Report prepared for the

Australian Energy Regulator

Advice on the Return on Equity

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PREAMBLE

The Australian Energy Regulator (AER) is currently assessing regulatory proposals from the following service providers: TransGrid, Transend, Directlink, Ausgrid, Endeavour Energy, Essential Energy, ActewAGL and Jemena.

The AER seeks expert advice to inform its assessment of the rate of return for these service providers. Advice has been sought on the following two matters:

1. Whether you consider the AER Rate of Retum Guideline[1] foundation model framework for estimating the return on equity (RoE) of our benchmark efficient entity would be expected to deliver estimates of the RoE for our benchmark efficient entity consistent with achieving the rate of return objective.

2. Whether you consider any material in the regulatory proposals from the service providers[2] and the three consulting reports[3], provide compelling reason to depart from the core framework underpinning the foundation model approach as outlined in Figure 5.1 on page 12 of the Guideline

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This report sets out my advice on each of these matters in turn.

[1] Australian Energy Regulator (2013).
[2] TransGrid (2014), Transend (2014), Directlink (2014), Ausgrid (2014), ActewAGL (2014) and Jemena Gas Networks (2014). It is understood that the WACC sections and supporting WACC attachments of the proposals submitted by Essential Energy and Endeavour Energy are identical to the WACC section and supporting WACC attachments of the proposal submitted by Ausgrid. It is also noted that: (i) Directlink does not propose to depart from the AER's Rate of Return Guideline in relation to the return on equity; and (ii) Transend accepts the views expressed by its independent expert (that there is strong evidence to support a cost of equity estimate above the value estimated using the AER's parameter values in its Rate of Return Guideline) but after considering the impact of a higher cost of equity on their customers has proposed to adopt the parameter values identified by the AER in its Rate of Return Guideline and explanatory statement.
[3] CEG (2014), NERA (2014) and SFG (2014b).

QUESTION 1

[Do] you consider the AER Rate of Retum Guideline foundation model framework for estimating the return on equity (RoE) of our benchmark efficient entity would be expected to deliver estimates of the RoE for our benchmark efficient entity consistent with achieving the rate of return objective ?

Yes.

The fundamental task of the regulator is to set prices which provide the regulated firm with an opportunity to earn a fair compensation for the efficient delivery of the regulated service. Specifically, the regulatory framework requires the determination of allowed revenues on a nominal, post-tax basis using a building block approach and which includes building blocks for operating costs, depreciation (a return of capital), a return on capital and the cost of corporate income tax.

The return on capital is to be determined within a weighted average cost of capital (WACC) framework such that it achieves the allowed rate of return objective – i.e. the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of the regulated service. The return on equity must be estimated such that it contributes to the achievement of the allowed rate of return objective.

In the Rate of Return Guideline the AER has proposed to use the Sharpe Capital Asset Pricing Model (CAPM)[4] as the foundation model within its foundation model framework for estimating the return on equity for regulated businesses. Under this approach, other information and alternative asset pricing models may be used to inform the input parameters of the Sharpe-CAPM – i.e. the risk free rate, the market risk

[4] The Sharpe-CAPM is also called the Sharpe-Lintner CAPM.

premium (MRP) and the equity beta – or to inform the overall return on equity. The Rate of Return Guideline has also proposed that a number of sources of information should not be given a role in determining the return on equity. The AER approach involves consideration of a vast amount of information – including various estimation methods, financial models, market data and other evidence – combined with the exercise of regulatory judgment in a process which iterates to a final point estimate of the return on equity.

In contrast, the service providers have largely proposed a multi-model approach which places significantly more weight on three alternative asset pricing models – the Black-CAPM, the Fama-French Model and the Dividend Growth Model (DGM)[5] – as well as alternative estimation methods and other evidence to arrive at a point estimate of the return on equity.

The allowed rate of return objective is unambiguous – the key determinant of the rate of return is risk. In other words, investors who supply capital to the benchmark efficient entity should receive a fair compensation having regard to the level of risk that they face. Of course, there are various ways of measuring risk but the point is clear – investors should be compensated for risk and only for risk.

The AER's choice of the Sharpe-CAPM as the foundation model is entirely appropriate and reasonable for this purpose. The Sharpe-CAPM is the standard (equilibrium) asset pricing model. It has a long established and well understood theoretical foundation and is a transparent representation of one of the most fundamental paradigms of finance – the risk-return trade off. The risk-return trade off simply states that a risk averse investor will want a higher expected return when faced with a higher risk. Equivalently, it is said that a risk averse investor will require a risk premium, or additional expected return over and above the risk free rate, for bearing risk. A model which quantifies the trade off between risk and return is commonly called an asset pricing model. In the Sharpe-CAPM, the risk of an asset is measured by its beta.[6]

[5] The Dividend Growth model is also called the Dividend Discount Model.
[6] This is discussed further under section (viii) of question 2.

An apparent weakness of the Sharpe-CAPM is the empirical finding, for example by Black, Jensen and Scholes (1972) and Fama and French (2004), that the relation between beta and average stock returns is too flat compared to what would otherwise be predicted by the Sharpe-CAPM – a result often referred to as the low beta bias. In considering the relevance of this evidence, however, it is important to recognize that the current objective is to determine the fair rate of return given the risk of the benchmark efficient entity rather than to identify the model which best explains past stock returns.

The AER's choice in using the Black CAPM to inform the beta estimate, using the DGM to inform the MRP estimate and not using the Fama-French model is also appropriate and reasonable. Further discussion of these models appears under question 2.

QUESTION 2

[Do] you consider any material in the regulatory proposals from the service providers and the three consulting reports, provide compelling reason to depart from the core framework underpinning the foundation model approach as outlined in Figure 5.1 on page 12 of the Guideline ?

No.

