion of the RAB. The link, however, between current interest rates and the return on the equity financed component of the RAB has remained intact.

To put the foregoing another way, bond proxies are likely to respond to interest movements in a fashion that is to some extent similar to bonds. That is, there is likely to be an inverse relation between prices and interest rates. However, the inverse relation can be moderated to the extent that the returns on a bond proxy has characteristics somewhat like floating rate debt.

The current expectation is that interest rates will rise from their current low levels, but in Australia it does not seem that interest rates will rise sharply, if at all, in the near future. For example, Westpac (May 2018) is forecasting that the cash rate will be on hold in 2018 and 2019, while the NAB (April 2018) is forecasting the cash rate to rise from the current 1.5% to 1.75% by the end of 2018 and to 2.25% by the end of 2019.[12]

> *c. If there is an interest rate effect, would this change the fundamental/underlying systematic risk 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 energy network services?*

The effect of interest rate changes on bond proxies is discussed under 8 a and 8 b above. As discussed at 8 b, according to its beta the stock acting as a bond proxy is expected to behave like a mixture of a government bond and an investment in the market index. The higher the beta, the more the stock behaves like the market index and vice versa. We note that both systematic and unsystematic risk are important to the classification of a stock as a bond proxy. For bond proxies it is desirable that both systematic and unsystematic risk are low. It is this combination of low systematic risk and low unsystematic risk that gives rise to the stability of returns (low total variance) which is the characteristic required of a bond proxy.

In the context of the CAPM, the extent that investors accept lower returns than normal for a bond proxy, can be explained in two ways. First, in times of low interest rates the search for yield may

[12] https://www.nab.com.au/business/international-and-foreign-exchange/financial-markets/interest-rate-forecast. Viewed 7 May

reduce the market risk premium. For example, suppose the market risk premium shrinks from 6% to 4% and the beta of the bond proxy is 0.5, then the risk premium on the bond proxy shrinks from 3% to 2%. Alternatively, the betas of bond proxies might fall during periods of low interest rates.[13] Suppose the beta fell from 0.5 to 0.3 then with a 6% market risk premium the risk premium on the stock would fall from 3% to 1.8%. If both the market risk premium and the beta fall the stock's risk premium in our example would shrink to 1.2%.

Comparators

9. In the Joint Expert Report, experts discussed comparators used for estimating the equity beta. Please comment on the suitability of the AER's current comparator set for estimating equity beta for 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 energy network services, including:

a. Explain if the companies in the AER's comparator set (particularly the 3 remaining firms) were at cyclically low points in Henry's 2014 study.

It is well understood that sensitivity of firm revenue to business cycles is a key determinant of the equity beta. This sensitivity is captured by the revenue beta, and as stated in question 1, the revenue beta is a key driver of the asset beta and hence the equity beta. However, the cyclicality of the economy does not appear to be the issue here. Rather the question is about whether beta is varying through time in a cyclical fashion, moving from high to low and back again. There is plenty of research which shows mean reversion in beta for stocks in general, but this is not cyclical behaviour and mean reversion does not seem to be an issue in Henry's (2014) beta estimates for the AER comparator set.

There is also research that shows beta may depend on market conditions, with betas tending to be lower in bull markets than during bear markets. However, the stability of equity betas for the, regulated businesses, as discussed in question 2, is inconsistent with both mean reversion and cycles in beta, unless the cyclical variation is of small magnitude. Yao (2012) in a study of the time variation of industry betas in Australia found that the utility and health industries had the most stable betas. Yao's sample covered the period 2000 to 2008, with the both the time varying beta and a smoothed interest rate curve following a U shaped pattern, with the minimum point in

[13] As we discuss in question 9a below there is some evidence that utility betas fall as interest rates fall. However, we do not claim that this is a definitive result with respect to the AER comparator firms.

2003. Yao also suggests that the pattern in utility betas broadly followed the equity market. However, the positive effect of interest rates on utility betas was statistically significant, while the effect of the market excess return was not.

From the start of the GFC in 2008 government bond yields were generally moving downwards until mid-2012. From mid-2012 to the end of 2013 government bond yields were rising but fell in 2014. If betas for the AER comparator stocks followed the pattern identified by Yao for utilities, then between 2008 and 2014 the betas would have first been expected to decline and then increase during 2012 and 2013. However, the pattern of variation between 2008 to 2014, if any, in betas for the AER comparator set is an empirical question.

Evidence has been advanced for a rise in beta based on more recent studies, but this rise seems to be largely driven by the leverage adjustment. As we have repeatedly advised, most recently in the expert evidence session, the leverage adjustment to beta should be viewed with considerable caution. In this context Damodaran (undated) makes the observation that: "*The equity betas estimated for highly levered firms in practice tend to be much lower than the betas estimated from the levered beta equation developed in the preceding section.*"[14] It is desirable to rigorously test this observation and to determine if this result holds for alternative approaches to adjusting beta for leverage. It is also desirable to determine if Damodaran's suggested solution to this problem, by adjusting for the debt beta and also unlevering using the average leverage ratio and then relevering using the current leverage ratio, provides an effective solution. Unfortunately we expect the research required would be a very challenging task.

b. Explain the suitability of expanding the comparator set by including overseas energy networks and other Australian infrastructure firms and considerations required if these firms are used as comparators.

The principal that additional data, uncritically used, will improve a small amount of good data is clearly not true. One good examiner will deliver a more accurate examination result than

[14] The method used by Damodoran assumes the debt beta is zero and uses the following formula:
$\beta_L = \beta_u (1 + (1-t) (D/E))$
where
β_L = Levered Beta for equity in the firm
β_u = Unlevered beta of the firm (i.e., the beta of the firm without any debt)
t = Corporate tax rate
D/E = Debt/Equity Ratio

averaging over the good examiner and a bad one. Expanding the comparator set by including overseas energy networks and other Australian infrastructure firms seems full of problems. The fundamental problem is one of representativeness. The objective is to construct a sample that provides a representative estimate of the beta for the BEE. The current problem of a small sample size and therefore a potentially high standard error, or sensitivity of the results to a particular observation, is not solved by collecting data from a different population.

The problems include difficulties in interpreting different betas from different countries with differing systems of utility regulation, different technologies and operating conditions, different energy market conditions, and differing leverage. Differing levels of leverage across countries suggest fundamental differences in the nature of the businesses and/or the environment they operate in. There is also the issue that the beta is being estimated in different capital markets where market conditions differ and the countries' market portfolios differ.

For the purposes of discussion, we will treat the overseas country as Canada. So, a proposed comparison would need to examine homogeneity between the foregoing factors in Canada and Australia. In particular, treating as equivalent betas estimated against different market portfolios is troubling to us. Possible solutions include putting all the companies in a global framework with a common global market portfolio, but that is inconsistent with the AER's domestic CAPM. A second solution is to treat the Canadian company from the perspective of an Australian investor. To do this express the Canadian company returns in Australian dollars then compute its beta with respect to the Australian market.

It should be clear from the foregoing that we see considerable difficulties in extending the sample of firms by using overseas comparators and were this to be done it is not clear what is to be concluded. For example, recent estimates of the betas of electricity transmission networks in UK regulatory deliberations (Northern Ireland Determination 2014, see appendix 13.3) have been of the order of 0.5. Previous submissions from regulated businesses have advocated the use of data from the USA, which would have led to a higher beta than the 0.7 the AER currently uses. Thus the AER's beta lies above recent estimates from the UK and below estimates from the USA. Does this suggest that the AER's estimate should be moved up or down? It seems very likely that the answer will depend upon whether it comes from a regulated business or a consumer group.

With respect to the use of infrastructure firms we have previously expressed our view that infrastructure firms will have higher betas than the regulated businesses and it turned out that this was the case. While our priors have been confirmed it is not clear what we learn from the estimate of infrastructure betas that is particularly useful in respect to the betas of the regulated businesses. All that we learn is that the AER beta is appropriately of lower rank order than the betas for infrastructure firms.

c. Explain if information from de-listed firms should be included in the comparator set.

Given the reduction in the number of listed companies currently available to estimate beta, de-listed companies should definitely be used as they provided relevant data whilst listed. As discussed earlier at question 2, beta has been stable through time and therefore historic estimates of beta, including from companies that are now delisted, can be used to inform current estimates of beta.

d. Consider and explain if the 3 still-listed firms (APA, AST and SKI) remain appropriate for informing the equity beta 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 energy network services given differences in each firm's revenue from, and level of involvement in, regulated network services.[15]

One of the problems in a very small sample is that each observation has a large weight in determining the estimate from the sample. Thus, the idiosyncratic characteristics of a particular company could have a substantial impact on the estimation of beta in the current sample of three firms. In this context it is of particular concern that 90% of APA's revenue is derived from unregulated activities, whereas the BEE is considered to be a regulated entity. It is thus questionable whether APA is appropriate in terms of representativeness. We have not studied the risk of APA's unregulated activities rigorously, but it may well be the case that APA's unregulated activities are riskier than their regulated activities. If so the inclusion of APA in the comparator set will lead to an upward biased estimate of beta for the BEE. In any event, the estimated beta for APA will be primarily determined by its unregulated activities. The AER should therefore give consideration to whether APA should be deleted from the comparator set. This would reduce the current comparator set to two firms, making the small sample problem even

[15] For example: over 90 per cent of APA's revenue is unregulated see: APA, Annual report 2017, p. 16. For AST, close to 90 per cent of its revenue is regulated, see: AST, Annual report 2017, pp. 34–35.

worse. However, this problem would be alleviated by inclusion of the data from delisted firms as suggested in our answers to question 2 and question 9 c.

