Response to the Economic Regulation Authority on estimation of the risk free rate

REPORT FOR DBNGP (WA) NOMINEES PTY LTD

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1 Introduction

1.1 Issue

1 We have been retained by DBNGP (WA) Nominees Pty Ltd (DBP) to provide a report that addresses one particular aspect of setting allowed returns on regulated energy networks – how to estimate the risk free component of the cost of equity. In the recent draft decision by the Economic Regulation Authority of Western Australia (ERA)[1] the cost of equity is estimated using the Capital Asset Pricing Model (CAPM).[2] According to this model, the cost of equity is estimated as the sum of the risk free rate and a premium for bearing systematic risk.

2 This report has been authored by Jason Hall, Lecturer in Finance at the Ross School of Business, University of Michigan and Director of Frontier Economics. I have Honours degree in Commerce and a PhD in finance from The University of Queensland. I teach graduate level courses with a focus on valuation, have published 15 research papers in academic journals and have 17 years practical experience in valuation and corporate finance.

3 A copy of my curriculum vitae is attached as Appendix 2 to this report.

4 My opinions set out in this report are based on the specialist knowledge acquired from my training and experience set out above. I have been provided with a copy of the Federal Court's Practice Note CM 7, entitled "Expert Witnesses in Proceedings in the Federal Court of Australia", which comprises the guidelines for expert witnesses in the Federal Court of Australia (Expert Witness Guidelines). I have read, understood and complied with the Expert Witness Guidelines.

5 The specific issue we address is as follows – whether the risk free rate should be estimated with reference to the yield to maturity on government bonds with a term equal to the regulatory period; or whether the risk free proxy should be a longer term government bond of 10 years. The key point we make is that the ERA's (2015) view in favour of the prior approach does not hold once we move outside a stylized model in which only interest rate risk matters, and into a real situation in which:

a. investors are exposed to an array of risks, not just interest rate risk;

b. businesses and investors have already worked out that an efficient financing structure is to finance with long term debt, and that

[1] ERA (2015).

[2] Sharpe (1964), Lintner (1965) and Mossin (1966).

taking on additional short term debt leads to an increase in refinancing risk; and

c. given the quantitative metrics currently available to estimate the equity risk premium (beta and the market risk premium), there is no realistic way in which the regulator can make a trade-off between the average lower risk free rate by moving to a short term proxy, and the implied higher refinancing risk.

6 To place this issue in context, in the draft decision the ERA (2015) estimated the cost of equity for the Dampier to Bunbury Natural Gas Pipeline (the pipeline) at 7.28%.[3] The cost of equity is comprised of a risk free component of 1.96% and a systematic risk premium component of 5.32%. The systematic risk premium is the product of an equity beta estimate of 0.70 and market risk premium of 7.60%.[4]

7 The risk free rate was estimated as the average yield to maturity on five year government bonds over 20 trading days ending 2 April 2015.[5] Had the ERA used 10 year government bonds as a proxy for the risk free rate, the corresponding average yield to maturity would have been 2.46%.

8 The ERA (2015) estimates the market risk premium as the expected market return relative to a risk free rate estimated with five years to maturity.[6] We do not know exactly what estimate of the market risk premium the ERA would have used if a 10 year government bond was the proxy for the risk free rate. But our best estimate is that the market risk premium would have been 7.10%. That is, a 0.50% increase in the risk free rate estimate would be offset by a 0.50% reduction in the market risk premium estimate.

9 This means that, had a 10 year proxy for the risk free rate been used, the cost of equity would be 7.43%[7], rather than 7.28%.

10 That view of the ERA (2015) is that, in estimating the risk free rate, the ERA should estimate the yield on government bonds with the same term to maturity as the length of the regulatory period.[8] For example, this means that if the allowed return was to be reset every 10 years, the risk free rate would be estimated as the yield on a government bond with 10 years to maturity; and if the

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[3] ERA (2015), para. 427.

[4] Cost of equity = risk free rate + beta × market risk premium = 0.0196 + 0.70 × 0.0760 = 0.0196 + 0.0532 = 7.28%.

[5] ERA (2015), para. 156.

[6] ERA (2015), para. 143.

[7] Cost of equity = risk free rate + beta × market risk premium = 0.0246 + 0.70 × 0.0710 = 0.0246 + 0.0497 = 7.43%.

[8] ERA (2015), para. 116.

allowed return was to be reset every five years, the risk free rate would be estimated as the yield on a government bond with five years to maturity. We refer to the ERA's view as the *term matching* approach.

11 In this report we present the view that the approach adopted by the ERA (2015) leads to an under-estimate of the cost of capital. Essentially, the basis for the term matching approach is that by setting prices more frequently the regulator is able to significantly reduce the risk of an energy network, such that investors require significantly lower returns on investment. We question whether the administrative choice over whether to set prices each year, every five years, or every 10 years can have such a material influence on the risk that is reflected in the prices investors pay for assets. After all, outside of regulation there is considerable variation in the frequency of price adjustments and that does not seem to bear any association to estimates of the cost of capital.

12 The justification for term matching relies on the theoretical situation in which an investor buys a risk free floating rate note, under which the principal is guaranteed and the coupon payment varies each period as a function of movements in government bond yields. This theoretical situation is then applied to the real situation in which investors buy a risky asset, for which the regulated asset base in the future is estimated by the regulator (which may, or may not, have a different view than the regulated business) and for which the allowed return on that asset base is estimated by the regulator (which is an imprecise estimate of the cost of equity embedded in traded asset prices). The real considerations which affect asset prices and expected returns in the market mean that the cost of capital actually faced by a regulated energy network is not reduced merely by term matching.

13 The rationale that underpins our view is presented in the sub-section below.

1.2 Rationale

1.2.1 Interest rate risk is only one risk facing businesses and which investors account for

14 Term matching appears to reduce risk and therefore the cost of capital only if we make the assumption that investors ignore all other risks in valuing regulated assets. It relies upon the assumption that the asset base is guaranteed at the end of each regulatory period. Once the asset base is no longer guaranteed, investors care about all risks which affect the present value of cash flows over the life of the asset. The only way that all other risks can be ignored is if we simply assume (a) that there is no uncertainty over whether the CAPM holds, and (b) that any risk affecting the potential cash flows outside the first regulatory period has zero systematic risk. This means that term matching is justified only with strong, and unverified, assumptions about how investors value assets.

15 Both the ERA (2015)[9] and Lally (2015)[10] consider the idea that there can be risk associated with the asset base at the end of the regulatory period, and that risk can be reflected in the equity risk premium. This is considered under Sub-section 1.2.4.

1.2.2 Long term financing is optimal and already minimises the cost of capital

16 The implications of the term matching approach are at odds with the actual debt financing practices for businesses that are large, have low volatility of earnings, long lived assets and high leverage. A normal business practice for firms with these characteristics – which are exactly the characteristics typical of energy networks – is to borrow with a long term to maturity. In subsequent discussion we refer to these firms as *large, capital-intensive businesses*. For these firms, issuing long term debt represents the optimal trade-off between the relatively higher interest rates on long term debt, and the increased refinancing risk associated with short term debt.

17 The term matching approach is based upon the idea that financing would be more efficient if businesses borrowed using short term debt. This idea only holds if refinancing risk can be taken out of consideration. In turn, this only holds in the situation in which lenders have a guaranteed payoff at the end of each regulatory period.

1.2.3 Term matching is inconsistent with regulation as an approximation of competitive market outcomes

18 Term matching only appears to provide the correct rate of return if we assume that regulation can achieve outcomes that regulation is not designed to achieve, or is able to achieve. Regulation takes the place of competition in circumstances in which the government or a regulator decides that it is not feasible for competition to move prices to economically efficient levels. This is typically the case with natural monopolies.

19 So the task of the regulator is to estimate, as best as possible given real world constraints, price caps or revenue caps that will incentivize the regulated company over time to set prices similar to the level that would prevail in a competitive market. Term matching goes beyond this basic idea. If the basis for regulation is to approximate competitive market outcomes, it cannot be the case that the price outcome would be different in two jurisdictions, purely on the basis that one regulator sets prices more frequently than another.