The service providers propose to deviate from the guidelines largely in ways which seek to place more emphasis on the Black-CAPM, the DGM and the Fama-French model. There are, however, limitations with each of these models which either restrict or preclude their role in determining a return on equity consistent with the allowed rate of return objective. In addition, there are a number of other issues raised in the regulatory proposals which warrant some discussion. Specifically, I now set out comments on each of the following eight items:

(i) The Fama-French Model
(ii) The Black-CAPM
(iii) Dividend Growth Models
(iv) The Wright Approach to Estimating the Market Risk Premium
(v) The NERA Adjustment to Historic Estimates of the Market Risk Premium
(vi) The NERA Debt Premium Comparison
(vii) Grossing-up Returns for Imputation
(viii) International Betas

(i) The Fama-French Model

The purported success of the Fama-French model in explaining the determinants of past stock returns is well documented. Certainly this is the position put forward in the regulatory proposals. However this is not the full story. In addition, this evidence does not necessarily mean that the Fama-French model is an appropriate model for estimating the return on equity for a benchmark efficient entity.

The empirical evidence supporting the Fama-French model (and a number of other asset pricing models for that matter) has recently been called into question by Lewellen, Nagel and Shanken (2010) who argue that the strength of the evidence is largely an artefact of using portfolios rather than individual assets to test the performance of the model. Further, they argue that once you take into account the cross sectional dependence in returns using Generalized Least Squares (GLS) rather than Ordinary Least Squares (OLS) then the explanatory power of the model is substantially reduced:

> *"The third key result is that none of the models provides much improvement over the simple or consumption CAPM when performance is measured by the GLS R^2 or q …. The average GLS R^2 is only 0.08 across the five models using size-B/M portfolios and 0.02 using the full set of 55 portfolios."*[7]

In regards to the Fama-French model in particular, Lewellen, Nagel and Shanken (2010) show that using Fama and French's 25 size-B/M portfolios as test assets results in an apparently impressive OLS R^2 of 0.78 but when the set of test assets is expanded to include 30 industry portfolios, then the more relevant resultant GLS R^2 is only 0.06.[8] This methodological shortcoming with many empirical asset pricing studies has similarly been identified by Daniel and Titman (2012) who state:

> *"We argue here that the failure of these tests to reject so many distinct factor models is not because the data are supportive of the models. Instead, we argue, the culprit is the test methodology: the models are tested on portfolios—*

[7] Lewellen, Shanken and Nagel (2010 p.189).
[8] See Table 1 in Lewellen, Shanken and Nagel (2010).

> *typically the 25 size and book-to-market portfolios first examined in Fama and French (1993) — using a test methodology like that of Fama and MacBeth (1973)".*[9]

Daniel and Titman (2012) suggest there is still no consensus concerning how the Fama-French model should be interpreted despite being the topic of debate for decades. Fama and French (1993) argue that the value and size factors are proxies for distress risk.[10] Lakonishok, Shleifer and Vishny (1994) argue that the value factor instead proxies for mispricing.[11] Daniel and Titman (1997) also suggest that the return premia on small stocks and value stocks cannot be viewed as compensation for risk.

The distinction between potential risk and non-risk interpretations of the Fama-French model is critical in the current context. Unless the Fama-French model determines returns on the basis of risk – and there is a question mark over whether this is indeed the case – then the model would not be appropriate for compensation purposes since by definition the resultant estimates of the return on equity would be inconsistent with the allowed rate of return objective.

Two other recent empirical papers are worth noting. The first paper provides new evidence on the Fama-French model. Fama and French (2014) present a five factor asset pricing model which adds a profitability factor (RMW – for robust minus weak profitability) and an investment factor (CMA – for conservative minus aggressive investment) to the existing market, size and value factors of the Fama-French model and find that their value factor (HML – for high minus low B/M) becomes redundant for describing average returns – a result which they describe as *"so striking we caution the reader that it may be specific to this sample"*[12] Their reservation is not surprising given they have previously argued that the value factor *"does the heavy lifting in the improvements to the CAPM"*.[13] The second paper provides new evidence on the Sharpe-CAPM. Savor and Wilson (2014) find that beta is positively related to average returns on days when employment, inflation, and interest rate news is scheduled to be

[9] Daniel and Titman (2012 p.108).
[10] The value factor is also referred to as the book-to-market or B/M factor.
[11] Specifically, high B/M stocks have higher returns because they are undervalued.
[12] Fama and French (2014 p.3). They go on to suggest that the average HML return is fully captured by the exposure of the HML factor to the other four factors and especially RMW and CMA.
[13] Fama and French (2004 p.40).

announced but is unrelated or even negatively related to average returns on non-announcement days.[14] They suggest as one possible explanation that announcement-day returns provide a much clearer signal of aggregate risk and expected future market returns, perhaps as a result of reduced noise or disagreement on announcement days:

> *"These results suggest that beta represents an important measure of systematic risk. At times when investors expect to learn important information about the economy, they demand higher returns to hold higher-beta assets."*[15]

The key message is that our understanding of empirical asset pricing is still far from complete.

(ii) The Black-CAPM

There are two possible reasons for using the Black-CAPM instead of the Sharpe-CAPM to estimate the return on equity – neither of which are particularly convincing.

The first is a theoretical argument. The assumptions underlying the Black-CAPM are the same as those underlying the Sharpe-CAPM except in relation to the risk free asset. In the Sharpe-CAPM, there is a risk free asset and investors are assumed to be able to borrow or lend freely at the risk free rate. In the fully-restricted version of the Black-CAPM, there is no risk free asset and hence no borrowing or lending at the risk free rate but investors are allowed to take long or short positions of any size in any risky asset.[16] Black also considers a partially-restricted version of the model where there is a risk free asset, investors may lend but not borrow at the risk free rate and investors again may take long or short positions of any size in any risky asset. A claim that the Black-

[14] According to Savor and Wilson (2014 p.172): *"The asset pricing restrictions implied by the mean-variance efficiency of the market portfolio …appear to be satisfied on announcement days: the intercept of the announcement-day securities market line (SML) for average excess returns is either not significantly different from zero or very low, and its slope is not significantly different from the average announcement-day stock market excess return"*.

[15] Savor and Wilson (2014 p.196).