Black CAPM and Low Beta Bias

10. In the Joint Expert Report, some experts espoused adjusting the equity beta to reflect low beta bias.[16] In the second *concurrent* expert evidence session, Mr Ilan Sadeh also stated that the rate of return set by the AER reflects return on the RAB and investors would want an alpha for the extra risks investors take on that is reflected in things such as opex allowance.[17] He also noted that network businesses would earn a return higher than the AER's rate of return allowance due to outperformance on opex allowance. Having regard to these statements, please explain:

a. What you understand to be low beta bias

We understand the term low beta bias to refer to a common result based on the empirical security market line SML (a plot of beta on the x-axis and expected returns on the y-axis). The empirical SML is estimated from realised returns, and is commonly found to have a higher intercept and flatter slope than would be expected according to the SL-CAPM. One interpretation of this result is that the SL-CAPM gives required returns that are biased downwards for low beta stocks, but there are two other interpretations. One interpretation is that there are problems with the methods and/or data used to estimate the empirical security market line. The other is that the empirical SML is correctly estimated, but that the result does not necessarily imply "low beta bias". We suggest these latter two explanations are valid alternatives to the first explanation. We have discussed this at length in previous reports and we discuss it further under question 10 b below.

b. If the AER should have regard to the Black CAPM and/or low beta bias when estimating the return on equity and equity beta.

We suggested that no weight should be given to the Black CAPM in our response to question 6 c. In this section we address the issue of low beta bias and particularly the points made in the paper titled "Low-Beta Bias", Gray (December 2017). In this paper, Gray presents arguments that low-beta stocks are under-priced relative to their betas and should have their betas enlarged. It

[16] AER, Expert Joint Report, 21 April 2018, p. 53.
[17] AER, Expert evidence session 2 – Unproofed transcript, 5 April 2018, p. 46.

transpires that this is based on the fallacy that an intercept for the estimated SML higher than the risk free rate and a flatter slope necessarily implies that low beta stocks are under-priced.

In previous reports we have argued that the so called low-beta bias should be not be taken as a compelling argument in favour of increasing the allowed rate of return. Below we provide an example that results in an increase in the SML intercept/flatter slope, but it is not evidence of low beta bias.

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

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

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

We now state the fallacy; that an SML intercept greater than the riskless rate is evidence of low beta assets being under-priced. In the following theorem, we disprove this fallacy.

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

Proof. Suppose asset 1 is low-beta and correctly priced while asset 2 is high-beta and over-priced. Δ is the penalty in returns arising from over-pricing for the high-beta asset, which for simplicity we assume constant.

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

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

We apply least squares to the regression and find that the estimator of the intercept can be written as

$\hat{\pi} = \pi - \Delta((\widehat{B_1})^2 - \widehat{B_1}\widehat{B_2})$c where c is some positive constant. Since $\widehat{B_2} > \widehat{B_1}$ by assumption, we see that the intercept is biased upwards, even though the low-beta assets are correctly priced. An identical argument shows that the estimated slope, $\widehat{\pi_1}$, will be biased downwards.

There are several other reasons why we should be suspicious of low-beta bias as a basis for increasing the allowed rate of return. For example, as noted by Partington and Satchell (2017) estimates of alpha and beta are negatively correlated under normal circumstances so high beta is associated with low alpha and low beta with high alpha. Additionally, there is the conditional CAPM which we touched upon in Question 2 and we discuss this next.

The Conditional CAPM

We define $E_t(X_{t+1})$ to mean the expectation of X_{t+1}, given all information known at time t. The conditional SL-CAPM is identical to the unconditional CAPM except that it will change as the conditioning information changes; thus it is the natural vehicle for discussing changing beta. The return relation becomes, see Jagannathan and Wang, (1996),

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

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

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

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

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

11. Mr Stephen Satchell stated that a lot of the low beta bias can be explained by historical interest rate movement.[18] Please explain how (historical) interest rate movements may explain the low beta bias.

In a previous report, Partington and Satchell demonstrated that by inverting the CAPM we can express the price of asset *i* at time *t* as:

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

Suppose now that interest rate, r_{ft}, were to change. What would be the consequences of the interest rate change on the price of the asset? It turns out after routine calculus, that a fall in interest rates will lower the price if β_i is greater than one and it will raise the price if it is less than one.[19] In the period in question interest rates generally fell, rather than rose and so we would expect low beta assets to have done well relative to high beta assets. More detail of this result is in Partington and Satchell (2017), which is based upon earlier work by Muijsson, Fishwick and Satchell, (2016). The above is not an anomaly, nor a behavioural quirk that requires compensation, but is the consequence of a sequence of exogenous events which may well reverse in the future.

[18] AER, Expert evidence session 2 – Unproofed transcript, 5 April 2018, p. 46.

[19] Another way to think about this is that under the CAPM every efficiently priced asset can be interpreted as equivalent to a portfolio divided between the market and a riskless bond, where the beta of the asset gives the proportion of the portfolio invested in the market. Low beta assets are equivalent to heavy weightings in bond investments and so they do well as interest rates fall and bond prices rise. Assets with betas greater than one are equivalent to portfolios that have negative weights in bonds, in other words they are short bonds. So they do badly as interest rates fall.

Market Risk Premium

12. Explain what should be considered a suitable range of long term dividend growth rates by the AER for use in the Dividend Growth Model. Could the monthly 10 year CGS yield be considered a suitable growth rate, as shown in work by Damodaran and Fenebris?

In a previous report, McKenzie and Partington (2013), we gave extensive consideration to the issue of possible long term growth rates for dividends. We quote an extract from that report below (pp. 14 - 15)[20]

> *"In the light of the foregoing discussion, it would appear that there are several ways to proceed. On the one hand, the empirical evidence suggests that the GDP growth rate may be a poor choice in setting the long run growth rate of dividends. On the other hand, we could take evidence from the long sweep of history. For example, we note that both Bernstein and Arnott (2003) and Ritter (2005) report the Dimson, Marsh and Staunton (2002) estimate that real dividend growth was 0.9% in Australia from 1900 until the start of the new century. Thus, it might be argued that the nominal dividend growth rate should be the long run average of 0.9% real growth adjusted for inflation. Alternatively, we could follow Bernstein and Arnott (2003) and argue that it should be the expected real GDP minus 2.4%. Alternatively, taking the more recent data from Barra (2010), it might be argued that the growth rate should be the real EPS growth of 0.5% adjusted for inflation, or the expected real GDP rate minus 2.7%.*
>
> *Additionally there are the estimates from Lally (2013) and CEG (2013) to consider. Lally (2013) focuses on the headline Bernstein and Arnott (2003) adjustment to GDP of 2.0% but argues for the adjustment to be reduced. Lally takes the long run GDP growth to be 3.0% and adjusts this down by 0.5%, 1.0% and 1.5%. While CEG (2013) takes the real growth rate to be 3.9% and also computes the run real dividend growth from 1884 to 2010 as 2.76%. Both Lally and CEG use the same rate for both expected inflation at 2.5%.*

In Table 2, we present alternative estimates of the long term dividend growth rate based on the information presented above. The range is quite wide, from 0.31% to 6.5%, with CEG data consistently providing the highest estimates both overall and across similar estimation methods. This variability in estimated growth rates highlights our earlier observation about the sensitivity of the model to the choice of the growth rate. Rather than making the judgment of Solomon

[20] We have omitted the footnotes to this quote.

about who has the best growth forecast we treat them all equally. Taking a simple average across all the growth estimates the value is 3.73%. Clearly the Lally/Barra growth estimate of 0.31% seems rather low. We would argue that the CEG estimate of 6.5% is too high as it allows no adjustment for the additional investment by shareholders that is required to support the growth. Deleting these two observations the mean of the remaining estimates is 3.78%."

In summary our analysis suggested a range of nominal dividend growth rates, excluding extreme values, from 1.23% to 5.5%, with a mean of a little under 4%. Rather than reproduce our own table, we present independent results in Table 3 from a recent report sponsored by Challenger Limited, Bianchi, Drew and Walk (2015). The column headed estimate of g gives the real dividend growth rate.