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[9] ERA (2015), para. 126.

[10] Lally (2015), p. 15.

1.2.4 Cost of equity rises due to an increase in refinancing risk

20 At the heart of the debate over the relevance of term matching is risk. The allowed return is the regulator's best estimate of a fair return on investment, given the risks of investment. On average, by using a lower term to maturity to estimate the risk free rate, the regulator arrives at a lower cost of capital estimate and therefore a lower risk assessment.

21 In the draft decision of the ERA (2015) the justification for the use of term matching is predicated on the basis that more frequent resetting of prices reduces interest rate risk. The issue of refinancing risk is not an issue that has been considered. But the trade-off between interest rate risk and refinancing risk is the underlying basis for real firms' consideration regarding the term to maturity on debt.

22 It is true that, if the regulator sets prices by making reference to interest rates prevailing at the time of the decision, a regulated business will reduce the tenor of its borrowing. The business will either issue short term debt or issue long term debt and enter into derivative contracts so that the payments to lenders are similar to the payoffs under short term debt. In other words, businesses will respond to the regulatory framework in a way which minimises risk.

23 What is not true is that the regulator's decision to set prices with reference to interest rates prevailing at the time of each decision has no other adverse impacts on the cost of capital. The term matching approach relies upon the assumption that the cost of debt can be reduced by borrowing in the short term, but the cost of equity is unaffected. This ignores theory and evidence that firms make a trade-off between short and long term debt financing in order to minimise their cost of funds.

24 The reason owners of large, capital-intensive businesses borrow over a long tenor is because they wish to minimise the cost of equity associated with refinancing risk. Borrowing in the short term gives debt holders more frequent potential claims on the assets in the event of economic distress and exposes the firm to potentially higher borrowing costs during refinancing periods. Term matching simply assumes there is no trade-off between short and long term debt issuance, which is at odds with firm financing decisions. Further, given the imprecision associated with beta estimation from stock returns and market returns, there is no reasonable possibility that refinancing risk is already accounted for in beta estimation.

1.3 Report structure

25 Hence, in our report, we present an explanation for why the term matching approach appears to provide a useful estimate of the risk free rate. We then

explain why, when considered as part of the whole regulatory process, the term matching approach is no longer valid. The rest of our report proceeds as follows.

a. In Section 2 we discuss normal returns in competitive markets and the process of estimating expected returns for a regulated industry;

b. In Section 3 we consider the rationale for aligning the term to maturity used to estimate the risk free rate with the duration of the regulatory period;

c. In Section 4 we consider whether equity holders are already compensated for risks via the estimate of the equity beta; and

d. In Section 5 we present our conclusions.

2 Normal returns in competitive markets and what happens under regulation

26 To understand the debate over term matching we need to understand the underlying premise for regulation of natural monopolies. In most industries, competition is the mechanism under which resources are allocated efficiently. In a competitive market, prices will adjust such that investors earn a normal return for bearing risk. The regulator takes the place of competition when a regulator or government forms a view that it is not feasible for competition to move prices to economically efficient levels. This is typically the case with natural monopolies. So the task of the regulator is to estimate, as best as possible given real world constraints, price caps or revenue caps that will incentivize the regulated company over time to set prices similar to the level that would prevail in a competitive market.

27 The ERA (2015) makes statements that are consistent with the idea that regulation attempts to mimic competitive market outcomes. The ERA states that:

> The Authority is satisfied that an equity rate of return derived from the Sharpe Lintner CAPM is consistent with the outcomes of efficient, effectively competitive markets.[11]

28 In addition, one of the ERA's (2015) criteria written in its guidelines is that a regulatory aim is to:

> seek to achieve rates of return that would be consistent with the outcomes of efficient, effectively competitive markets.[12]

[11] ERA (2015), para. 715.

[12] ERA (2015), para. 111.

29 Lally (2015) takes issue with the idea that the objective of regulation is to replicate competitive market outcomes. His view, as summarised in the paragraph below, is that the allowed rate of return reflects decisions made by the regulator which influence risk and so the cost of capital for the regulated business could differ from what prevails in a competitive market.

> Fourthly, the ERAWA (2013, Appendix 2, para 36) refers to an argument from the DBP (2013, para 5.45), that regulation should seek to set prices that would prevail in a competitive market, that the regulatory term is irrelevant to this, and therefore choosing the allowed risk-free rate to match the regulatory term is unwarranted. In response, the ERAWA argues that "the present value principle requires that the risk-free rate needs to match the term that would apply in an effectively competitive market for the period." I do not agree with the ERAWA's argument: once the regulatory term is chosen, the term for the allowed risk-free rate must match it, and this might differ from the risk-free rate term that underlies prices in a competitive market. In addition, I do not agree with the DBP's argument. As noted in Lally (2013a, pp. 44-45), "..the belief that regulation should seek to replicate competitive market outcomes is only true in the sense that unregulated firms in competitive markets charge prices that just cover costs, including the cost of capital, and regulation should seek to do likewise. Merely because both types of firms are subject to prices that just cover their costs, it does not follow that every detail about them is or should be identical. Nor is it possible for every detail to be identical because regulated firms are by definition regulated, in recognition of circumstances that differ from those of unregulated firms in competitive markets, and there are a variety of regulatory models. For example, one might regulate prices or revenues, and one might reset these at high or low frequency, and one might allow some costs to be passed-through. All of these regulatory choices affect the cost of capital of a regulated firm. So, having made the choice and therefore determined the cost of capital of the regulated firm, the cost of capital allowed by the regulator must compensate for it rather than match the cost of capital of an otherwise identical unregulated firm in a competitive market. Expressly alternatively, the cost of capital reflects risk, regulation affects the risk of regulated firms, and therefore the cost of capital for a regulated business may differ from the that of an otherwise identical unregulated firm in a competitive market."[13]

30 The limitation of the response from Lally (2015) above is there is no indication that any of the trade-offs mentioned above in setting the allowed return actually occur, or could realistically be expected to occur. We consider this in more detail in subsequent paragraphs. But in short, there is no indication that the reduction in the risk free rate that occurs from term matching (based upon the premise of risk reduction) is placed in the context of any other aspect of price setting. The risk free rate estimation decision is based entirely upon the idea that resetting prices more frequently lowers risk to equity holders.

31 Consider a situation in which there are two competitors in an industry (labelled firm A and firm B). It is a low risk industry but there is competition. It is also an industry in which businesses typically issue debt with a reasonably long term to

[13] Lally (2015), pp. 4 to 5.

maturity of 10 years. Competition is such that the returns achieved by the competitors are, on average, 9% per year. Yields on government bonds with 10 years to maturity are 5% per year, and yields on government bonds with one year to maturity are 4% per year. This means that the competitive market return earned by the two businesses is a 4% premium over the corresponding yield on 10 year government bonds.

32 The businesses could issue debt at a shorter term to maturity of one year, and this would likely be at a lower yield to maturity than 10 year debt. If this was an easy way to reduce the cost of capital we would expect the businesses to pursue the short term debt option. But large, capital-intensive businesses typically issue long term debt. While short term debt offers lower yields, long term debt reduces refinancing risk. So issuing long term debt appears to be the approach that large, capital-intensive businesses adopt to minimise their cost of capital.

33 In the context of the example, the expected return cannot be reduced below 9% simply by borrowing more short term debt. The equity holders will demand higher risk premiums to compensate for their increased risk exposure. The issuance of short term debt means there is more chance that the debt holders will have a claim on the assets because of an inability to repay or refinance the debt.

34 Now suppose that one of the firms is affected by a shock and is put out of business (an example is a natural disaster but the reason for going out of business is irrelevant). Firm B is put out of business so Firm A now has a monopoly position. Economic theory says that Firm A will attempt to take advantage of this monopoly position by raising prices. Suppose the price that maximises value for Firm A is such that expected returns are now 10%. This creates a welfare loss for consumers because Firm A now produces less.

35 The regulator recognises that Firm A is exploiting its monopoly position so steps in to take the place of competition. We already know that the normal, competitive market outcome is an expected return of 9%. Our contention is that an appropriate regulatory response would be to set prices such that, on average, the business is expected to earn a return of 9% – the same return that results from a competitive market outcome.