[16] There is also no restriction on short sales of risky assets in the Sharpe-CAPM but this assumption is redundant since in equilibrium all investors hold only long positions (in the market portfolio).

CAPM is more realistic than and so should be preferred to the Sharpe-CAPM is weak. Black (1972 p.446) himself acknowledges:

> *"This assumption is not realistic, since restrictions on short selling are at least as stringent as restrictions on borrowing"*

as does Fama and French (2004 p.30):

> *"The assumption that short selling is unrestricted is as unrealistic as unrestricted risk-free borrowing and lending"*.

The second is an empirical argument – the low beta bias. The difficulty here lay in knowing how to interpret this empirical evidence. It is important to be clear that the results of Black, Jensen and Scholes (1972) and the updated results in Fama and French (2004)[17] are said to be consistent with rather than being a direct test of the Black-CAPM. In other words, the Black-CAPM and the low beta bias are not equivalent concepts.[18]

In particular there are a number of competing (but not necessarily mutually exclusive) explanations for the low beta bias. It may reflect restrictions on riskless borrowing consistent with the Black CAPM.[19] It may reflect the impact of barriers to international investment consistent with the international CAPM of Black (1974).[20] Black identifies a variety of types of such barriers including the possibility of expropriation of foreign holdings, direct controls on the import or export of capital, reserve requirements on bank deposits and other assets held by foreigners, restrictions on the fraction of a business that can be foreign owned and even the barriers created by the unfamiliarity that residents of one country have with other countries. It may reflect a specification error in the proxy for the market portfolio consistent with the suggestion by Roll

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[17] See Figure 2 in Fama and French (2004).

[18] Whilst the Black-CAPM implies an empirical result like the low beta bias, the low beta bias does not imply the Black-CAPM.

[19] Black (1972 p.454) suggests: *"Thus the empirical results reported by Black, Jensen and Scholes are consistent with a market equilibrium in which there are riskless lending opportunities as well as with an equilibrium in which there are no riskless borrowing or lending opportunities"*.

[20] Black (1974 p.344) suggests: *"the presence of taxes on international investment tends to make high [beta] assets have negative [alphas] and low [beta] assets have positive [alpha's]. This is the direction of deviations from the capital asset pricing model found in empirical studies"*.

(1977).[21] It may reflect model misspecification consistent with the value and/or size effects of the Fama-French model.[22] It was also initially thought that it may reflect the impact of differential personal taxes consistent with the after-tax CAPM of Brennan (1970)[23] but this idea has since been dismissed by subsequent research.[24] It may reflect price pressure exerted by leverage-constrained investors who tilt their portfolios towards high-beta stocks relative to low-beta stocks in seeking higher expected returns, consistent with Frazzini and Pederson (2014).[25] It may reflect price pressure exerted by investors who seek lottery-like stocks[26] consistent with Bali, Brown, Murray and Tang (2014).[27]

The distinction between potential risk and non-risk interpretations of the low beta bias is similarly critical in the current context. Unless the low beta bias reflects risk not otherwise captured by the Sharpe-CAPM – and there is a question mark over whether this is indeed the case – then the low beta bias is strictly not relevant information for the purposes of determining an appropriate level of compensation and in particular for arguing for additional compensation relative to the Sharpe-CAPM for low beta stocks.

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[21] Roll (1977 p.131) states:*"For the Black, Jensen and Scholes data, for example, there was a mean variance efficient 'market' proxy that supported the Sharpe-Lintner model perfectly and that had a correlation of 0.895 with the market proxy actually employed."* . In other words, Roll shows that if Black, Jensen and Scholes (1972) used a slightly different proxy for the market then their econometric results would have been perfectly consistent with the Sharpe CAPM.

[22] Fama and French (2004 p.35-36) state: *"Starting in the late 1970s, empirical work appears that challenges even the Black version of the CAPM. Specifically, evidence mounts that much of the variation in expected return is unrelated to market beta … There is a theme in the contradictions of the CAPM summarized above. Ratios involving stock prices have information about expected returns missed by market betas."*

[23] Jensen (1972 p.29) states: *"Thus the tax effects may be a partial cause of the observed fact that high risk securities seem to earn less and low-risk securities seem to earn more than implied by the simple model"*

[24] See for example the discussion of U.S. dividend yield studies in Allen and Michaely (2003 p.364-368).

[25] See Proposition 1 in Frazzini and Pederson (2014 p.2) who state: *"Our model features several types of agents. Some agents cannot use leverage and, therefore, overweight high-beta assets, causing those assets to offer lower returns. Other agents can use leverage but face margin constraints. Unconstrained agents underweight (or short- sell) high-beta assets and buy low-beta assets that they lever up. The model implies a flatter security market line (as in Black (1972)), where the slope depends on the tightness (i.e., Lagrange multiplier) of the funding constraints on average across agents."*

[26] Bali, Cakici and Whitelaw (2011 p.428) describe lottery-like assets as *"assets that have a relatively small probability of a large payoff."*

[27] Brown, Murray and Ting (2014 p.2) argue: *"A disproportionately high (low) amount of lottery demand-based price pressure is therefore exerted on high-beta (low-beta) stocks, pushing the prices of such stocks up (down) and therefore decreasing (increasing) future returns. This price pressure generates an intercept greater than the risk-free rate (positive alpha for stocks with beta of zero) and a slope less than the market risk premium (negative alpha for high-beta stocks) for the line describing the relation between beta and expected stock returns."*

The Black CAPM is not widely adopted in practice[28] – there is one very good reason for this. The theoretical prediction which distinguishes the Black-CAPM from the Sharpe-CAPM is that the (shadow) risk free interest rate –more commonly called the zero beta rate – is unspecified except to say that it must be less than the expected return on the market portfolio. In the partially-restricted version of the model, the zero beta rate must also be above the risk free rate. From a practical point of view, this is not very useful due to the wide range of possible values that the zero beta rate may take on. The Black-CAPM therefore presents the non-trivial task of having to estimate the expected zero beta rate which the theory says could be anywhere in a very wide range as well as having to estimate an expected market risk premium relative to the expected zero beta rate.[29]