Table3: Estimates of Dividend Growth Rates and the Equity Risk Premium

Estiamte of g	Authority	Why this g?	Implied ERP
2.50%	Ritter (2002)	Estimate of real dividend growth	5.6%
1.50%	Parham (2013)	Australian productivity growth rate	4.5%
1.10%	Dimson, Marsh and Staunton (2011)	Australia (1900-2010)	4.1%
1.00%	Average	Average of Dimson, Marsh and Staunton and Bernstein and Arnott (2003)	4.0%
0.90%	Bernstein and Arnott (2003)	Australian real dividend growth	3.9%
0.83%	Dimson, Marsh and Staunton (2011)	World (USD) 1900-2010	3.8%
0.46%	Dimson, Marsh and Staunton (2011)	United Kingdom 1900-2010	3.4%
–0.11%	Dimson, Marsh and Staunton (2011)	World (Home Currency) 1900-2010	2.9%
–0.51%	Dimson, Marsh and Staunton (2011)	Netherlands 1900-2010	2.4%

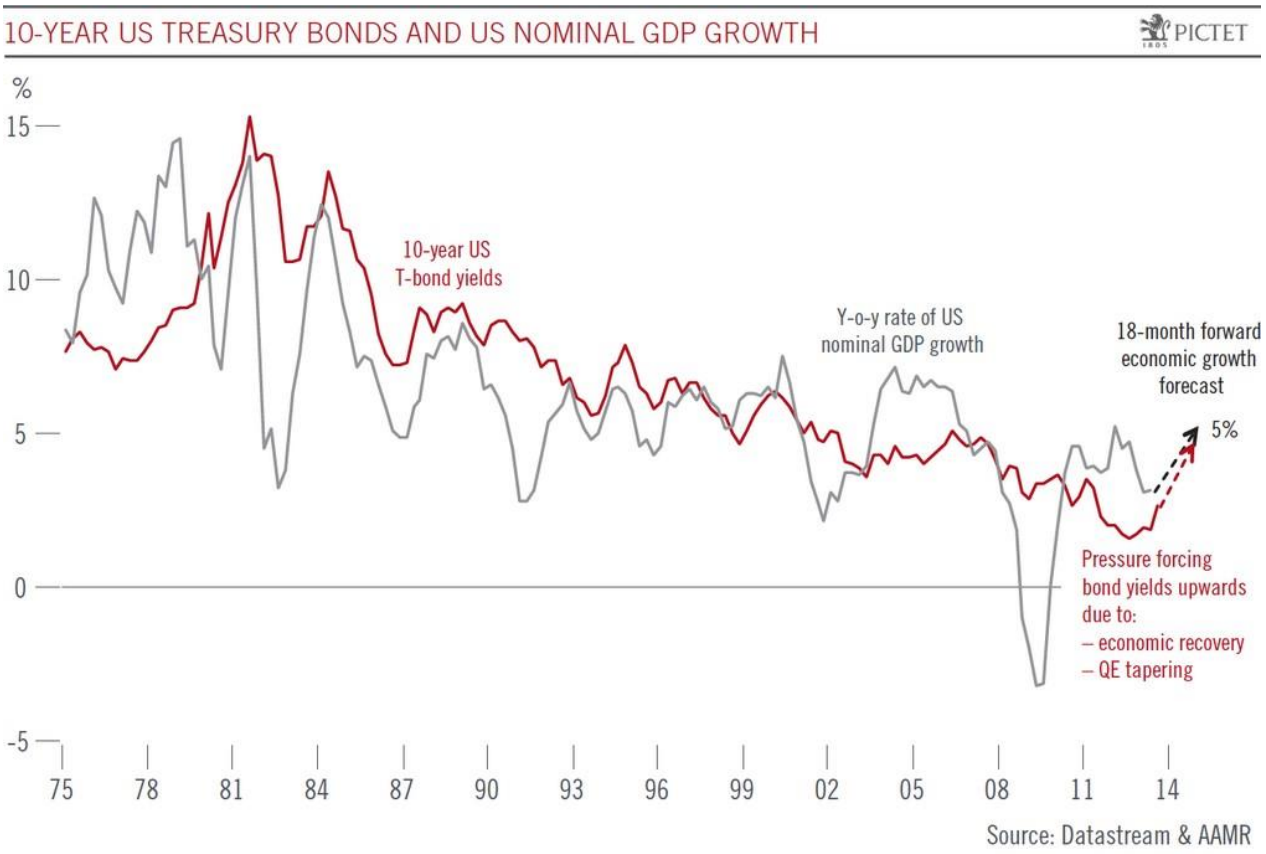
Source: Bloomberg (2015b); S&P Dow Jones Indices LLC (2015); Authors' calculations.

Source: Bianchi, Drew and Walk (2015).

The yield on ten year government bonds adds one more alternative to the list of possible estimates of the long term nominal growth rate, currently at 2.77%. In the first quarter of 2001, inflation was 1.9%. Assuming inflation is expected to run at 2%, this gives a growth rate in real dividends of approximately 0.77% or 0.8% to one decimal place. If we exclude estimates from Table 3 below 0.8% (all based on overseas data) and include our estimate from the government bond rate, the range of real growth rates is from 0.8% to 2.5%.

Damodaran has suggested both the expected GDP growth rate and the government bond rate as estimates of the long term growth rate. He further suggests that as a rule of thumb, the stable growth rate used in a valuation should not exceed the riskless rate used in forming the discount rate. This is to ensure consistency in the assumptions about inflation and real growth in both numerator and denominator of the valuation equation.

Damodaran's suggestion of using the government bond rate as the long term growth rate is based on his argument that in the long run the real growth rate in GDP cannot be lower than the real interest rate and that the two rates will converge as economies mature. Furthermore, given both the nominal GDP growth rate and the nominal bond rate contain the same premium for expected inflation Damodaran argues that the nominal government bond rate and the nominal GDP growth rate are equal. The nominal government bond rate is thus used as an estimator of the nominal GDP growth rate. The chart in Figure 3 shows that for the USA there has been some year by year correspondence between the 10 year government bond yield and nominal GDP growth, but there have also been periods where the two series have diverged substantially. What is also clear from the chart is that there are times when the bond yield was very high and it would have been a very poor predictor of future GDP growth rates.



Source: https://snbchf.com/monetary-fiscal-policy/inflation-expectations-gdp-growth-bond-yield/

Fenebris suggests the use of the government bond rate for the long term growth rate, but with an adjustment. They also suggest the use of the internal growth rate. The internal growth rate is

the rate that can be sustained without raising external finance and it is equal to the rate of growth of the book value of equity. With respect to government bonds, Fenebris suggests the use of the higher of the government bond rate minus two percent (r_f – 2%), or zero.

The requirement for a lower bound of zero illustrates one of the problems in using the government bond yield as an estimate of the stable long term growth rate. The bond yield can at times be driven by monetary policy. In the case of the EU, quantitative easing has resulted in very low, or in some cases negative yields on government bonds. Thus the 2% downward adjustment suggested by Fenebris would lead to substantially negative long term growth rates, which are implausible and hence the requirement for a lower bound of zero. Negative yields have been observed in Europe. One example of negative yields was for German 10 year government bonds. Thus, even without a 2% downward adjustment, there are times when taking the 10 year bond yield as the growth rate would be predicting a negative long run growth rate. This hardly seems sensible as long run growth projection for say the German economy.

Our conclusion on the use of the 10 year government bond yield as a predictor of expected dividend growth rates is that it is unlikely to be a better predictor than any of the alternatives. It is also likely that there will be periods where it is a poor predictor. Unfortunately, there is no unambiguously best way to estimate the long term growth rate in dividends. We are however, strongly of the view that where the growth rate in GDP is used, there needs to be a discount to that rate in order to account for the extra capital that will need to be invested in order to support the future growth.

13. Is the Dividend Growth Model a precise enough model to directly inform the AER's estimate of MRP for a forward looking rate of return?

In several previous reports we have strongly expressed the view that although the dividend growth model is a forward looking model it is not sufficiently precise to reliably track changes in the MRP. Indeed it is quite likely to give biased results. We have discussed the problems with the DGM at length in previous reports and most recently in the expert evidence session. Our view is unchanged and it is that the DGM is not sufficiently precise to directly inform the AER's estimate of the MRP for a forward looking return.

14. In the second concurrent expert evidence session Professor Stephen Gray and Mr Simon Wheatley claimed that to be consistent with the AER's Post Tax Revenue Model (PTRM) the AER must only consider arithmetic averages of single year historical returns, with no consideration to the geometric averages or different return periods. Please explain if you agree with these statements.