36 In this example there was no mention of the length of the regulatory period. All we have shown is the basis for the regulator taking action (the creation of a monopoly) and what appears to be a normal constraint on Firm A (setting prices so that Firm A earns the same return as under competition).

37 Now suppose that the regulator considers it economically efficient to set prices on an annual basis. We have no information about how frequently prices were set prior to Firm A achieving monopoly status. In some industries prices change rapidly (for example, retail petrol prices). In other industries prices are set according to long term contracts in order to provide some protection to investors against asset stranding (for example, property leases and take or pay

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contracts on gas pipelines). All we know is that the regulator elects to set prices once per year.

38 The yield on government bonds with one year to maturity is 4% per year, 1% below the yield on 10 year government bonds. According to the term matching approach the regulator would reduce the allowed return to 8%, comprising a 4% risk free component and a 4% risk premium. The basis for the term matching approach is that the regulator's decision to set prices on an annual basis has reduced Firm A's risk exposure. The idea is that, no longer will Firm A's investors be exposed to interest rate risk. This has been taken out of the equation by a decision to set prices on an annual basis. For this to hold, Firm A would also have to borrow at the shorter term to maturity in order for borrowing costs to decline with allowed returns.

39 Yet Firm A already had the ability to borrow with a short term to maturity, and could reset prices at high frequency or low frequency. Firm A decided to borrow with a long term to maturity (the normal case for a large, capital-intensive business) because this represented a decision which minimised its cost of funds after accounting for interest rate risk and refinancing risk.

40 It appears that the perceived risk reduction benefits of term matching come from the idea that regulation has a different objective to replication of competitive market outcomes. Suppose we start with the idea that Firm A is endowed with a natural monopoly position, and a decision is made by the government to constrain Firm A's ability to exercise its monopoly pricing power. The regulator is then assigned the task of deciding what a fair price is for Firm A to charge for its output.

41 The regulator adopts what is now a reasonably common building block approach, and is the approach adopted by the ERA (2015). The regulator:

a. makes an estimate of the asset base for Firm A;

b. makes an estimate of Firm A's efficient costs;

c. makes an estimate of the risks faced by firm A (and which are considered relevant to asset prices); and

d. ultimately makes a decision on a set of prices and other terms that constrain Firm A's behaviour.

42 Different decisions made by the regulator could affect the risk faced by the business, and this will have flow on effects. It should be emphasised however, that regulation of the monopoly business does not increase value for the business above what would result from competition. Regulatory constraints reduce firm A's ability to extract monopoly rents but, all else equal, these constraints do not place firm A in a better position than if it was unregulated.

43 This is important to understand because the low risk nature of a regulated energy network does not come from its regulated status. The low risk nature of the

network comes from providing an essential service to a large number of customers which cannot be efficiently replicated by a competitor. This is why asset risk is low, and leverage ratios are high, which consequently leads to increased risk and returns to equity holders. Regulation is imposed on the business as a constraint on prices so that output increases to an economically efficient level.

44 The specific issue at hand is the decision of the regulator as to how frequently to reset prices. According to the term matching idea, annual price setting implies an allowed return of 8% and setting prices every 10 years implies an allowed return of 9%.

45 The term matching idea only holds if the reduction in interest rate risk is not offset by any other risks, including refinancing risk. So the question is, "**Has the process of regulation – setting prices frequently, applying an estimated return to the regulated asset base and adding estimated costs – been able to lower interest rate risk without an offsetting impact on other risks?"**

46 In our view, the answer is no. An investor considering buying a stake in firm A will still consider a series of annual cash flow projections, and perform a present value computation of those projections. The investor will still consider a series of expected cash flows, but now those cash flows are determined by a more frequent estimation process. The business will take on more short term debt, so that its movement in interest expense each year will be more closely aligned with the annual change in revenue. But this will be at least offset by a commensurate increase in the cost of equity such that the overall cost of capital is at least as high as in the normal situation in which the firm issues long term debt.

3 Rationale for aligning the term to maturity with the length of the regulatory period

3.1 Regulators' view: A floating rate analogy

47 On average, government bonds with a longer term to maturity offer higher returns than government bonds with a shorter term to maturity. The terminology we use is that the normal yield curve is upward sloping. The yield curve can be inverted, flat or have other unusual shapes. But in the typical case the longer the term to maturity the higher the interest rate. In relation to the draft decision by the ERA (2015) the five year yield to maturity was 1.96% and the 10 year yield to maturity was 2.46% for the corresponding 20 day trading period.

48 The view of the ERA (2015) and Lally (2015) is that an investment in a regulated business is analogous to an investment in a floating rate bond. At five year intervals prices are reset, meaning that investors are not exposed to interest rate movements from outside the five year window.

49 For instance, Lally (2015) discussed survey evidence which indicates that interviewees use the same risk free rate input for regulated and unregulated businesses. Lally's view is that the respondents are mis-estimating risk and states that (our emphasis added):

> Since regulated businesses subject to five-yearly price resets are **similar to a very long-term bond with its coupon reset every five years**, the belief on the part of all of these analysts that the appropriate risk-free rate for valuing regulated businesses (with five year cycles) is the same as that for unregulated businesses implies a belief that fixed rate bonds should be valued in the same way as floating rate bonds. This implicit failure to appreciate the difference between fixed-rate and floating-rate bonds undercuts the credibility of the interviewees.[14]

50 The following section from the ERA's (2015) draft decision summarises the ERA's view that an investment in a regulated asset is analogous to an investment in a floating rate note.

> By the same reasoning a 10 year debt instrument with 5 yearly resets would use an index with a 5 year yield to maturity as the interest rate risk exposure is limited to 5 years at a time, on account of the base rate being reset every 5 years to match the prevailing market yield. Similarly, equity holders' exposure to base risk is limited to five years at a time due to the 5 yearly regulatory reset.
>
> Lally previously has made exactly this point in a worked example rebutting SFG's claims
>
> > The scenario examined here is conceptually identical to that of a floating rate bond, and the same recursive valuation process applies. For such bonds, the interest rate used at each reset point must be for a term matching the reset frequency (Jarrow and Turnbull, section 13.2.4).
>
> The Authority therefore considers the appropriate term for the risk free rate and base rate in the current regulatory setting – where the rate of return is reset every 5 years concomitant with market conditions – is 5 years, in order to ensure NPV = 0.[15]

51 The rationale that underpins term matching is that, with more frequent rate resets, the investor in a regulated energy network does not bear interest rate risk. At the end of the regulatory period, the regulator will refer to another set of yields on government bonds in order to re-estimate the allowed return. If yields rise so will allowed returns. Under this rationale the investor is only exposed to movements in interest rates during the regulatory period.

[14] Lally (2015), p. 18.

[15] ERA (2015), Appendix 4, para. 135 to 137.

3.2 Our view: Interest rate risk is only one of many risks

52 The issue that we and the ERA need to grasp is whether the floating rate analogy (based upon risk free interest rates, no estimation error in discount rates, no uncertainty over principal amount, and no estimation error in operating costs, capital expenditure and depreciation) can be applied to the situation in which the regulator is actually setting prices. In the actual price-setting situation:

a. The investors bear risk (rather than the theoretical risk-free case);

b. There is estimation error in working out the fair risk-adjusted return (in the floating rate bond analogy there is no estimation error in interest rates);

c. The principal is not guaranteed. Instead, the regulator makes an estimate of the regulated asset base at intermediate intervals (which stands in contrast to the assumption of perfect foresight in the principal); and

d. The regulator needs to estimate operating costs, depreciation and capital expenditure in working out an allowed revenue stream and therefore regulated prices – all of which involve estimation error and debate between the regulated entity and the regulator (and which are not part of the consideration in the floating rate note analogy).

53 The specific issue is whether the differences listed immediately above actually matter for setting the allowed return. Our view is that these differences do matter, for the following reason.