Two brief comments on two related items from the NERA (2014) report. First, NERA acknowledge that their finding that the zero beta premium is equal to the MRP appears implausible but they argue that this simply suggests that there is no relationship between beta and return.[30] Nonetheless a potentially unsettling implication is that there is a minimum variance portfolio that has no exposure to the risk of the market but is still expected to yield the same return as the market portfolio.[31] The plausibility of such a portfolio would largely depend on the level of risk of that portfolio. Second, NERA's distinction between the true market portfolio (of all risky assets) and a portfolio of risky stocks[32] is moot. We know that we can't observe the true market portfolio – which is relevant for tests of the CAPM but which is not overly important for applications since the typical starting point is to choose an appropriate proxy for the market against which the assets under consideration are believed to be priced.[33]

The above discussion suggests we still have an incomplete understanding of the low beta bias.

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[28] NERA (2014 p.93).

[29] Consistency would demand that historic estimates of the market risk premium relative to the risk free rate be adjusted to reflect the time series of historic zero beta rates.

[30] NERA (2014 p.92).

[31] Note this is not to say that the zero beta portfolio is riskless but rather that it is an asset with purely unsystematic risk.

[32] NERA (2014 p.81).

[33] For example, if the task is to estimate returns for domestic equities then one could choose a local stock index or an international stock index as the proxy for the benchmark market.

(iii) Dividend Growth Models

A DGM is no more than the fundamental principle of discounted cash flow (DCF) applied to the pricing of stocks. A similar approach is a well-established technique used in the pricing of bonds. But stocks differ from bonds in two important ways – cash flow and maturity – which in turn reduces the efficacy of the model when applied to stocks.

The principle of DCF tells us that the current (fair) price of a bond is equal to the present value of its expected future cash flows discounted at an appropriate rate reflecting the risk of the cash flows. The discount rate is also called the cost of debt or expected return on the bond. More often, one uses the contractual cash flows on the bond – interest coupons and principal payments – rather than the expected cash flows on the bond. In this case, the discount rate is called the yield or promised return on the bond. Mathematically, the yield is the internal rate of return which equates the present value of the contractual cash flows to the current price of the bond.[34] The reason for the widespread use in bond markets is that the contractual cash flows are readily determined and usually have a finite maturity.

The principle of DCF similarly tells us that the current (fair) price of a stock is equal to the present value of its expected future cash flows discounted at an appropriate rate reflecting the risk of the cash flows. The discount rate is also called the cost of equity or expected return on the stock. Unlike bonds, future cash flows on stocks are not contractually specified nor have a finite maturity and so are subject to non-trivial estimation error – particularly the further ahead one looks. The typical assumption applied in this case is that the underlying firm continues as a going concern indefinitely and the expected future cash flows consist of a stream of indefinite future dividends.[35] Given the current stock price and an assumed stream of expected future dividends, the

[34] If the bond is risk free then the expected cash flow is equal to the contractual cash flow and the expected return on debt and yield are one and the same. If the bond is subject to default risk then the expected cash flow will be less than the contractual cash flow and the expected return on debt will be less than the yield.

[35] Some models specify cash flows for only a finite period and a terminal value at the end of the final period. In this case, the terminal value is usually based on an assumption (either explicity or implicitly) about the expected cash flows for all periods thereafter.

model can then be used to back out an implied cost of equity – mathematically this is equivalent to determining the internal rate of return on the stock.

Notwithstanding the solid DCF foundation upon which it is based, DGMs are not a panacea for the challenges associated with using an asset pricing model to estimate the return on equity. Arguably DGMs simply transfer the uncertainty and difficulties in estimating the parameters of an asset pricing model to uncertainty and difficulties in estimating the expected future dividend stream and in particular in estimating the expected growth rate in dividends. This can best be seen from the constant growth DGM. The most general version of a DGM states that the current price of a stock P_0 is equal to the present value of the expected future dividends discounted at the cost of equity k_e:

$$P_0 = \frac{E(\tilde{d}_1)}{1+k_e} + \frac{E(\tilde{d}_2)}{(1+k_e)^2} + \cdots \quad (1)$$

where $E(\tilde{d}_1)$ is the expected dividend at the end of the first period, $E(\tilde{d}_2)$ is the expected dividend at the end of the second period, etc. If it is assumed that the firm is expected to pay a stream of dividends which grow at a constant rate of g per period, then (1) simplifies to:

$$P_0 = \frac{E(\tilde{d}_1)}{k_e - g} \quad (2)$$

Rearranging (2) then gives the cost of equity:

$$k_e = \frac{E(\tilde{d}_1)}{P_0} + g \quad (3)$$

Equation (3) simply states that the implied cost of equity is equal to the expected dividend yield next period plus the assumed growth rate.

More complicated models like two-stage and three-stage DGMs seek to allow for more realistic future dividend streams but by introducing additional assumptions and parameters to be estimated, it is not clear that the results coming out of such models are necessarily any more meaningful.

The DGM proposed by SFG essentially adopts a brute force approach to estimating the implied cost of equity for the market. It substitutes a large number of combinations of a set of parameter estimates into an assumed valuation model – in this case, a ten-year three-stage DGM – with the objective of simultaneously determining the expected cash flows and discount rate which best fits the data, subject to certain assumed constraints. The model is interesting but the regulatory environment involving an aggregate regulatory asset base measured in the tens of billions of dollars is not an appropriate setting to trial a new model whose widespread use and acceptance is yet to be established.

(iv) The Wright Approach to Estimating the Market Risk Premium

The (expected) market risk premium (MRP) is a relative concept – it is the forward looking additional expected return over and above the risk free rate to compensate investors for risk. Historic or ex-post measures of the MRP are also referred to as excess returns. The key issue is how best to estimate it.