The estimation of the market risk premium is for the purpose of determining investors' required rate of return. This return is equal to their expected rate of return if prices are in equilibrium. Investors compound returns and whether or not the AER compounds returns is not relevant to the return that investors require/expect. It is well established that the arithmetic average of annual returns will overestimate expected returns if the holding period is more than one year. The holding period of investors is likely to be more than one year. For example, in the expert evidence session it was suggested that some investors in the regulated businesses had investment horizons of 20 years. Given investor holding periods of more than one year it is appropriate for the AER to have regard to the geometric average for returns. It is also appropriate for the AER to consider return periods of more than one year.

15. Consider and explain if evidence exists to support the use of the Wright Approach, and its underlying theory of a one-to-one inverse relationship between the risk free rate and the MRP, in the Australian market.

We are not aware of any substantive evidence in support of the Wright approach in the Australian market. We also find it implausible that there is a one to one inverse relation (perfect negative correlation) between the risk free rate and the MRP.

Utilising the Wright approach, the regulated businesses have argued that as bond yields fall the market risk premium expands to offset the interest rate decrease and vice versa as bond yields rise. Let us assume that this is the case. Then, *ceteris paribus*, we would not expect the market to rise as bond yields fall. This is because the reduction in the equity discount rate due to the fall in interest rates would be offset by the increase in the market risk premium. Neither would we expect the market to fall as bond yields rise. Yet the evidence, discussed below, shows that the normal state of affairs is the exact opposite of the foregoing. In order to support the Wright approach, therefore, it is necessary to argue that historically changes in interest rates did cause a change in the risk premium, but there was a change in some other factor that more than offset the risk premium change. That, for example, as interest rates fell future dividends were expected

to grow more quickly and this expected increase in dividends more than offset the increase in the risk premium, and vice versa as interest rates rose. Perhaps the argument might be that there were consistently countervailing effects from inflation. We do not find such arguments particularly convincing support for the Wright approach.

The evidence (Ilmanen 2003; Rankin and Idil 2014) is that the correlation between the return on the market and the government bond yield was generally positive during the 20th Century. However, there have been periods of negative correlation during the 1930s, 1950s, and since the latter part of the 1990s. A positive correlation between the return on the market and bond yields is equivalent to a negative correlation between the level of the market index and bond yields.[21] Thus the correlation between the market index and bond yields has generally been negative, but has turned positive in some periods.[22] That is, stock markets rise when bond yields fall and vice versa, but sometimes this pattern reverses. While the evidence in Ilmanen and in Rankin and Idil mainly focuses on the US market, Rankin and Idil also report similar results for Australia.

[21] As bond yields rise stock prices fall in order for the stock to offer higher returns.
[22] Ilmanen suggests that this is more likely in recessions, weak equity markets and periods of flight to quality.

References

AER (2013) *Better Regulation Explanatory Statement Rate of return Guidelines (Appendices)*, December.

AER (2017) *AER Staff Beta Analysis*, June.

AER (February 2018) *Discussion Paper*: *The Allowed Rate of Return*, *Compensation for Risk and the Use of Data when Judgement is Required.*

AER (March 2018) *Discussion Paper: Equity Beta.*

Arora V. (2014) *Estimates of the Price Elasticities of Natural Gas Supply and Demand in the United States*, MPRA Paper No 54232, Uni-Muenchen.

Barra (2010) *Is There a Link Between GDP Growth and Equity Returns?* Barra Research Bulletin, May.

Bernstein, W. and Arnott, R. (2003) Earnings Growth: The Two Percent Dilution, *Financial Analysts Journal*, September/October.

Black F., Jensen M. and Scholes M. (1972) The Capital Asset Pricing Model: Some Empirical Tests, in *Studies in the Theory of Capital Markets*, ed. Michael C. Jensen, Praeger.

Bianchi R., Drew M. and Walk A. (2015) *The (un)Predictable Equity Risk Premium,* Challenger.

Brealey R., Myers S., Partington G. and Robinson D. (2000), *Principles of Corporate Finance,* McGraw-Hill.

CEG (2013) *Estimating E[Rm] in in the Context of Recent Regulatory Debate*, June.

Damodaran (undated) *Estimating Risk Parameters,* Stern School of Business.

Dimson, E., Marsh P. and Staunton, M. (2002) *Triumph of the Optimists: 101 Years of Global Investment Returns*, Princeton University Press.

Dimson E., Marsh P. and Staunton M. (2015) *The Dimson-Marsh-Staunton Global Investment Returns Database*, Morningstar.

Fama E, and MacBeth J. (1973) Risk, Return, and Equilibrium: Empirical Tests, *Journal of Political Economy*, 81.

Fama, E., and French, K. (2004) The Capital Asset Pricing Model: Theory and Evidence, *Journal of Economic Perspectives*, 18.

Fan S. and Hyndman R. (2010) *The Price Elasticity of Demand in South Australia*, Working paper, Monash University (Subsequently published in *Energy Policy,* 2013, 39.).

Graham, J. and Harvey C. (2001) The Theory and Practice of Corporate Finance: Evidence from the Field, *Journal of Financial Economics* 60.

Gray S. (December 2017) *Low-Beta Bias; A Report Prepared for ACTEWAGL Distribution*, Frontier.

Henry O. (2014) *Estimating β: An Update*, April.

Harvey C. and Liu Y. (2018) *Lucky Factors*, Available on SSRN.

Ilmanen A. (2003) Stock-Bond Correlations, *Journal of Fixed Income,* 13.

Lally, M. (2013) *The Dividend Growth Model,* March.

McKenzie M., and Partington G. (2013) *Report to the AER the Dividend Growth Model (DGM)*.

Muijsson C., Fishwick E. and Satchell S. (2016) The Low-beta Anomaly and Interest Rates, in *Risk-Based and Factor Investing*, ed. J. Emmanuel, Elsevier.

NAB (April 2018) https://www.nab.com.au/business/international-and-foreign-exchange/financial-markets/interest-rate-forecast. Viewed 7 May.

Oxera (2011) *The Impact of Longer Asset Lives on the Cost of Equity*, Prepared for the Energy Networks Association.

Partington G. and Satchell S. (2016) *Report to the AER: Cost of Equity Issues 2016 Electricity and Gas Determinations.*

Partington G. and Satchell S. (2017) *Report to the AER: Discussion of Submissions on the Cost of Equity.*

Rankin E. and Idil M. (2014) A Century of Stock-Bond Correlations, *Reserve Bank Bulletin,* September Quarter.

Sharpe, W. F. (1964) Capital asset prices: A theory of market equilibrium under conditions of risk, *Journal of Finance*, 19.

Ritter, J. (2005) Economic growth and equity returns, *Pacific-Basin Finance Journal*, 13.

Teh J. (2018) *Defensives: Perception v Reality,* Vertium Asset Management.

Wespac (May 2018) *Australia and New Zealand Weekly*.

Yao J. (2012) Semi-Parametric Examination of Industry Risk: The Australian Evidence, *Australian Economic Papers,* December.

Expert Witness Compliance Declaration

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

Signed

Graham. H. Partington

Steven. E. Satchell

Appendix 1

Expert report on risk and return on equity

The AER requires advice from the consultant on the rate of return that achieves the National Gas and Electricity Objectives, the revenue and pricing principles and the Allowed Rate of Return Objective (details provided below).

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

- The likelihood that the rate of return on equity is to be applied as part of a binding rate of return guideline (details provided below)
- The revenue and pricing principles in National Electricity Law and National Gas Law (details provided below)
- A range of relevant material including:
    - the current 2013 Guideline,
    - issues/discussion papers and submissions published as part of our 2018 review of our Guideline,
    - the concurrent expert evidence sessions,
    - previous expert advice provided to the AER,
    - expert reports commissioned by regulated energy businesses and any other stakeholders and submitted to the AER during past regulatory determination processes,
    - previous and current regulatory proposal from regulated energy businesses.

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

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

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

Risk

1. What is the systematic risk and overall riskiness 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 energy network services?

    a. Consider and explain how the regulatory framework[23] affects (cashflow/revenue) risk for 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 energy network services? Explain if there would be any effect on the return on equity.

2. The Expert Joint Report concluded that the true systematic risk is likely to be stable over time for 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 energy network services over time.[24] Please explain if you agree with this statement and if correct what this implies for the estimation of equity beta.

3. The Expert Joint Report noted that experts agreed that technological risk does not need to be considered separately in estimating equity beta.[25] Explain if technology risk should be reflected in the rate of return and return on equity for 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 energy network services?

4. In the expert evidence sessions, experts largely agreed that systematic risk should be compensated through the rate of return and non-systematic risks compensated via the expected cashflows. However, there was discussion on how potentially catastrophic risk such as natural disasters should be compensated. Taking into account both the nature of this risk and clauses in the regulatory framework that allow certain expenditures to be re-opened

[23] For example:

- Provisions are in place to allow for reopening capital expenditure decisions for certain events (NER 6.6.5, 6A.7.1) once a regulatory decision has commenced.
- Cost pass-through mechanisms (NER 6.6.1, 6A.7.2–6A.7.3; NGR 97(1)(c)) are in place so businesses may apply to pass certain risks/costs to relevant users. This may include but would not be limited to insurance cap, insecure credit risk, retailer insolvency, natural disasters and terrorism events. For example see: AER, Final decision CitiPower distribution determinations 2016 to 2020 Attachment 15–Pass through events, May 2016, pp. 6–8.
- Revenue caps and expected demand based cost allowance mitigate demand risks.
- There is no stranding risk as RAB cannot be optimised.
- No inflation risk as inflation risk is carried by consumers via the CPI-X mechanism.