54 We do not think that investors price assets by ignoring any uncertainty over cash flows outside of the regulatory period, merely because the regulator decides to reset prices more frequently. In estimating the value of an asset, standard theory (which underpins all building block regulation) states that we estimate the present value of all expected cash flows at a rate which reflects the risk of those cash flows. In a normal situation in which an investor values a large, capital-intensive business, the risk free rate which underpins the discount rate estimate would be a long-term government bond yield.[16] The rationale for this choice is that there are risks associated with cash flows over a long period of time, and the cost of debt and cost of equity should also be estimated using a long duration of cash flows. Corporate bonds issued to finance large, capital-intensive business have a long term to maturity. There is demand from companies to borrow money with a long

[16] This is consistent with the ERA's (2015, para. 144 to 146) use of the ten year government bond yield as the proxy for the risk fee rate in regulation of rail assets.

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investment maturity, despite the higher interest rates, so long duration is the typical company's preference for minimising the cost of capital.

55 The two contrasting views can be illustrated with a simple net present value equation, illustrated in Figure 1.

56 In our view, investors project a set of expected cash flows and apply discount rates to those cash flows which reflect risks associated with those cash flows. The regulator adopts a number of processes, parameter estimates and judgements each period and investors form a view on all expected cash flows for the life of the asset (left side). The cash flows are expected cash flows and so are not guaranteed. The contrasting situation is shown on the right side. In the right side equation, cash flows outside of year one are irrelevant for value because any increases or decreases in cash flows are perfectly offset by increases or decreases in discount rates.

Figure 1. Net present value equations

Risk after period 1	No risk after period 1
$Value = \frac{CF_1}{(1+r_1)} + \frac{CF_2}{(1+r_1)\times(1+r_2)} + \cdots + \frac{CF_n}{(1+r_1)\times(1+r_2)\times\ldots\times(1+r_n)}$	$Value = \frac{CF_1}{(1+r_1)} + \frac{Asset\ base}{(1+r_1)}$

57 Which of these views is correct depends upon the particular situation at hand. The view of the ERA (2015) and Lally (2015) holds if either:

a. forward rates are an unbiased estimate of future spot rates; or

b. there is no uncertainty about cash flows after the end of the regulatory period of a type that matters for the pricing of assets; or

c. there is uncertainty about the asset base of a type that matters for the pricing of assets, but the equity risk premium increases to account for this risk. As we discuss in Section 4 there is no reason to think that the ERA (2015) does account for any risk of this type, or that the ERA could measure the different discount rates associated with the series of expected cash flows compared to the asset base.

58 The points above address what is the central basis for Lally's (2015) view that, even if there are risks other than interest rate risk to be considered, this should be accounted for in the risk premium, or might be accounted for somewhere else in the entire suite of regulatory considerations (such as cost pass throughs). The reality of the ERA's task is that the ERA has one metric for measuring risk (beta) and one estimation technique (regression of stock returns on market returns) and the cost of equity is estimated entirely independent of the rest of the regulatory determination. So the reality of the situation is that, under term matching, the risk

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free rate will fall (on average) but there is no potential for any corresponding consideration of risks other than interest rate risk.

59 When considering regulated assets, we question whether the pricing of assets by investors on the basis of all expected cash flows actually changes. For the floating rate analogy to hold, investors would have to believe that eliminating the risk premium associated with long duration cash flows can be achieved by one simple process – setting prices more frequently. Further, investors would also have to believe that interest rate risk can be reduced by the same simple process without any offsetting increases in risk affecting the cost of capital. That is the heart of the matter that is addressed in our report.

60 In a normal situation in which expected cash flows are set by competitive market forces, investors price assets by (1) estimating a series of expected cash flows; and (2) using discount rates that reflect a stream of expected cash flows over a long period of time. The discount rates used by investors to set asset prices are higher, on average, than short duration discount rates.

61 In the regulated asset situation, expected cash flows are partly determined by competitive market forces (this impacts actual costs, capital expenditure and depreciation) and partly determined by a regulatory estimation process (which is used to estimate allowed returns, the asset base and allowed recovery of costs, capital expenditure and depreciation). Our view is that investors still price assets by (1) estimating a series of expected cash flows; and (2) using discount rates that reflect a stream of expected cash flows over a long period of time. The view that supports term matching is different. For term matching to hold, investors would have to decide that merely by the regulator making a set of decisions each regulatory period, the risk premium associated with long duration cash flows has been negated.

62 We do not believe this is true because all that has changed is that one set of estimates has been replaced by another set of estimates. It is not the case that the process by which the regulator sets prices – making a set of estimates over a period of time – has immunised investors from a risk they would have otherwise faced.

63 In the normal situation in which expected cash flows are set by competitive market forces, prices fluctuate as economic conditions change. Prices are not locked in for the life of the asset and the discount rates used by investors reflect the risks associated with price fluctuations. Some increased in costs are passed on to consumers and so prices rise; in other situations costs decline and some of this cost decline leads to lower prices due to competition.

64 In the regulated asset situation in which expected cash flows are, in part, determined by regulatory estimates, the regulator uses interest rate movements as one component of setting prices. It is not the case that, in the absence of regulation, prices would have been locked in for an extended period of time

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thereby exposing the business to interest rate risk. All that has happened is that the regulator has adopted a process – including estimating discount rates on a periodic basis – to set prices at a particular frequency. This process does not convert a series of relatively higher risk/higher return expected cash flows into a relatively lower risk/lower return cash flows.

4 Risk exposure of equity holders including consideration of beta

65 The key point we make is that there are trade-offs when it comes to issuing short term debt versus long term debt. We know that a normal financing program for a large, capital-intensive business will be to issue debt with a reasonably long term to maturity. We also know that, if a regulator decides to reset prices at a particular frequency with reference to interest rates at the time, a regulated business will depart from this normal practice and issue debt with a different term to maturity. The regulated business will attempt to minimise the volatility of cash flows by aligning the term to maturity on debt issuance with the regulatory period.

66 This is consistent with theory put forward by Morris (1976) who writes:

> One element of the risk of borrowing is that the firm's cash inflows will not be sufficient to cover the fixed outflows necessary to service the debt. One way in which firms attempt to deal with this risk is to follow a hedging policy whereby the maturity of the debt is chosen so as to approximately equal the asset life. …
>
> [However]
>
> … If the covariance between the firm's net operating income and interest rates is sufficiently high, then the use of short term debt may cause total interest costs to take on the character of variable, rather than fixed, costs so that the firm is not subject to the tyranny of the "break even point" which is so often associated with fixed costs and the use of leverage.

67 The point made by Morris (1976) was repeated by Lally (2007) who noted that, under term matching, firms will align the term to maturity on borrowing with the length of the regulatory period in order to mitigate refinancing risk. As much as possible the firm will structure its borrowings so that if interest rates fall just before the start of a regulatory period (and so revenues fall) the firm's interest expense will fall. For businesses with high leverage (such as energy networks) interest rate risk management is important for mitigating the risk of distress, but it is also important for minimising the volatility of cash flows to be used for investment and dividends.

68 The response of regulated businesses to align their borrowing costs with a driver of revenue (interest rate movements) does not mean that the overall risk to the business has been reduced. It does not mean there has been a reduction in the

overall cost of capital. All that happens is that the regulator decides upon one mechanism for setting prices, and the business responds.

69 For our argument to hold there must be something that affects the overall cost of capital of a regulated business, and which offsets the reduced borrowing cost associated with short term debt. This offsetting factor is an increase in the cost of equity. Our view is that the overall cost of capital of the business has not fallen, merely because the regulator makes a decision to reset prices more frequently and businesses respond by issuing debt at shorter maturities. Rather, the overall cost of capital will be at least as high as in the case where the business issued long term debt, making a decision that the business considers to be the capital structure that minimises the cost of funds.

70 The weighted average cost of capital for a business that issues short and long term debt is shown below, in which S = short term debt, L = long term debt, E = equity, and V = value (the sum of S, L and E). r represents the expected return on each financing source.

$$WACC = r_s \times \frac{S}{V} + r_d \times \frac{L}{V} + r_e \times \frac{E}{V}$$

71 The firm chooses its allocation of short term debt, long term debt and equity by having regard to the lower interest costs associated with short term debt versus the increased refinancing risk. The reason owners of large, capital-intensive businesses borrow over a long tenor is because they wish to minimise the cost of equity associated with refinancing risk. Borrowing in the short term gives debt holders more frequent potential claims on the assets in the event of economic distress and exposes the firm to potentially higher borrowing costs during refinancing periods.