The standard approach to estimation is to treat the MRP as a distinct random variable. This largely follows from the risk-return trade off paradigm. For example, Cochrane (2001 p.11) suggests:

> *"In fact, much asset pricing focuses on excess returns. Our economic understanding of interest rate variations turns out to have little to do with our understanding of risk premia, so it is convenient to separate the two phenomena by looking at interest rates and excess returns separately":*

It also follows from theory. In deriving the Sharpe-CAPM one arrives at the less familiar relationship between expected return and risk:

$$E(r_j) = r_f + Acov(r_j, r_m) \quad (4)$$

where $E(r_j)$ is the expected return on asset j, r_f is the risk free rate, $cov(r_j, r_m)$ is the covariance of the return on j with the return on the market and A is a measure of the aggregate relative risk aversion in the economy in equilibrium – which in turn is a complex weighted average of the relative risk aversion of the individual investors in the economy. Equation (4) says that the appropriate risk premium on asset j is equal to $Acov(r_j, r_m)$ where A represents the "price of risk" and $cov(r_j, r_m)$ represents the "quantity of risk". Unfortunately A is unobservable but applying (4) to the market portfolio gives:

$$A = \frac{E(r_m) - r_f}{var(r_m)} \quad (5)$$

where $var(r_m)$ is the variance of the return on the market. Substituting (5) into (4) gives the CAPM in its more familiar form:

$$E(r_j) = r_f + \beta_j[E(r_m) - r_f] \quad (6)$$

where β_j is the beta of asset j and $E(r_m) - r_f$ is the expected MRP. Equation (6) says that the appropriate risk premium on asset j is equal to $\beta_j[E(r_m) - r_f]$ where $[E(r_m) - r_f]$ represents the "price of risk" and β_j represents the "quantity of risk".

The standard approach then is to directly estimate the item of interest – the expected MRP. If historic data is used, this involves getting a sample of historic excess returns over some past period on which to base an estimate. This is precisely the approach adopted by Brailsford, Handley and Maheswaran (2008, 2012) and Dimson, Marsh and Staunton (2002) who state:

In practice, and perhaps because of its measurability, the historical risk premium is often treated as a proxy for the prospective risk premium".[36]

Contrary to the claim by the service providers, such an approach does not assume the market risk premium is constant over time nor does it ignore any possible time varying relationship between the MRP and the risk free rate – by definition, such variation is taken into account by sampling the MRP at different points in time.

It is noted that the AER estimate of the MRP is not solely based on the historical record.

Wright adopts an alternative non-standard approach to estimating the MRP. Rather than treating the MRP as a distinct variable he suggests estimating the return on the market – by estimating the real return on equity and combining this with a current forecast of inflation to give an estimated nominal return on equity – and the risk free rate separately.

It appears to be based on two main ideas. First, a claim that the standard approach is internally inconsistent as it purportedly uses a different estimate of the risk free rate for the purposes of estimating the MRP.[37] But this is not correct. As discussed above, the item being estimated under the standard approach and the item being substituted into (6) is the MRP. It is a single estimate of a single item. It is not an estimate of the expected return on the market and an estimate of the risk free rate. Second, Wright draws on previous work by Wright, Mason and Miles (2003) which in turn draws on work by Siegel (1998) to conclude that:

"*regulators should work on the assumption that the real market cost of equity is constant … as a direct consequence, whatever assumption is made on the risk-free rate, the implied equity premium must move point by point in the opposite direction."*[38]

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[36] Dimson, Marsh and Staunton (2002 p.163).
[37] CEG (2014 p.3-4)
[38] Wright (2012 p.2-3).

The theoretical justification for such an assumption is far from clear whilst the empirical evidence that is presented is not compelling. More importantly, this is a proposition whose widespread use and acceptance is yet to be established. Until then (if at all), there is no compelling reason to move from the standard approach to estimation.

<u>(v) The NERA Adjustment to Historic Estimates of the Market Risk Premium</u>

The service providers claim that there is a downward bias in the Brailsford, Handley and Maheswaran (BHM) historic returns data set upon which the AER relies. More specifically, NERA (2013) note that Brailsford, Handley and Maheswaran (2008, 2012) use a series of dividend yields provided to them by the Australian Stock Exchange (ASX) that is also largely based on a series of dividend yields produced by Lamberton. They also note that the yields that BHM use have been adjusted downwards to take account of perceived deficiencies in the original Lamberton series. NERA conducts an analysis of the data in order to:

> *"assess whether the adjustment to Lamberton's yield series in the data that Brailsford, Handley and Maheswaran employ is warranted"*

and conclude that:

> *"The evidence suggests that some adjustment should be made but that the adjustment should be smaller than the adjustment made in their data. An estimate of the downwards bias generated by inappropriately adjusting Lamberton's yield series is 18 basis points for the period that Dimson, Marsh and Staunton examine, 1900 to 2012, but 37 basis points for the longer period, 1883 to 2011, on which the AER in large part focuses.* [39]

[39] NERA (2013 p.ii). NERA provide an update for the period 1883 to 2012 in a later paper.

Before addressing NERA's analysis, it is appropriate to clarify a very important misconception concerning the adjustment. Contrary to the claim by SFG[40] – and it is not clear whether this view is also shared by NERA – the adjustment was not something which BHM took upon themselves to apply to the Lamberton data. Rather, the data that the ASX provided to BHM had already had been adjusted by the ASX. In other words, the ASX had many years earlier decided in their knowledge and wisdom that some adjustment was necessary and it was the ASX who determined the amount and adjusted the data accordingly. BHM simply sought to confirm their understanding of the data series provided by the ASX by reconciling it back to original sources.[41]

There are a number of significant limitations with the NERA analysis and their suggested alternative adjustment.

First, NERA have based their conclusion on a comparison of only seven data points – December 1891, December 1901, December 1911, December 1921, December 1931, December 1941 and December 1951 – out of the 300 possible quarters over the period 1883 to 1957. Further, in only four of their data points (December 1891, December 1901, December 1911, December 1921) is their estimated adjustment smaller than the adjustment applied by the ASX.[42]

Second and more fundamentally, NERA have neither used the same sources that Lamberton employed nor have they reconciled their seven dividend yields with the corresponding yields of Lamberton. They acknowledge the problem:

> *"Since Lamberton uses a variety of sources and we do not know precisely which sources he uses to compute the yield to each issue on each date, it is not surprising that our yield estimates differ from his."*

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[40] SFG (2014 p.50).