[24] AER, Expert Joint Report, 21 April 2018, p. 51.

[25] AER, Expert Joint Report, 21 April 2018, p. 43.

and events/costs to be passed to the user,[26] please consider and explain if this risk should be compensated through the rate of return.

5. In the Expert Joint Report, Mr David Johnstone challenged the standard Sharpe-Lintner CAPM approach for estimating the required rate of return which references the degree of systematic risk (captured in the equity beta parameter).[27] With regard to this please explain:

    a. If the Sharpe-Lintner CAPM framework (via the equity beta parameter) is appropriate for reflecting and compensating for the systematic risk 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 energy network services?

    b. If non market-based data (for example, annual report information) can be used to estimate systematic risk and if this be consistent the Sharpe-Lintner CAPM and preferable to the use of market based data for estimating equity beta?

Equity beta

6. Please explain your view on the best estimate of an equity beta to be applied in a Sharpe-Lintner CAPM for 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 energy network services, including your view on the AER's:

    a. Previously applied methods of empirical estimation of equity beta from listed Australian energy network businesses

    b. Empirical estimation of industry/sector betas for various Australian sectors/industries

    c. Role provided to the Black CAPM in the AER's 2013 rate of return guideline. Please also explain if the AER should have regard to the theory of the Black CAPM (and the associated possibility of market imperfections) as it did in its April 2015 and subsequent regulatory determinations when selecting a point estimate for the equity beta.

[26] For example:

- Provisions are in place to allow for reopening capital expenditure decisions for certain events (NER 6.6.5, 6A.7.1) once a regulatory decision has commenced.
- Cost pass-through mechanisms (NER 6.6.1, 6A.7.2–6A.7.3; NGR 97(1)(c)) are in place so businesses may apply to pass certain risks/costs to relevant users. This may include but would not be limited to insurance cap, insecure credit risk, retailer insolvency, natural disasters and terrorism events. For example see: AER, Final decision CitiPower distribution determinations 2016 to 2020 Attachment 15–Pass through events, May 2016, pp. 6–8.
- Revenue caps and expected demand based cost allowance mitigate demand risks.

[27] AER, Expert Joint Report, 21 April 2018, p. 22 & 39.

7. Some experts observed that the estimates for the 3 remaining firms have increased since 2013 in the Joint Expert Report.[28] Please explain what factors would contribute to observations of increasing equity beta (for example, economic environment, changes in interest rates, etc)? Explain if these observations are likely to reflect a genuine change in the underlying systematic risk 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 energy network services.

8. Utilities and other low beta stocks are sometimes called bond proxies.

    a. Consider and explain if the AER's comparator firms can be classified as bond proxies

    b. Explain if and how does the interest rate environment to date, and a changing interest rate environment, affect the movement and return of bond proxies relative to the market index and each other?

    c. If there is an interest rate effect, would this change the fundamental/underlying systematic risk 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 energy network services?

Comparators

9. In the Expert Joint Report, experts discussed comparators used for estimating the equity beta. Please comment on the suitability of the AER's current comparator set for estimating equity beta for 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 energy network services, including:

    a. Explain if the companies in the AER's comparator set (particularly the 3 remaining firms) were at cyclically low points in Henry's 2014 study.

    b. Explain the suitability of expanding the comparator set by including overseas energy networks and other Australian infrastructure firms and considerations required if these firms are used as comparators.

    c. Explain if information from de-listed firms should be included in the comparator set.

[28] AER, Expert Joint Report, 21 April 2018, p. 52.

d. Consider and explain if the 3 still-listed firms (APA, AST and SKI) remain appropriate for informing the equity beta 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 energy network services given differences in each firm's revenue from, and level of involvement in, regulated network services.[29]

Black CAPM and low beta bias

10. In the Expert Joint Report, some experts espoused adjusting the equity beta to reflect low beta bias.[30] In the second concurrent expert evidence session, Mr Ilan Sadeh also stated that the rate of return set by the AER reflects return on the RAB and investors would want an alpha for the extra risks investors take on that is reflected in things such as opex allowance.[31] He also noted that network businesses would earn a return higher than the AER's rate of return allowance due to outperformance on opex allowance. Having regard to these statements, please explain:
    a. What you understand to be low beta bias
    b. If the AER should have regard to the Black CAPM and/or low beta bias when estimating the return on equity and equity beta.
11. Mr Stephen Satchell stated that a lot of the low beta bias can be explained by historical interest rate movement.[32] Please explain how (historical) interest rate movements may explain the low beta bias.

Market Risk Premium

12. Explain what should be considered a suitable range of long term dividend growth rates by the AER for use in the Dividend Growth Model. Could the monthly 10 year CGS yield be considered a suitable growth rate, as shown in work by Damodaran and Fenebris?
13. Is the Dividend Growth Model a precise enough model to directly inform the AER's estimate of MRP for a forward looking rate of return?
14. In the second concurrent expert evidence session Professor Stephen Gray and Mr Simon Wheatley claimed that to be consistent with the AER's Post Tax Revenue Model (PTRM)

[29] For example: over 90 per cent of APA's revenue is unregulated see: APA, Annual report 2017, p. 16. For AST, close to 90 per cent of its revenue is regulated, see: AST, Annual report 2017, pp. 34–35.
[30] AER, Expert Joint Report, 21 April 2018, p. 53.
[31] AER, Expert evidence session 2 – Unproofed transcript, 5 April 2018, p. 46.
[32] AER, Expert evidence session 2 – Unproofed transcript, 5 April 2018, p. 46.

the AER must only consider arithmetic averages of single year historical returns, with no consideration to the geometric averages or different return periods. Please explain if you agree with these statements.

15. Consider and explain if evidence exists to support the use of the Wright Approach, and its underlying theory of a one-to-one inverse relationship between the risk free rate and the MRP, in the Australian market.

Appendix 2

CURRICULUM VITAE GRAHAM PARTINGTON

PERSONAL

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HIGHER EDUCATION AND EMPLOYMENT

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

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

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

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

Awards and Major Research Grants

Awards

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

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

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

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

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

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

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

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

1985: Butterworths Travelling Fellowship

Major Research Grants

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

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

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

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

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 College Teaching Fellow

COLLEGE Trinity College, Cambridge University

DATE OF BIRTH 22nd February 1949

CAREER 1971-73 - School Teacher

1973-74 - Computer Executive

1974-76 - Research Officer

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

1978-79 - Lecturer (Statistics Department) at LSE

1979-80 - Lecturer (Economics Department) at LSE

1980-86 - Lecturer, University of Essex

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

1986-89 - Assistant Lecturer, University of Cambridge

1989-2000 - University Lecturer at the University of Cambridge

1991-93 - Reader, Birkbeck College

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

2010-2012 - Visiting Professor, Sydney University.

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

2012- 2014 -Visiting Lecturer ,RHUL, London University

2013 -Professor, Sydney University

2014 - Fellow(Title E), Trinity College

<u>CURRENT RESEARCH</u>

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

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

JOURNAL AFFILIATIONS

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

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

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

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

SUBMITTED PUBLICATIONS

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

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

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

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

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

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

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

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

Econometrica.

FORTHCOMING PUBLICATIONS

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

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

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

2015 Publications

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

2014 Publications

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

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

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

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

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

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

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

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

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

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

,PP. 230-236, Pub. Date: March 29, 2013

DOI: 10.4236/jmf.2013.31A022

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

2012 PUBLICATIONS

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

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

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

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

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

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

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

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

Defining Single Asset Price Momentum in terms of a Stochastic Process

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

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

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

175, Part 3, pp. 1–21

2011 PUBLICATIONS

Large deviations theorems for Optimal Investment problems with large portfolios, (with B. Chu and J. Knight), *European Journal of Operations Research*, Vol. 211, No. 3 (June 2011), pp. 533-555..

Some New Results for Threshold AR(1) Models, (with J. Knight); in *the Journal of Time Series Econometrics*. Vol. 3: Issue 2, Article 1. **DOI:** 10.2202/1941-1928.1085

Stability Conditions for Heteroscedastic Factor Models with Conditionally Autoregressive Betas. (with G. Christodoulakis); in *the Journal of Time Series Analysis*.. Article first published online: 10 JAN 2011 | DOI: 10.1111/j.1467-9892.2010.00706.x

'Social Welfare Issues of Financial Literacy and Their Implications for Regulation' with O. Williams in *Journal of Regulatory Economics.* Online first, (21st of April, 2011).