72 There is theoretical and empirical literature on the trade-offs businesses make in deciding upon a mix of short and long term debt. With respect to theory the following papers are relevant. This is not an exhaustive list but serves to illustrate that there are trade-offs that affect borrowers' choices regarding debt maturity. There are negative impacts on firms' cost of capital associated with the issuance of short term debt.

a. As mentioned above, Morris (1976) presents a theory that short term debt is preferable when cash inflows are positively correlated with interest rate movements.

b. Diamond (1991) puts forward a theoretical model which is based upon the trade-off between the increased liquidity risk of short term debt (by liquidity risk, Diamond means the potential loss of control to lenders if the debt cannot be repaid or refinanced). Diamond's model explains why short term debt is issued by firms with high credit ratings and low credit ratings. Highly rated firms are prepared to bear liquidity risk so they can refinance, and lowly

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rated firms have no choice but to borrow in the short term and potentially lose control to lenders in the event of default. For our purposes the key point is that Diamond's model is premised on the trade-off between lower interest rates from short term debt and increased risk of loss of control.

73 Empirically, we have the following relevant results.

a. Choe (1994) provides cross-sectional evidence that average stock returns, and by implication the equity risk, is higher for firms that issue more short term debt. This provides some evidence of a trade-off between the relatively lower average yield on short term debt and an increase in expected equity returns.

b. Stohs and Mauer (1996) show that long term debt is issued by large firms with low volatility of operating earnings, long lived assets and high leverage. This result is consistent with our contention that a normal debt issuance program for a large business with long-lived assets (characteristics of an energy network) would be to issue long term debt because this minimises the cost of funds. The researchers state that "[t]he positive relation between debt maturity structure and leverage is consistent with the hypothesis that firms lengthen debt maturity as leverage increases to offset the higher probability of a liquidity crisis." Issuing short term debt (to align interest costs with the interest rate driver of revenue) does not come without the equity return trade-offs implicit in the normal decision to issue long term debt.

c. Graham and Harvey (2001) surveyed managers on a set of corporate finance decisions including decisions relating to the maturity of debt. 63% of respondents said that it was important or very important to match the maturity of debt with the life of their assets, and 49% of respondents said it was important or very important to issue long term debt to minimize the risk of having to refinance in "bad times."

74 In sum, the finance literature makes the point that the debt maturity choice of firms is the result of a risk-return trade-off which maximises firm value (which is the same as minimising the cost of funds). Borrowing in the short term is optimal for some firms (for example, firms that are relatively smaller, riskier or have short lived assets). The risk to equity holders increases as a result of this decision to finance debt in the short term but it still represents the optimal financing decision for those firms. Borrowing in the long term is optimal for other firms (for example, large, capital-intensive firms). These firms pay higher interest costs but there is less risk that assets end up in the hands of lenders.

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75 In estimating the equity risk premium, the ERA (2015) forms a set of comparable listed firms and estimates equity beta via regressions of stock returns on market returns. The ERA estimated a range for beta of 0.3 to 0.8[17] and concluded that an appropriate beta estimate for the pipeline was 0.7.[18] The range for beta used by the ERA of 0.3 to 0.8 occurs because regression-based beta estimates have a high degree of imprecision.

76 The figure of 0.7 is above the mid-point of the range of 0.3 to 0.8 for several reasons which are unrelated to any consideration of a trade-off between interest rate risk and refinancing risk. The ERA (2015) arrives at a beta estimate of 0.7 because of a lack of empirical support for regression-based beta estimates. There is evidence that beta estimates below one have a downward bias[19] for estimating the cost of equity and this evidence is consistent with the theory underlying the Black CAPM.[20] The ERA (2015) used a beta estimate of 0.8 for the Goldfields Gas Pipeline but states that this would be excessive for the DBP because of its diversified customer base.[21]

77 The imprecision in beta estimates makes it highly unlikely that the estimate of equity beta can be disaggregated into risk associated with the issuance of long term debt, and any incremental risk associated with a decision to issue short term debt. There is simply no way of knowing how much equity beta should be increased from a baseline estimate to account for increased refinancing risk. This does not mean that businesses are not actually making a trade-off between the benefits and costs associated with the issuance of short term debt. It simply means that we cannot measure the impact of that decision with respect to beta estimates formed from regressing stock returns on market returns. Further, there is nothing in the ERA (2015) draft decision that suggests that such a disaggregation is possible, nor that consideration of refinancing risk had any bearing on the beta estimate of 0.7 for the pipeline.

78 Lally (2015) considers the issue of an equity risk premium associated with the value of the asset base at the end of the five year period. His view is that, if there is any risk associated with the asset value at the end of the regulatory period, then this would be accounted for in a risk premium and that term matching for the risk free rate would still apply.[22]

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[17] ERA (2015), para. 227.

[18] ERA (2015), para. 257.

[19] ERA (2015), para. 242.

[20] ERA (2015), para. 247.

[21] ERA (2015), para.

[22] Lally (2015), p. 15.

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79 The ERA (2015) shares the view that the risk exposure to equity holders is incorporated into the equity risk premium. The ERA states that:

> [E]xcept under highly stylised circumstances, the Authority acknowledges that the value of any asset at the end of the investment horizon cannot be known with full certainty. Risk premia generally apply.
>
> In the case of debt instruments, credit risk factors impact the certainty of full and timely payment of the ending market value (for example the principal).
>
> Similarly, here the credit rating, and hence the debt risk premium, accounts for credit risk over the average term of finance issuance that stems from factors such as declaration of redundant assets, changing depreciation schedules, disallowance of forecast capital expenditure from being included in the asset base and disruptive technologies.
>
> With regard to equity, an investor can diversify such risks away and to the extent they cannot, they are compensated through the equity risk premium via the weighting (equity beta) the premium is given.[23]

80 The key point is that there is no reason to think that the ERA (2015) does incorporate any risks over the asset base into the allowed return to equity holders, or that the ERA could incorporate this risk into an equity beta estimate in the future. So what actually happens in the regulatory decision can be summarised as follows.

a. If the regulatory period was 10 years the ERA would adopt an estimate of the risk free rate equal to the yield to maturity on a 10 year government bond. As an example in the current context, the risk free rate would be 2.46%. This would be consistent with the financing practices for large, capital-intensive businesses and with the ERA's rail decisions.

b. Now suppose that the government announces that the regulatory period will be reduced to five years. The ERA decides that the risk free rate estimate should be equal to the yield on a five year government bond. In the current context, the risk free rate would be reduced to 1.96%. This would be inconsistent with the financing practices of large, capital-intensive businesses. But the regulated business would enter into contracts to hedge its risk exposure, thereby attempting to lock in the five year risk free rate. Interest rate risk is reduced but refinancing risk increases.

c. The reduction in interest rate risk is reflected in the lower risk free rate. But there is no reason to think that the beta estimate would be altered due to an increase in refinancing risk. Simply, the reduction in interest rate risk is accounted for because we can

[23] ERA (2015), para. 126 to 129.

easily measure five and ten year government bond yields. The increase in refinancing risk is ignored because we cannot easily measure equity risk exposure.

d. The ultimate result is an assumption that the regulator can reduce the risk to a business, and therefore the cost of capital, simply by making an administrative choice to set prices more frequently.