[41] Brailsford, Handley and Maheswaran (2008) note the following advice was received from the ASX: *"A stock accumulation index for the period 1882-1979 was constructed retrospectively by the SSE in the mid-1980s based on the above (quarterly) price index data and three historical dividend yield series available at that time"* (p.79) and *"Consequently, the SSE determined that the reported Lamberton/SSE yield series was prima facie not appropriate for the purposes of constructing an accumulation index and 'it was concluded that the real weighted dividend yield was probably overstated about a third on average and therefore the [Lamberton/SSE yield] was reduced by 25% in the early years of the accumulation index where we didn't have any other dividend yields to guide us'"* (p.80).

[42] See Table 2.2 in NERA (2013)

and seek to address it by relying on their estimates being:

> *"strongly correlated with his estimates over time".* [43]

But this is far from satisfactory. A necessary first step in arguing there is a problem with the ASX adjustment (and by implication a problem with the BHM historic returns data set) is to precisely reconcile their estimates with those of Lamberton. NERA have failed to do this.

More generally, NERA have considered the dividend yield issue in isolation of the other limitations with the historic data prior to 1958.[44] To claim there is a downward bias in the BHM historic returns data set would require not only reconstructing the entire historic dividend yield series but to be sure, would probably require one to reconstruct the entire stock return series along similar lines to what Dimson, Marsh and Staunton have done in relation to U.K. stock return data.[45]

(vi) The NERA Debt Premium Comparison

NERA (2014) suggests that information on the prevailing conditions for the market for equity funds can be inferred from observed bond yields.

They examine debt premiums on ten-year BBB bonds around the period of the global financial crisis (GFC) and present evidence that in the post-GFC period, debt investors require an additional debt risk premium of over 150 basis points relative to pre-GFC debt premiums from which they conclude:

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[43] NERA (2013 p.11).
[44] See Brailsford, Handley and Maheswaran (2008 p.76-77) for further details.
[45] Brailsford, Handley and Maheswaran (2008 p.80-81): *"The key question then follows as to how far the adjustment factor should be below the value of one. This is a very difficult question to answer directly as it would involve reconstructing the dividend series from source data over a long period of time. … We cannot be more specific, but note that there is no strong evidence to suggest that we should diverge from the currently used adjustment factor. Nonetheless, what this issue reveals is that these data and the equity premium obtained thereof should be treated with caution."*

> *"Given the rise in the pricing of risk in the debt markets following the GFC, it would be expected that a similar, if not larger, increase in the premium would be required by equity investors".*[46]

There are, however, a number of limitations with the NERA analysis and conclusion upon which it is based.

First, NERA does not distinguish between the expected return on debt and the yield on the debt and therefore is effectively comparing apples and oranges when it tries to use a debt premium (based on a yield) to infer something about an equity premium (based on an expected return). The appropriate comparison would examine the expected return on debt with the expected return on equity.[47]

Second, NERA does not appear to examine the extent to which equity and debt markets are integrated or segmented – this is crucial to if one wishes to use prices in one market to comment on the reasonableness or otherwise of prices in the other market.

Third, NERA doesn't consider the extent to which risk is shared between debt and equity investors in a firm. For example consider a firm which is equally financed by one debt holder and one equity holder who differ only with respect to priority of payment. Clearly the debt is less risky than the equity. Now assume that the priority of payment ceases. What impact does this have on the risk faced by the debt holder? By definition, the debt is now more risky. What about the equity holder? We cannot say without imposing further structure/assumptions on the analysis. For example if one assumes that there is no overall change in the risk of the firm's assets then the risk to the equity holder falls since some of that risk is now shared with the debt holder.

Finally, NERA suggests that the equity premium is too low relative to the debt premium. But an equally valid alternative hypothesis that has not been examined is whether the debt premium is too high relative to the equity premium.

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[46] NERA (2014 p.56).

[47] NERA (2014 p.114) is incorrect in claiming that the regulated return on equity is a yield. All the models (Sharpe-CAPM, Black-CAPM, Fama-French model and DGM) provide estimates of the expected return on equity. Further, the WACC framework strictly requires as inputs, estimates of the expected return on equity and the expected return on debt.

(vii) Grossing-up Returns for Imputation

One has to be careful when grossing-up returns for imputation as the appropriate formula/method varies according to the context.

SFG (2014b) argues that in approaches that use data to produce ex-imputation estimates of the required return on the market then the relationship between the ex-imputation return r_{ex} and the with-imputation return r_{with} is given by the standard Officer (1994) gross-up formula:[48]

$$r_{ex} = r_{with}\left[\frac{1-T}{1-T(1-\gamma)}\right] \tag{7}$$

where T is the corporate tax rate and γ is the assumed value of gamma.

SFG goes on to suggest that it should use the above formula to convert standard ex-imputation estimates of the MRP provided by survey respondents into regulatory with-imputation estimates.[49]

The conversion formula (7) is indeed appropriate in the setting that Officer (1994) considers but is in general not correct in non-perpetuity settings.[50] In this case, it is appropriate to use theta to directly gross-up the imputation credits associated with the dividend component of the return rather than grossing-up the entire return.[51] For example, in relation to historic estimates of the equity premium (and historic stock returns) this is precisely the approach adopted by Brailsford, Handley and Maheswaran (2012) in their tables 2 and 3.[52] This approach should similarly be used to gross-up an ex-imputation MRP estimate from experts.