Uncertain Survival and Time Discounting: Intertemporal Consumption Plans for Family Trusts (with S. Thorp); in *Journal of Population Economics*, (2011) 24:239-266.

Hedge Fund Replication (with J. Grummit); in *Journal of Derivatives and Hedge Funds,(1-18, 2011)*

Managing the Risk of Hedge Fund Outflows, (with B. Scherer), *Journal of. Alternative Investments,* Fall, v14n2, p. 18-23 (2011).

2010 PUBLICATIONS

The Optimal Mortgage Loan Portfolio in UK Regional Residential Real Estate (with Y. Cho and S. Huang) in *Journal of Real Estate Finance and Economics*, pp. 1-33-33., doi:10.1007/s11146-010-9269-9, (25 September 2010).

How Loss Averse are Investors in Financial Markets? (with S. Huang), in *Journal of Banking and Finance.* vol. 34, issue 10, pp. 2425-2438.

ASSET ALLOCATION AND A TIME-VARYING RISK TARGET (WITH R. CHEN AND J. LUO), IN QASS, VOL. 4, NO. 2, PP. 1-28.

An Experimental Survey of Investment Decisions for Retirement Savings,(with H. Bateman, J. Louviere, S. Thorp, and T. Islam), in *Journal of Consumer Affairs;* vol 44. No 3, pp. 463-482, (2010).

The Dangers of Double-Marking,(with J. Pratt) in *Higher Education Review*, vol 42, no 2, (Spring 2010).

Understanding Analysts' Forecasts (with R. J. Louth, P. Joos, and G. Weyns), in *European Journal of Finance*, 2010, 16.1-2, pp. 97-118.

Exact Properties of Measures of Optimal Investment for Benchmarked Portfolios (with J. Knight), in *Quantitative Finance,* 10.5, pp. 495-502 (May 2010).

Forecasting Risk and Return from Ordered Information (Lessons from the Recent Financial Crisis), (with S.M. Wright), in *Economic and Financial Modeling*, pp. 3-37, (Spring 2010).

Optimal Investment and Asymmetric Risk: A Large Deviations Approach, (with J. Knight), *Optimization: A Journal of Mathematical Programming and Operations Research*, vol. 59, no. 1, pp. 3–27, (January 2010).

Modelling Conditional Heteroscedasticity and Skewness using the Skew-Normal Distribution (with R. Corns), in *Metron,* vol 68, no. 3, (December 2010).

Using Approximate Results for Validating VaR, (with J. Hong, J. Knight and B. Scherer),

in *Journal of Risk Model Validation,* vol. 4, no 3 (June 2010).

2009 PUBLICATIONS

Fairness in Trading-a Microeconomic Interpretation (with B. Scherer); in *Journal of Trading,* , pp. 1-8, *(*Winter 2009).

On the Valuation of Warrants and Executive Stock Options: Pricing Formulae for Firms with Multiple Warrants/Executive Options, (with T. Darsinos), in *QASS.* vol. 3 (2), pp. 69-114.

Implementing risk appetite in the management of currency portfolios, (with J. Luo and P. Saks), *Journal of Asset Management,* vol 9 (6), pp. 380-397.

Collecting and Investing in Stamps (with J. Auld.) in *Collectible Investments for the High Net Worth Investor*; chapter 8; S. Satchell (editor).

Computing the Mean/Downside Risk Frontiers: the Role of Normality. (with A. D. Hall), in *Optimizing the Optimizers,* S. Satchell (editor*).*

Some Properties of Averaging Simulated Optimisation Models (with J. Knight), in *Optimizing the Optimizers,* S. Satchell (editor*).*

Emerging From an Economic Crisis: Why Equity-Only Portfolios Remain a Bad Idea, (with R. Lewin and M. J. Sardy) in *Business and Economics Journal*, Academic & Business Research Institute (AABRI), (2009).

The Link between Macroeconomic Factors and Style Returns, (with Q. Jessica Zhang, P. Hopkins, and R. Schwob), in *Journal of Asset Management,* vol 10 (5), pp. 338-355.

Des Rating Qualitatifs por regagner le confiance des investisseurs; *L'Agefi Magazine*; 22/09/09, Fund Management Ratings *Investment Week* (July 2009).

2008 PUBLICATIONS

Testing for Infinite Order Stochastic Dominance with Applications to Finance, Risk and Income Inequality (with J. Knight), *Journal of Economics and Finance,* vol. 32(1); pp. 35-46.

The Accuracy of Credit Scoring Receiver Operating Characteristic in the Presence of Macroeconomic Shocks , (with G. Christodoulakis), *Journal of Risk Model Validation,* Volume 2/ Number 3, (Fall 2008).

2007 PUBLICATIONS

Endogenous Cross Correlation (with J. H. S. Yang), DAE Working Paper 0219, *Macro-economic Dynamics,* vol 11, S1, pp. 124-153.

The Underlying Return Generating Factors for REIT Returns: An Application of Independent Component Analysis (with C. M. Lizieri and Q. Zhang), *Journal of Real Estate Economics,* 35(4); pp. 567-596.

Analytic Models of the ROC Curve: Applications to Credit Rating Model Validation (with W. Xia), (QFRC Discussion paper, Number 181), *The Validation of Risk Models,* G. Christodoulakis *and* S. Satchell (editors), (2007).

Skew Brownian Motion and Pricing European Options (with R. Corns), in *European Journal of Finance* 13(6); pp. 523-544.

Bayesian Analysis of the Black-Scholes Option Price, DAE Working Paper no. 0102, University of Cambridge, (with T. Darsinos), (2001), in *Forecasting Expected Returns ;*S. Satchell(editor).

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. *Forecasting Expected Returns;* S. Satchell (editor).

Changing Correlation and Equity Portfolio Diversification Failure for Linear Factor Models during Market Declines (with A. Sancetta), in *Applied Mathematical Finance,* vol. 14, No 3, 227-242, (July 2007).

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

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

The Behavioural Components of Risk Aversion (with G. B. Davies), *Journal of Mathematical Psychology,* vol 51, pp 1-13, (2007).

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

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

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

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

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

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

UK Measures of Firm-Lived Equity Duration: Value Creation in Multinational Enterprise, (with R. A. Lewin, M. J. Sardy), (editors J. J. Choi, R. W. Click), *International Finance Review*, vol. 7, pp. 307-338, (2007).

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

2006 PUBLICATIONS

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

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

Asymmetry, Loss Aversion and Forecasting, (with S.A. Bond), in *Journal of Business*, vol. 79, no. 4, pp. 1908-1830, (2006).

Asymmetry and Downside Risk in Foreign Exchange Markets, (with S.A. Bond)

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

2005 PUBLICATIONS

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

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

Valuing Information Using Utility Functions: How Much Should We Pay for Linear Factor Models? (with S. Hwang) in *The European Journal of Finance,* vol. 11, no. 1, pp. 1-17, (February 2005).

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

New Test Statistics for Market Timing with Applications to Emerging Markets Hedge Funds (2004) (with A. Sancetta) in *The European Journal of Finance*, October 2005, Vol. 11, no. 5 pp. 419-443.

Edited special issue of Hedge-Fund Econometrics in *The European Journal of Finance* (October 2005).

Diversification When It hurts? The Joint Distribution of Real Estate and Equity Markets. (with J. Knight and C. Lizieri), 2005. *Journal of Property Research*, Vol 22,no 4.

Robust Cross-sectional Factor Modelling Approach to Equity Forecast Construction with S.M.Wright, *Economic and Financial Modelling*, Vol. 12 No. 4, Winter 2005, pp. 153-182.

2004 PUBLICATIONS

Forecast Evaluation in the Presence of Unobserved Volatility. In *Econometric Reviews* pp. 203-216 (with G. Christodoulakis). 2004.

Bayesian Estimation of Risk-Premia in an APT Context. Cambridge Working Papers in Economics 0329, in *Linear Factor Models in Finance*, J. Knight and S. Satchell (eds.) pp. 61-82, Butterworth and Heinemann. (with T. Darsinos)

Small-Noise Arbitrage Pricing Theory (in *Linear Factor Models in Finance*, pp. 141-162, edited by J. Knight and S. Satchell, Butterworth and Heinemann).

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

Draw Downs as a Measure of Hedge Fund Risk: Some Stylized Facts (with A. Sancetta and G. Lande). In G. N. Gregoriou, V.N. Karavas and F. Rouah (editors), *Hedge Funds: Inside the Black Box Using A Quantitative Approach*. Chapter 13, pp. 235-246. Washington: Beard Books.

The Copula Function as a Model and Approximation to Multivariate Distributions in *Econometric Theory 20* pp. 535-562 (with A. Sancetta)

Measuring Style Tilting and Decomposing Style Risk (2004). in *Journal of Asset Management* June, Vol. 5, No. 1 pp. 18-28 (with T. Darsinos).