81 The inability to disaggregate beta estimates into different risk components supports our view as to how an appropriate cost of capital estimate can be derived for the regulated business, which is as follows.

a. A normal financing arrangement which minimises the cost of funds is for the firm to issue long term debt. This is how the firm would be expected to behave in a competitive market, is consistent with the empirical evidence on the debt maturity structure of firms, and is consistent with the ERA rail decisions.

b. For the regulated business facing price resets each regulatory period, revenue will be higher when interest rates rise, and revenue will be lower when interest rates fall. It is normal business practice to mitigate risk, and the risk exposure from price resets can be mitigated by refinancing debt each regulatory period (or using derivatives to achieve the same result). Cash flow risks are reduced but this is offset by other risks that increase the cost of equity, in particular, refinancing risk. Refinancing risk is the reason why unregulated large, capital-intensive businesses borrow long term.

c. Investors will not ascribe a higher value to the firm merely because the regulator has elected to re-estimate prices at a higher frequency. In the absence of regulation, investors will project a series of cash flows and discount those cash flows at a rate which reflects their risk. Under regulation, investors will still project a series of cash flows and discount those cash flows at a rate which reflects their risk. One series of cash flow estimates (the market determined estimates) has been replaced with another series of cash flow estimates (a combination of regulation and market impacts) and risk remains.

d. If a firm would make its own value-maximising decision to issue long term debt, and instead issues short term debt in response to a regulatory constraint, it is difficult to see how this reduces the cost of capital. Term matching only appears to reduce the cost of capital if we make the assumption that investors only care about interest rate risk, and that other risks are simply assumed to be negligible.

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e. The implication is that term matching does not actually reduce the cost of funds for a business. It merely reduces the risk to lenders who now have more frequent potential asset claims, and increases the risk to equity holders. Under this framework, we can estimate the cost of capital as if the firm borrowed in a normal manner for a large, capital-intensive firm, by issuing long term debt.

5 Conclusion

82 In this report we consider the term matching approach for estimating the risk free component of the cost of equity on a regulated energy network. Under the term matching approach the risk free rate is estimated using the yield to maturity on government debt with the same tenor as the regulatory period.

83 The basis for the term matching approach is that investors are no longer exposed to interest rate movements outside of the regulatory period, because these interest rate movements affect earnings and the cost of capital at the same time. The asset value at the end of the regulatory period is predictable, or at least any risks associated with the asset base are irrelevant for asset values today.

84 We question whether this view is correct for the following three reasons.

a. Interest rate risk is only one risk facing businesses and which investors account for.

The theoretical basis for term matching is consideration of a risk free security which has payoffs which flow directly from interest rate movements. There is no principal uncertainty, no estimation error in risk premiums, and no estimation error in operating costs, capital expenditure and depreciation. The implication of the risk free security analysis is that the risk exposure is analogous to a floating rate note. Then, when it turns to all of the other risks affecting cash flows – uncertainty over the allowed asset base, uncertainty over the allowed risk premium, and uncertainty over allowed operating costs, capital expenditure and depreciation – there is an assumption that these risks are either non-systematic or are already accounted for in beta.

Lally (2015) forms the view that even if the risks mentioned above exist, the appropriate place to account for these risks is in the risk premium and that the short term government bond yield is still the best proxy for the risk free rate. Yet there is no realistic prospect that this consideration has taken place in the ERA (2015) decision, or that it could take place, given the imprecision in estimation of risk to equity holders. The ERA decision invokes an assumption that investors are not concerned with risk

associated with future estimates of the asset base, simply because one set of estimates of cash flows (partly determined by a regulators process and partly determined by market forces) replaces another set of estimates of cash flows (those determined by market forces).

Risk is the very reason why businesses issue long term debt. Using the floating rate note analogy as the basis for term matching means that interest rate risk is considered, but any other risk is assumed to be irrelevant. If the risks were irrelevant then large, capital-intensive businesses would already issue short term debt.

b. Long term financing is optimal and already minimises the cost of capital. The cost of equity rises due to an increase in refinancing risk.

The normal financing arrangement for a large, capital-intensive business is to issue long term debt. When prices are set according to interest rate resets, regulated entities issue short term debt or enter into derivative contracts to transform long term debt into (in substance) short term debt. This is normal, risk-reduction behaviour. But this does not mean that the overall cost of capital has been lowered. It simply means that the firm has elected to issue short term debt to mitigate interest rate risk, and this will be accompanied by increased risk to equity holders.

If the overall cost of capital for large, capital-intensive businesses could be reduced by issuing short term debt, then businesses of this type would issue short term debt. They issue long term debt because they recognise that the relatively lower yields on short term debt come at an increased risk to equity holders. This risk to equity holders does not go away merely because the regulator decides to set prices using one technique, and businesses rationally respond to that technique. Further, there is no mechanism in a typical regulatory approach to estimating the cost of equity, to account for this risk. Given the imprecision of beta estimates typically used in regulation, there is no reasonable prospect that the regulator can determine whether any beta estimate accounts for the increased risk associated with short term debt.

c. Term matching is inconsistent with regulation as an approximation of competitive market outcomes.

The typical yield curve is upward sloping. So, all else equal, typical prices will be relatively higher in jurisdictions with long regulatory

periods and relatively lower in jurisdictions with short regulatory periods. The premise of regulation is to take the place of competitive market outcomes. Regulatory constraints are designed with the underlying intention of setting prices that would prevail in a competitive market, thereby allowing businesses to earn a normal return commensurate with risk. The length of the regulatory period is based upon the judgement of the government or the regulator as to what is economically efficient and what can be administered. It is independent of any analysis of what would prevail in a competitive market. This inconvenient result suggests something is missing in the justification for term matching. As discussed above, what is missing is consideration of all risks other than interest rate risk and the allocation of risk to equity holders.

85 In conclusion, our view is that we can estimate the cost of capital as if the firm borrowed in a normal manner for a large, capital-intensive firm, by issuing long term debt.

6 Declaration

86 I confirm that I have *made all the inquiries that* I *believe are desirable and appropriate and no matters of significance that I regard as relevant have, to my knowledge, been withheld from the Court.*

Dr Jason Hall

7 References

Choe, Y.S., 1994. "The substitution effects of short-term debt for long-term debt on the expected returns of common stocks," *Asia Pacific Journal of Management,* 11, 187–203.

Diamond, D.W., 1991. "Debt maturity structure and liquidity risk," *Quarterly Journal of Economics,* 106, 709–737.

Economic Regulation Authority of Western Australia, 2015. *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 – 2020*, 22 December.

Graham, J.R., and C.R. Harvey, 2001. "The theory and practice of corporate finance: Evidence from the field," *Journal of Financial Economics,* 60, 187–243.

Lally, M., 2007. "Regulation and the term of the risk free rate: Implications of corporate debt," *Accounting Research Journal,* 20, 73–80.

Lally, M., 2015. "Review of arguments on the term of the risk free rate," *Report for the Economic Regulation Authority of Western Australia,* 20 November.

Lintner, J., 1965. "The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets," *Review of Economics and Statistics,* 47, 13–37.

Morris, J.R., 1976. "On corporate debt maturity structures," *Journal of Finance,* 31, 29–37.

Mossin, J., 1966. "Equilibrium in a capital asset market," *Econometrica,* 34, 768–783.

Sharpe, W.F., 1964. "Capital asset prices: A theory of market equilibrium under conditions of risk," *Journal of Finance,* 19, 425–442.

Stohs, M.H., and D.C. Mauer, 1996. "The determinants of corporate debt maturity structure," *Journal of Business,* 69, 279–312.

8 Appendix 1: Instructions

In its Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline 2016 -2020, dated 22 December 2015 (**Draft Decision**), the ERA has maintained its use of the five-year risk-free rate for the return on equity, whereas DBP in its submissions (Rate of Return - Supporting Submission: 12, 31 December 2015) in support of its AA proposal favoured a ten-year term. The relevant arguments made by the ERA in relation to the risk free rate are mostly contained in pages 27 to 34 of the ERA's Appendix 4 to the Draft Decision, and in an expert report prepared by Associated Professor Martin Lally. Both documents are available here. Please note that the Lally paper addresses arguments on the term of the risk-free rate made by both DBP and GGP, and we require the consultant to consider Lally's points only insofar as they pertain to DBP (ignore, therefore, pages 9 to 12 of the Lally paper).