[48] SFG (2014b p.41).
[49] SFG (2014b p.73).
[50] Officer (1994) assumes a perpetuity framework whereby there is a full distribution of free cash flow and franking credits each period and returns are entirely in the form of fully franked dividends i.e. there are no capital gains. This means that $\gamma = \theta$ within the Officer framework.
[51] It is noted that the SFG approach specifies gamma rather than theta in the conversion formula and so indirectly allows for less than full payout of credits based on the assumed distribution ratio F but this will not necessarily correspond to the actual payout of credits associated with the return.
[52] See Brailsford, Handley and Maheswaran (2008 p.84-85) for details.

Similarly, if one wishes to gross-up an expected future dividend stream in the context of a DGM then again the best approach is to use theta to directly determine the value of credits distributed with the dividend each period. In this case, the grossed-up cash flow stream is expressed on an after-company-before-personal-tax basis and by definition, the resultant implied cost of equity will also be expressed on an after-company-before-personal-tax basis.

(viii) International Betas

The service providers suggest significantly more regard be given to the betas of international comparable firms (specifically U.S. firms) in estimating the beta of an efficient benchmark entity. SFG (2014a) suggests that estimates of U.S. firms receive a 76% weighting and estimates of Australian firms receive a weighting of 24%.[53]

The difficulty here is that domestic betas and international betas are not strictly comparable and so we have a classic case of comparing apples and oranges. In general, domestic betas and international betas measure different things and are not comparable due to potential differences in the covariance structure and level of systematic risk in the respective markets. This is purely a definitional difference. The Australian beta of an Australian firm *j* is equal to:

$$\beta_j^A = \frac{cov\left(r_j^A, r_m^A\right)}{var\left(r_m^A\right)} \quad (8)$$

where r_j^A is the return on asset *j* measured in the local (AUD) currency, r_m^A is the return on the Australian benchmark market measured in the local currency, $cov\left(r_j^A, r_m^A\right)$ is the covariance of the return on j with the market and $var(r_m^A)$ is the variance of the return on the market. The U.S. beta of a U.S. firm k is equal to:

[53] SFG (2014a p.40)

$$\beta_k^U = \frac{cov(r_k^U, r_m^U)}{var(r_m^U)} \tag{9}$$

where r_k^U is the return on asset k measured in the local (USD) currency, r_m^U is the return on the U.S. benchmark market measured in the local currency, $cov(r_k^U, r_m^U)$ is the covariance of the return on k with the market and $var(r_m^U)$ is the variance of the return on the market.

It should be clear from (8) and (9) that by definition, β_j^A and β_k^U are measuring different things. In other words, the beta of an asset is a relative measure of the asset's systematic risk. In the case of a domestic beta, this is relative to the Australian benchmark market. In the case of a U.S. beta, this is relative to the U.S. benchmark market. If we find that $\beta_j^A < 1$ and $\beta_k^U < 1$ then the most we can say is that the Australian firm is less risky than the Australian market and the U.S. firm is less risky than the U.S. market. It is not valid to directly compare their magnitudes in the absence of a model for comparing domestic betas with international betas.[54] A further complication arises from the fact that the returns in the different markets are expressed in different currencies. Any comparison of betas would also need to take into account currency risk.

Moreover, the service providers and their consultants have not presented sufficient evidence to establish the comparability of domestic and international betas. This includes the analysis by CEG which is far from complete.[55]

In the Rate of Return Guideline, the AER has proposed to use a beta estimate from the upper end of their range. This is an appropriate exercise of regulatory judgment to give some but not too much regard to both international beta estimates and the low beta bias (discussed under section (ii) above).

[54] Alternatively an international asset pricing model could be used in which betas are measured relative to the same international benchmark market.

[55] Section 5.3 of CEG (2013). In addition it is noted that the Hamada formula used by CEG to consider the impact of different corporate tax structures is based on a perpetuity framework.

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REGULATORY PROPOSALS

ActewAGL, 2014.

Ausgrid, 2014.[56]

Directlink, 2014.

Jemena Gas Networks, 2014.

Transend, 2014.

TransGrid, 2014.

[56] In relation to the NSW DNSPs (Ausgrid, Endeavour Energy and Essential Energy) I only looked at the Ausgrid proposal as the AER indicated the WACC sections of all the NSW DNSP proposals and the supporting consulting reports were identical.

Expert Witness Compliance Declaration

I have read the Guidelines for Expert Witnesses in proceedings in the Federal Court of Australia and this report has been prepared in accordance with those guidelines. As required by the guidelines I have made all the inquiries that I believe are desirable and appropriate. No matters of significance that I regard as relevant have, to my knowledge, been withheld.

Signed

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John Handley

16 October 2014

Dr John C. Handley

May 2014

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1. QUALIFICATIONS

BCom, BMath *Newcastle*, MCom (Hons) *Melbourne*, PhD *Melbourne*

EMPLOYMENT HISTORY

Period	***Organisation***	***Position***
Jul 1993 to date	University of Melbourne Melbourne	Associate Professor of Finance (since July 2005)
May 2008 to Aug 2012	Stern School of Business NYU New York	Visiting Associate Professor of Finance (Summer 2008, Fall 2009, Summer and Fall 2011, Summer 2012)
Aug 1988 to Jul 1993	SBC Australia *(Now UBS)* Sydney and Melbourne	Corporate Finance Executive
Nov 1985 to Aug 1988	Coopers & Lybrand *(Now Pricewaterhousecoopers)* Newcastle	Audit Senior

2. RESEARCH

Research Focus: Corporate finance, derivative security pricing, corporate finance applications of derivative security pricing

Recent Scholarly Publications

- Brown, C.A., J.C. Handley and K. Palmer, 2013. "A Closer Look at Barrier Exchange Options". Journal of Futures Markets, 33, 1, 23-43.
- Brailsford, T.J., J.C. Handley and K. Maheswaran, 2012. "The Historical Equity Risk Premium in Australia: Post-GFC and 128 Years of Data". Accounting and Finance, 52, 237-247.
- Handley, J.C., 2008. "Dividend Policy: Reconciling DD with MM". Journal of Financial Economics, 87, 528-531.
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Harvard Case Studies

- Tufano, P. and J.C. Handley, 1999. "General Property Trust". Harvard Business School case study 299-098, HBS Publishing.