Generalising the Universal Performance Measure. *Risk Magazine*, June 2004 pp. 80-84 (with T. Darsinos).

Data Pooling: a necessity for the majority of UK mortgage lenders. *Credit Risk International*, (June, 2004)

.

Calculating Hedge Fund Risk: the Draw Down and the Maximum Draw Down. in *Applied Mathematical Finance,(2004)* (with A. Sancetta), Vol. 11, pp 259-282.

., "Treasury Management of Core Banking Deposits",(with R.A. Lewin), *Journal of Bond Trading and Management*, Volume 2, Number 2, 2004.

2003 PUBLICATIONS

Assessing the Merits of Rank-based Optimisation for Portfolio Construction, in S. Satchell and A. Scowcroft eds., *New Advances in Portfolio Construction and Implementation*, Butterworth-Heinemann, London. (With S. Hwang, S. Wright)

New Advances in Portfolio Construction and Implementation, Butterworth and Heinemann (with A. Scowcroft) (eds.).

Some Exact Results for Efficient Portfolios with Given Returns, in S. Satchell and A. Scowcroft eds., *New Advances in Portfolio Construction and Implementation*, Butterworth-Heinemann, London. (with G. Hillier).

Value at Risk Linear Exponent (VARLINEX) Forecasts" (with Guoqiang Wang and Knight, J.), *Quantitative Finance 3* (2003) 332-344.

An Analysis of the Hedging Approach to Modelling Pension Fund Liabilities (with J. Randall) reprinted in *Asset and Liability Management Tools* A Handbook for Best Practice edited by Bernd Scherer.

Mortgage Default and Posession: A Competing Hazards Approach. *Journal of Money, Credit and Banking* Vol. 35(2), pp. 425-442. (with B.M. Lambrecht and W.R.M. Perraudin)

Utility Functions Whose Parameters Depend on Initial Wealth. Oct. 2003. *Bulletin of Economic Research*, Vol. 55, pp. 357-371 (with C. Pederson)

Can NN Algorithms and macroeconomic data improve OLS Industry Returns Forecasts?(with C. Pedersen). June, 2003. *The European Journal of Finance, Vol. 9,no 3,273-289.*

2002 PUBLICATIONS

Correlated ARCH (CorrARCH): modelling the time-varying conditional correlation between fianacial asset returns *European Journal of Operational Research*, Vol. 139 (2), pp 351-370. (with G. Christodoulakis) 2002.

On the Evolution of Global Style Factors in the MSCI Universe of Assets *International Transactions in Operational Research*, Vol. 9(1), pp 1-18. (with G. Christodoulakis) 2002.

Calculating the Misspecification in Beta from Using a Proxy for the Market Portfolio, in *Applied Financial Economics 12,* pp. 771-781 (with S. Hwang)

Performance Measurement of Portfolio Risk with Orthant Probabilities (with M. Lundin) in *Performance Measurement in Finance* (eds. J. Knight and S. Satchell), pp. 261-284. (Butterworth and Heinemann).

Performance Measurement in Finance, Butterworth and Heinemann. (With J. Knight) (eds.) 2002.

On the Foundation of Performance Measures under Assymetric Returns, *Quantitative Finance 2*, no. 3, pp. 217-223. (with C. Pederson) 2002.

Molten Lava meets Market Langour, *Quantitative Finance*, Vol. 2, no. 6, pp. 405-406 (with A. Sancetta), 2002.

Using Bayesian Variable Selection Methods to Choose Style Factors in Global Stock Return Models, *Journal of Banking and Finance* 26 pp. 2301-2325. (With S. Hwang and A. Hall), 2002.

Statistical Properties of the Sample Semi-Variance, with an Application to Emerging Markets Data. in *Applied Mathematical Finance*, Vol. 9, no. 4 pp. 219-239 (With S.A. Bond)

Efficient Estimation of the Stochastic Volatility Model via the Empirical Characteristic Function. *Australian and New Zealand Journal of Statistics* 44, pp. 319-335 (with J.L. Knight and J. Yu), 2002.

2001 PUBLICATIONS

Forward and Spot Rates in a Bi-variate TAR Framework, *European Journal of Finance* Vol. 7, pp. 131-143 (with R. Daccó) 2001.

Lower Partial-Moment Capital Asset Pricing Models: A Re-examination, 1996, *IFR Discussion Paper No.20*, (in *Downside Risk*, Butterworth and Heinemann). 2001.

On the Volatility of Financial Risk: An Investigation Using Returns from European Markets, *The European Journal of Finance*. (with C. Pederson, B. Eftekhari) 2001.

VaR versus Tracking Error: the Strengths and Weaknesses of Two Performance Measures, in E. Acar, eds., *Measuring Added Value: In Financial Institutions, Financial Times* Prentice Hall, London. (with S. Hwang) 2001.

Tracking Error: Ex-Ante versus Ex-Post Measures, *Journal of Asset Management,* Vol. 2, No. 3, 241-246. (with S. Hwang) 2001.

Modelling Emerging Market Risk Premia using Higher Moments, *International Journal of Finance and Economics 1999,* 4:4, pp271-293, reprinted in *Return Distributions in Finance* (Satchell S E and Knight J (eds.)), Butterworth and Heinemann 2001, pp75-115. (with S. Hwang) 2001

An Exponential Risk Measure with Application to UK Asset Allocation, *Applied Mathematical Finance* Vol.7 (2), 127-152. (with S. Hwang, and D.C. Damant) 2001.

Forecasting Nonlinear Functions of Returns Using LINEX Loss Functions, *Annals of Economics and Finance* Vol.2., 187-213. (with S. Hwang, J. Knight). 2001.

Pricing Derivatives Written on Assets with Arbitrary Skewness and Kurtosis, *Return Distributions in Finance,* pp.229-250, Butterworth and Heinemann. (with J. Knight) (eds.) 2001.

A Note on Bayesian Inference in Asset Pricing, *IFR Discussion Paper No. 45* 1997, *Econometric Theory 17,* No.2, pp475-482. (with J. Knight) 2001.

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

Efficiency, Considerations in the Negative Exponential Failure Time Model, *Handbook of Applied Econometrics and Statistical Inference* (Marcel Dekker). (with J. Knight) 2001.

The Probability Functions of Options Prices, Risk-Neutral Pricing and Value-at-Risk, *Return Distributions in Finance,* pp.252-275. (With J. Knight and G. Wang) 2001.

Global Equity Styles and Industry Effects: Portfolio Construction via Dummy Variables, *Journal of International Financial Markets, Inst. And Money*, 11, pp1-28. (With G. Kuo) 2001

Investigating the Benefits of Mutuality: Mutual Versus Proprietary Annuity Provision. *Journal of Pensions Management*, Vol. 7, No. 1. (With R.A. Lewin) 2001.

Deriving the Arbitrage Pricing Theory when the Number of Factors is Unknown in *Quantitative Finance 1* (Sept. 2001), 502-508. (With L. Middleton) 2001.

On the Characterisation of Investor Preferences by Changes in Wealth, *Geneva Papers on Risk and Insurance: Theory* 26(3), pp. 175-194. (With C. Pederson) 2001.

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

PUBLISHED (REFEREED) PAPERS - ECONOMICS/FINANCE

Eighteenth Century British Trade: Home-spun or Empire Made, (with T.J. Hatton and J. Lyons) (1983), *Explorations in Economic History*, pp. 161-182.

Approximations to the Finite Sample Distributions for Non-stable First Order Stochastic Difference Equations, (1984), *Econometrica*, September , pp. 1271-1289.

Underestimation and Overestimation of the Leontief Inverse Revisited, (with S.Lahiri) (1985), *Economic Letters*, December , pp. 181-187.

The Validity of Edgeworth Approximations for the Distribution Function of Estimators in Linear Difference Equations, (with J.D. Sargan) (1986), *Econometrica*, January , pp. 189-240.

Properties of the Expected Value of the Leontief Inverse, Some Further Results, (with S. Lahiri) (1986), *Mathematical Social Sciences*, February 2:1, pp. 69-82.

Exact Results for Telser' Single Equation Estimator in the Seemingly Unrelated Regressions Model, (with G. Hillier) (1986), *Econometric Theory*, April, pp. 66-75.

Differential Mortality in Rural Bangladesh, (with J. McIntoch and A. Nasim) (1986), *Journal of Applied Econometrics*, October , pp. 345-354.

Source and Subgroup Decomposition Inequalities for the Lorenz Curve (1987) *International Economic Review*, June, pp. 323-330.

Asymptotic Properties of the Maximum Likelihood and Non-linear least Squares Estimators for Noninvertible Moving Average Models, (with K. Tanaka) (1989), *Econometric Theory*, pp. 333-353.

Conditional and Unconditional Independence, (with J. Knight) (1990), *Econometric Theory*, 6:2, p. 283.