We summarise the ERA's main contentions on this issue as they appear in the Draft Decision, as follows: :

1. Although risk premia do apply (the value of the RAB is not known with absolute certainty), and although the assets last for longer than five years, equity in infrastructure is equivalent to a bond and the risk faced during the access period is similar to the credit risk on a bond with a term to maturity similar to the regulatory period (pages 29 to 31 of Appendix 4 to the Draft Decision).
2. Commercial practice may well favour a longer tenor but the ERA is undertaking a different task to analysts in that it is not valuing an asset in respect of cashflows to perpetuity, but rather considering the cashflows appropriate to the regulated asset base (which is considered first). It therefore follows that the five-year tenor is appropriate given the regulatory timeframe (pages 31-32 of Appendix 4 to the Draft Decision).
3. Gas is fundamentally different from rail because rail uses the gross replacement value for asset valuation, which is different to that used in gas. (page 32 of Appendix 4 to the Draft Decision). Consultants may find the ERA's own assessment of GRV (available here) useful in this respect.

Lally considers the ERA's points, as well as those put forward by SFG in support of DBP (see here) and develops a simplified model of appropriate tenor for the risk-free rate when the RAB is subject to different types of uncertainty.

The consultant is asked to consider the approach adopted by the ERA in its Draft Decision and the views expressed by Lally (including the model developed by Lally) and to provide an expert opinion on which comments on the ERA's reasoning, and the views expressed by Lally which support them, in favour of a

five year tenor for the risk-free rate in preference to the arguments in favour of a ten-year tenor (as previously proposed by DBP in its Submission 12 and advocated by SFG Consulting in its report included as Appendix B to that submission) for the purposes of determining a return on equity which contributes to the achievement of the allowed rate of return objective, as required by Rule 87 of the National Gas Rules.

Since it is possible that your expert report may be relied on in future proceedings before the Australian Competition Tribunal, we require that the work be undertaken in accordance with the Federal Court Guidelines for Expert Witnesses (attached). Further, your report should contain a declaration that you have been given and have read, understood and complied with Practice Note CM7 issued by the Federal Court of Australia concerning guidelines for expert witnesses. It should also contain a declaration that you have made all the inquiries that you believe are desirable and appropriate and that no matters of significance that you regard as relevant have, to your knowledge, been withheld.

9 Curriculum vitae of Dr Jason Hall

Jason Hall, PhD BCom(Hons) CFA

Lecturer in Finance
Ross School of Business
The University of Michigan (Room 4443)
701 Tappan Avenue
Ann Arbor, Michigan, USA 48104
Phone: +1 734 926 6989
Email: uqjhall@umich.edu
Research: http://ssrn.com/author=114606

Director
Frontier Economics
Level 1, South Bank House, Stanley Street Plaza
South Bank, Queensland, Australia 4101
Phone: +61 419 120 348
Email: jason.hall@frontier-economics.com.au
Website: frontier-economics.com.au
Skype: jason.lance.hall

Experience

2013-15	Ross School of Business, The University of Michigan (Lecturer in Finance)
2008	Ross School of Business, The University of Michigan (Visiting Assistant Professor in Finance)
2015	Frontier Economics (Director)
2000-14	SFG Consulting (Director)
2000-12	University of Queensland Business School, The University of Queensland (Senior Lecturer)
1997-99	Credit Suisse First Boston (Equities analyst)

Education

2005	PhD in finance from The University of Queensland
2003	Chartered Financial Analyst designation by the CFA Institute
1996	Bachelor of Commerce with First Class Honours from The University of Queensland

Research

Journal articles

Impact of sector versus security choice on equity portfolios, with Ben McVicar, *Applied Financial Economics*, 2013, 23 (12), 991 – 1004.

Unconstrained estimates of the equity risk premium, with Stephen Gray, Tristan Fitzgerald and Ravi Jeyaraj, *Review of Accounting Studies*, 2013, 18 (2), 560 – 639.

Market risk exposure of merger arbitrage in Australia, with Matthew Pinnuck and Matthew Thorne, *Accounting and Finance*, 2013, 53 (1), 185 – 215.

The value of imputation credits on hybrid securities, with Clinton Feuerherdt and Stephen Gray, *International Review of Finance*, 2010, 10 (3), 365 – 401.

Forecast accuracy and stock recommendations, with Paul Tacon, *Journal of Contemporary Accounting and Economics*, 2010, 6 (1), 18 – 33.

Speculation and e-commerce: The long and the short of IT, with Colin Ferguson, Matthew Pinnuck and Frank Finn, *International Journal of Accounting Information Systems*, 2010, 11 (2), 79 – 104.

Bias, stability and predictive ability in the measurement of systematic risk, with Stephen Gray, Drew Klease and Alan McCrystal, *Accounting Research Journal*, 2009, 22 (3), 220 – 236.

Leveraged superannuation, with Peter Dunn and Scott Francis, *Accounting and Finance*, 2009, 49 (3), 505 – 529.

Persistence in growth versus market expectations, with Matthew Tochterman, *Australian Journal of Management*, 2008, 33 (1), 169 – 199.

Relationship between franking credits and the market risk premium: A reply, with Stephen Gray, *Accounting and Finance*, 2008, 48 (1), 133 – 142.

Comment on 'Regulation and the term of the risk free rate: Implications of corporate debt', *Accounting Research Journal*, 2007, 20 (2), 81 – 86.

Valuation of mining projects using option pricing techniques, with Shannon Nicholls, *JASSA*, 2007, Issue 4 (Summer), 22 – 29.

Relationship between franking credits and the market risk premium, with Stephen Gray, *Accounting and Finance*, 2006, 46 (3), 405 – 428.

Electronic commerce investments, the resource-based view of the firm, and firm market value, with Colin Ferguson and Frank Finn, *International Journal of Accounting Information Systems*, 2005, 6 (1), 5 – 29.

Auditor conservatism and voluntary disclosure: Evidence from the Year 2000 systems issue, with Peter Clarkson and Colin Ferguson, *Accounting and Finance*, 2003, 43 (1), 21 – 40.

Working papers

Portfolio rebalancing and mutual fund tournament behavior, with Paul Tacon, Finance and Corporate Governance Conference 2011, FIRN Frontiers in Finance Conference 2011, Financial Management Association Annual Meeting 2012.

The impact of security analyst recommendations on the trading of mutual funds, with David Costello, AFAANZ Conference 2010 (Winner Best Paper in Finance), Australasian Finance and Banking Conference 2010.

Forecasting stock returns using investor flows under short-sales constraints, with Paul Tacon, Australasian Finance and Banking Conference 2011, Finance and Corporate Governance Conference 2012, AFAANZ Conference 2012, Financial Management Association Annual Meeting 2012, Southern Finance Association Annual Meeting 2012.

Presentations

Accounting and Finance Association of Australia and New Zealand Conference (5) 2005, 2007, 2009-10, 2012
Asian Finance Association Conference 2009
Australasian Finance and Banking Conference (2) 2008, 2010
Australian National University Seminar Series 2012
Coal Trade, hosted by AIC Worldwide 1999
Coaltrans Asia, hosted by Coaltrans Conference Limited 1999
Contemporary Accounting Research/Journal of Contemporary Accounting and Economics Joint Symposium 2009
CPA Mining and Energy Conference 2006
Financial Management Association 2012
First Annual Private Equity Conference, hosted by Television Education Network 2007
JBWere Family Business Conference 2010
Melbourne Centre for Consumer Finance Investment & Regulatory Symposium 2008
PhD Conference in Economics and Business, hosted by University of Western Australia 2003
Southern Finance Association 2012
University of Melbourne Seminar Series (2) 2005, 2010
University of Queensland Seminar Series 2008

Referee activity

Accounting and Finance (8 reviews) 2003, 2005, 2009-13
Accounting Research Journal (3 reviews) 2002, 2006, 2010
Applied Financial Economics (3 reviews) 2012-13
Australian Journal of Management 2012
Contemporary Economic Policy 2011
European Financial Management 2014
Financial Review 2013
International Journal of Emerging Markets 2013
International Review of Finance 2012
MIS Quarterly 2003
Quarterly Journal of Finance and Accounting 2010
Quarterly Review of Economics and Finance 2012

Research grants

PricewaterhouseCoopers/Accounting and Finance Association of Australia and New Zealand 2006: Returns, tax and volatility – Superannuation choice with a complete information set ($8,500)