Work in Progress

- Brown, S.J., J.C. Handley and P. Lajbcygier. "Choice Among Alternative Benchmarks: An Asset Pricing Approach"
- Handley, J.C. and J. Dark. "Investment Waiting Times"
- Brown, C.A., J.C. Handley and A. Lamba. "A Direct Test of Market Timing"
- Brown, C.A., J.C. Handley and A. Lamba. "Share Buybacks and Information Asymmetry – Winners and Losers"
- Brown, C.A., J.C. Handley and K. Palmer. "Partial Differential Equations for Asian Option Prices".
- B. Esty and J.C. Handley. "The Victorian Desalination Project". Case Study.

Recent PhD Supervisions

- Vicky Chow, "An Examination of Alternative Option Hedging Strategies" (joint with C. Murawski) – in progress.
- Michelle Low, "Option Implied Risk Neutral Density Functions" (joint with J. Dark) – completed May 2014.
- Mohd Edil Abd Sukor, "The holiday effect in Asian stock markets: Spending holidays, non-spending holidays and firm size" (joint with R. Brown) – completed January 2014
- Chang Liu, "Credit portfolio tranche pricing: credit risks and non-credit risks" (joint with G. Schwann) – completed February 2013
- Wei Zhang, "Dynamic Currency Hedging for International Stock Portfolios" (joint with C. Brown and J.Dark) – completed June 2012.

3. TEACHING

Teaching Focus: Financial Management, Corporate Finance, Derivatives, Investments

Awards

- 2013 Dean's Certificate of Excellent Graduate Teaching.
- 2012 Dean's Certificate of Excellent Graduate Teaching.
- 2011 Dean's Certificate of Excellent Graduate and Postgraduate Teaching.
- 2010 Dean's Certificate of Excellent Graduate/Postgraduate Teaching.
- 2009 Dean's Certificate of Excellent Undergraduate and Postgraduate Teaching.
- 2008 Dean's Certificate for Excellence in Graduate Teaching.
- 2007 Dean's Certificate for Excellence in Undergraduate and Postgraduate Teaching.
- 2006 Dean's Certificate of Excellent Undergraduate and Postgraduate Teaching.
- 2005 Dean's Certificate of Excellent Undergraduate and Postgraduate Teaching.
- 2004 Dean's Certificate of Excellent Undergraduate Teaching.
- 2003 Dean's Individual Award for Excellence in Teaching in the Faculty of Economics and Commerce.

4. ADMINISTRATION AND LEADERSHIP

- Head, Department of Finance, Aug2012—.
- Academic Director, Master of Applied Finance Program, 2012—.
- Deputy Head (Academic Programs), Department of Finance, 2009—Aug2012.
- Coordinator, PhD Program in Finance, 2009.
- Academic Director, Master of Applied Finance Program, 2006—2008.
- Coordinator, Honours Program in Finance, 2001—2003.
- Chair, 2003 Review Committee of the Honours Program in Finance at Uni Melbourne
- Chair, 2002 Review Committee of the Undergraduate Program in Finance at the University of Melbourne

5. ENGAGEMENT

I have provided expert advice on various financial matters to the Australian Accounting Standards Board, Australian Competition and Consumer Commission, Commonwealth Bank of Australia, Australian Energy Regulator, KPMG Corporate Finance and the New Zealand Commerce Commission, including the following recent engagements:

- 2012, Consultant to the Australian Energy Regulator in relation to the Estimation of the historical market risk premium to inform the AER's assessment of the rate of return for gas and electricity regulatory processes in 2012

- 2011, Consultant to the Australian Energy Regulator in relation to certain proceedings before the Australian Competition Tribunal, February.

- 2011, Consultant to the Australian Energy Regulator on matters dealing with the gas access arrangements of APT Allgas and Envestra in Queensland and South Australia for the period 2011 to 2016, January.

- 2010, Consultant to the Australian Energy Regulator on matters dealing with the AER Electricity Distribution Determinations for Queensland and South Australia for 2010-2015, Victoria for 2011-2015 and Gas Distribution Decisions for New South Wales and the Australian Capital territory for 2010-2015, March–May, September-October

- 2009, Consultant to the Australian Energy Regulator on matters dealing with the AER Electricity Distribution Determinations for Queensland and South Australia for 2010-2015, October.

- 2009, Consultant to the Australian Energy Regulator on matters dealing with The AER Review of Proposed Debt and Equity Raising Costs and the Weighted Average Cost of Capital for the 2009–14 Regulatory Control Period, April.

- 2009, Consultant to the Australian Energy Regulator on matters dealing with The AER Review of the Weighted Average Cost of Capital for Electricity Distribution and Transmission, March/April.

- 2009, Consultant to the New Zealand Commerce Commission on matters dealing with the Telecommunications Service Obligations (TSO) Determination for the years ending 30 June 2005 and 2006, June.

- 2008, Consultant to the Australian Energy Regulator on matters dealing with The AER Review of the Weighted Average Cost of Capital for Electricity Distribution and Transmission, November.

- 2008, Consultant to the New Zealand Commerce Commission on matters dealing with the Telecommunications Service Obligations (TSO) Determination for the years ending 30 June 2004 and 2005, April.

- 2008, Presentation to the ACCC / AER on the Weighted Average Cost of Capital of Regulated Firms, February.

- 2007, Consultant to the New Zealand Commerce Commission on matters dealing with the Telecommunications Service Obligations (TSO) Determination for the year ending 30 June 2004, March.

- 2006, Consultant to the New Zealand Commerce Commission on matters dealing with the Telecommunications Service Obligations (TSO) Determination for the year ending 30 June 2004, May.

- 2005, Consultant to the New Zealand Commerce Commission on matters dealing with the Telecommunications Service Obligations (TSO) Determination for the year ending 30 June 2003, February.

- 2003, Consultant to the New Zealand Commerce Commission on matters dealing with the Telecommunications Service Obligations (TSO) Determination for the period ending 30 June 2002, June.

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