Random Variable Generation via Double Sampling, (with J. Knight) (1990), *Econometric Theory*, 6:4, p. 487.

Estimating Variance from High, Low, and Closing Price, (with C. Rogers) (1991), *Annals of Applied Probability*, 1:4, pp. 504-512.

The Variance of Property Returns, Some Problems of Time-Weighted Measures, (with C. Lizieri) (1992), *Journal of Property Valuation and Investment*, pp. 541-547.

Predicting British Financial Indices: An Approach Based on Chaos Theory, (with Y. Yoon and N. Linden) (1993), *Structural Change and Economic Dynamics*, 4:1, pp. 145-162.

Asymptotic Expansion for Random Walks with Normal Errors, (with J. Knight) (1993), in *Econometric Theory*, 9:3, pp. 363-376.

Exact Critical Regions and Confidence Intervals for the Maximum Likelihood Estimator in the Exponential Regression Model, (with J. Knight) (1993), *Economics Letters*, 41:3, pp. 225-231.

Some Generalisations of a Result by Muth on the Optimal Properties of Exponentially Weighted Forecasts, (with A. Timmermann), (1994) *Economics Letters*, 45:2, pp. 261-266.

Apprenticeships and Job Tenure: A Competing Risks Model with Time-varying Covariates, (with A. Booth) (1994), *Oxford Economic Papers*, 46, pp. 676-695.

A Bias Correction for Taken's Correlation Dimension Estimator (1994), *Econometric Theory*, 10:2, p. 439.

The Estimation of the Volatility of Stock Prices: A Comparison of Some Different Methods that Use High and Low Prices, (with C. Rogers and Y. Yoon) (1994), *Applied Financial Economics*, 4, pp. 241-247.

A Bias-Adjusted Black and Scholes Option Pricing Model, (with M. Ncube) (1995), *Applied Financial Economics*, 5, 51-60.

An Assessment of the Economic Value of Nonlinear Foreign Exchange Rate Forecasts, (with A. Timmermann) (1995), *Journal of Forecasting*, 14:6, pp. 477-497.

Statistical Modelling of Asymmetric Risk in Asset Returns, (with J. Knight and K. Tran) (1995), *Applied Mathematical Finance*, 1:2, pp. 155-172.

Some Statistics for Testing the Influence of the Number of Transactions on the Distribution of Returns, (with Y. Yoon) (1995), *Economic and Financial Computing*, Spring, pp. 21-37.

Option Pricing with GARCH and Systematic Consumption Risk I, (with A. Timmermann) (1995), *Derivatives Use, Trading and Regulation*, 1:3, pp. 279-291

Option Pricing with GARCH and Systematic Consumption Risk II, (with A. Timmermann) (1995), *Derivatives Use, Trading and Regulation*, 11:4, pp. 353-367.

The Hazards of Doing a Ph.D., (with A. Booth) (1995), *Journal of the Royal Statistical Society A*, 158, Part 2, pp. 297-318.

An Approximation to Garch, (with J. Knight) (1995), *Econometric Theory*, 11:1, Problem 95.1.3.

Testing for Short-Termism in the U.K. Stock Market, A Comment, (with D. Damant) (1995), *Economic Journal*, 105, pp. 1218-1223.

On the Optimality of Adaptive Expectations: Muth Revisited, (with A. Timmermann) (1995), *International Journal of Forecasting*, 11:3, pp. 407-416.

A Bias Correction for Taken's Correlation Dimension Estimator (Solution) (1995), *Econometric Theory*, 11:4, p. 804.

Confident Hedging-Finite Sample Properties of the Hedge Ratio, (with M. Ncube) (1996), *Derivatives Use, Trading, and Regulation*, 2:2, pp. 144-158.

Some Problems with Modelling Asset Returns using the Elliptical Class, (with B. Eftekhari) (1996), *Applied Economic Letters*, 3, pp. 571-572.

British Phd Completion Rates: Some Evidence from the 1980's, (with A. Booth) (1996), *Higher Education Review,* 28:2, pp. 48-56.

Finite Sample Results for the Negative Exponential Regression Model, (with J. Knight) (1996), *Journal of Statistical Planning and Inference*, 50, pp. 91-102.

Approximating the Finite Sample Bias for Maximum Likelihood Estimators using the Score, (with B. Lambrecht and W. Perraudin) (1996), *Econometric Theory*, 12:1, p. 199 (problem).

Pricing a Boost Option, (with J. Knight) (1997), *Derivatives, Use Trading and Regulation*, 3:4, pp. 362-371.

The Cumulant Generating Function Method Estimation, Implementation and Asymptotic Efficiency, (with J. Knight) (1997), *Econometric Theory*, 13:2, pp. 170-184.

The Analytic Properties of Trading Rules, (with E. Acar) (1997), *Applied Mathematical Finance*, 4, pp. 1-16.

Approximating the Finite Sample Bias for Maximum Likelihood Estimators using the Score, (with B. Lambrecht and W. Perraudin) (1997), *Econometric Theory*, 13:2, p. 310 (solution).

Interactions Between Property Shares and the Equity Market: An Investigation of Linkages in the UK 1972-1992, (with C. Lizieri) (1997), *Journal of Real Estate, Finance and Economics*, 15:1, pp. 11-26.

Property Company Performance and Real Interest Rates: A Regime-Switching Approach, (with C. Lizieri) (1997), *Journal of Property Research*, 14:2, June, pp. 85-98.

The Pricing of Market-to-Market Contingent Claims in a No-arbitrage Economy, (with R. Stapleton and M. Subramanian) (1997), *Australian Journal of Management*, 22:1 June, pp. 1-20.

The Black and Scholes Option Price as a Random Variable, (with M. Ncube) (1997) , *Mathematical Finance*, 7:3 July, pp. 287-305.

Existence of Unbiased Estimators of the Black/Scholes Option Price, Other Derivatives and Hedge Ratios, (with J. Knight) (1997), *Econometric Theory*, December, pp. 791-807.

The Simulation of Option Prices with Applications to Liffe Options on Futures, (with G. Christodoulakis) (1997), Birkbeck College IFR Discussion Paper No.7, in *European Journal of Operations Research*, 114, pp. 249-262.

Time to Default in the UK Mortgage Market, (with B. Lambrecht and W. Perraudin) (1997), *Economic Modelling*, 14, pp. 485-499.

An Analysis of the Hedging Approach to Modelling Pension Fund Liabilities, (with J. Randall) (1998), *Journal of Pensions Management*, Part I, 4:2 December, pp. 183-198.

Measurement Error with Accounting Constraints, (with R.J. Smith and M.R. Weale) (1998), *Review of Economic Studies*, 65:1 January, pp. 109-134.

A Comparison of the Likely Causes of Asian and U.S. Crashes, (with C. Pedersen) (1998), *Politics, Administration and Change*, 29 January-June, pp. 1-17.

Real Interest Regimes and Real Estate Performance: A Comparison of UK and US Markets, (with C. Lizieri, E. Worzala, and R. Daccó) (1998), *Journal of Real Estate Research*, 16:3, pp. 339-356.

Evaluation of Mutual Fund Performance in Emerging Markets, (with S. Hwang) (1998), *Emerging Markets Quarterly*, 2:3 Fall, pp. 39-50.

A Class of Financial Risk Measures, (with C. Pedersen) (1998), in *Geneva Papers On Risk and Insurance: Theory*, 23, pp. 89-117.

Why do Regime-Switching Models Forecast so Badly, (with R. Daccó) (1999), *Journal of Forecasting*, 18, pp. 1-16.

An Analysis of the Hedging Approach to Modelling Pension Fund Liabilities, Part II, (with J. Randall) (1999), in *Journal of Pensions Management*, 4:3, pp. 259-268.

Modelling Emerging Market Risk Premia Using Higher Moments, (with S. Hwang) (1998), DAE Discussion Paper No. 9806, and in *International Journal of Finance and Economics*, 1999, 4:4, pp. 271-296.

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)

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

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

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

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

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

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

4. ROLE AND DUTIES OF THE EXPERT WITNESS

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

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

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

Harmonised Expert Witness Code of Conduct

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

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

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

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

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

(a) acknowledge in the report that:

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

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

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

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

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

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

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

6. CASE MANAGEMENT CONSIDERATIONS

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

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

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

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

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

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

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

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

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

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

7. CONFERENCE OF EXPERTS AND JOINT-REPORT

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

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

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

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

(a) who should prepare any joint-report;

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

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

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

Conference of Experts

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

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

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

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

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

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

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

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

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

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

Joint-report

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

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

8. CONCURRENT EXPERT EVIDENCE

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

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

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

9. FURTHER PRACTICE INFORMATION AND RESOURCES

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

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

J L B ALLSOP
Chief Justice

25 October 2016

Annexure A

HARMONISED EXPERT WITNESS CODE OF CONDUCT[34]

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

[34] 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[35] 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

[35] 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.