Australian Research Council Discovery Grant 2002-4: Quantification issues in corporate valuation, the cost of capital and optimal capital structure ($126,000)

UQ New Staff Research Start-up Fund: The competitive advantage of investments in electronic commerce ($10,000)

Research students

PhD (1 student)

2012 – Paul Tacon

Honours (20 students)

2012 – Edward Parslow (Carnegie Wylie)
2011 – James Lamb (Port Jackson Partners)
2010 – Jeremy Evans (JP Morgan), Sarah Thorne (JP Morgan), Alexandra Dwyer (Reserve Bank of Australia)
2009 – Tristan Fitzgerald (UNSW), David Costello (National Australia Bank), William Toe (Ernst & Young)
2008 – Ben McVicar (Credit Suisse), Matthew Thorne (Credit Suisse)
2007 – Sam Turner (ABN Amro Morgans)
2006 – Paul Tacon (PhD, UQ), Ravi Jeyaraj (Navis Capital), Thomas Green (Crescent Capital), Alexander Pascal-Bossy (Macquarie)
2005 – Angela Gill (Wilson HTM), Andrew Wagner (Macquarie)
2004 – Matthew Tochterman (M. Fin. Eng., UC Berkeley), Justyna Lewandowska (JP Morgan), An Pham (UBS)

Masters (2 students)

2003 – Scott Francis (A Clear Direction Financial Planning), Hernando Barrero (PricewaterhouseCoopers)

PhD reader
Damien Cannavan 2012

Teaching

Ross School of Business, The University of Michigan
Valuation (2014-2015; MBA students; avg. rating 3.9)
Corporate Investing Decisions (2014; BBA students avg. rating 4.2)
Corporate Financing Decisions (2015; BBA students avg. rating 3.0)
Corporate Financial Policy (2008; MBA students; avg. rating 4.3)

UQ Business School, The University of Queensland (Mean teacher ratings out of a possible 5.0)
Awarded undergraduate teaching prize 2009
Empirical Finance Honours (2009-12; PhD and Honours students; avg. rating 4.1)
Corporate Finance Honours (2005 & 2011; PhD and Honours students; avg. rating 4.7)
Investments & Portfolio Management (2002-7, 2009-10 & 2012; B.Com, MBA & M.Com students; avg. rating 3.8)
Corporate Finance (2002-4, 2006-10 & 2012; B.Com, MBA and M.Com students; avg. rating 3.8)
Finance (2005-6; M.Com students; avg. rating 3.7)
Corporate Finance and Investments (Mt Eliza Business School, Beijing 2003; MBA students)
Technology Valuation and Project Evaluation (Singapore 2004; Masters of Technology Management students)
Auditing (Summer 2000/1-2001/2; B.Com, MBA and M.Com students; avg. rating 3.8)

Executive education
Risk Management and Financial Analysis (Rabobank 2000-10)
Financial Analysis of Innovative Investments (UQ Business School 2007)
Credit Analysis (Queensland Treasury Corporation 2005)
Capital Management (UQ Business School 2004)
Making Critical Financial Decisions (UQ Business School 2003)
Business Valuation and Analysis (UQ Business School 2003)
Cost of Capital Estimation (UQ Business School 2003)
Analysis of Real Options (Queensland Treasury 2003)

Student competitions
Rotman International Trading Competition
Manager of the UQ Business School trading team (2007 & 2009-12) which competes annually at the University of Toronto amongst 50 teams. UQ is the 9th most successful entrant from 66 schools which have competed in any of the same years, finishing 3rd in 2010, 6th in 2007, 11th in 2009, 14th in 2011 and 18th in 2012.
UBS Investment Banking Competition
Judge for the UQ section 2006-7 & 2009-12. Faculty representative at the national section 2008.
JP Morgan Deal Competition
Judge for the UQ section 2007-8.
Wilson HTM Research Report Competition
Delivered two workshops as part of the 2006 competition and was one of three judges.

Industry engagement

From 2000-15, I have provided consulting services as a director of SFG Consulting and Frontier Economics (from November 2014). A selection of projects is listed below.

Energy network businesses (2014-2015)
In December 2014 the Australian Energy Regulator (AER) released a set of draft determinations for electricity and gas networks. This was the first set of draft determinations since the publication of the AER's rate of return guidelines in December 2013. It was also the first set of draft determinations since the publication of new rules by the Australian Energy Market Commission (AEMC). I co-authored a series of expert reports addressing almost all aspects of the regulated rate of return. The reports related to (1) estimation of the cost of equity using the Black Capital Asset Pricing Model (CAPM), (2) interpretation of empirical evidence on the beta estimate for use in the Sharpe-Lintner CAPM, (3) the merits of estimating the cost of equity using the Fama-French model, (4) the application of the dividend discount model for estimating the cost of equity, both at the firm and market levels, (5) the distinction between the redemption rate and the market value of imputation credits, and (6) the manner in which the AER has evaluated evidence in reaching conclusions on the allowed return on equity. The reports were commissioned by Jemena Gas Networks, Jemena Electricity Networks, ActewAGL, APA, Ausgrid, Ausnet Services, CitiPower, Endeavour, Energex, Ergon, Essential Energy, Powercor, SA PowerNetworks and United Energy.

Retail electricity and gas margins in NSW (Independent Pricing and Regulatory Tribunal 2006-13)

In 2006-7, 2009-10 and 2012-13 I acted as part of a team which was engaged to estimate electricity costs and margins for electricity and gas retailers in NSW. My role related to the estimation of a profit margin which would allow the retailer to earn a return commensurate with its systematic risk. The approach developed was novel in that the margin was derived without reference to any pre-defined estimate of the asset base. Rather, the margin was a function of the potential increases or decreases in cash flows which would result from changes in economic conditions. Reports are available from IPART.

Advice on rules to determine regulated rates of return (Australian Energy Markets Commission 2012)

In 2012 the AEMC made changes to the rules relating to regulation of electricity and gas networks. Independent rule change proposals were forward by the Australian Energy Regulator and the Energy Users Association of Australia. Both groups argued that application of the existing rules by the regulator generate upwardly-biased estimates of the regulated rate of return. As part of a team I provided advice to the commission on whether the rule change proposals provide evidence on an upward bias, and if so, whether the proposed amendments were likely to reduce the extent of any bias. The rules themselves did not create any bias, but did unnecessarily exacerbate the variation of electricity prices from one five year period to the next. The rules have now been amended to mitigate this variation.

Expert evidence relating to regulated rates of return (Electricity network businesses 2011)

In April 2011 the Australian Competition Tribunal heard an appeal by electricity networks on the regulated rate of return set by the Australian Energy Regulator. The issue was the value of dividend imputation tax credits. The Tribunal directed us to perform a dividend drop-off study to estimate the value of a distributed credit. Largely on the basis of our evidence the Tribunal determined that an appropriate value for a distributed credit was 35 per cent of face value. The Tribunal determination is available on its website and our expert report is available on request.

Estimation of risks associated with long-term generation contracts (New South Wales Treasury 2010)

In 2010 the NSW Government privatised a segment of its electricity industry, by selling three electricity retailers and entering into two generation agreements termed GenTrader contracts. The state-owned generators agreed to provide generation capacity in exchange for a charge. The generators also agreed to pay penalties in the event that their availability was less than agreed. As part of a team, I provided advice to NSW Treasury on the risks associated with the contracts. The estimated penalties resulting from this analysis are used by NSW Treasury in their budgeting role and in providing forward-looking analysis to the Government.

Litigation support relating to asset valuation (Alcan 2006-7)

In 2006-7 I acted as part of a team which provided litigation support to Alcan in a dispute with the taxation authority in the Northern Territory. The dispute related to whether Alcan was required to pay stamp duty as a result of its acquisition of an additional 30 per cent interest in Gove Alumina Limited. One issue was whether the acquisition was land-rich, meaning that the proportion of the asset considered to be land exceeded a threshold triggering stamp duty.

Methodology for evaluating public-private partnerships (Queensland Treasury Corporation 2005)

In 2005 I acted as part of a team which advised QTC on evaluating public-private partnerships, which typically require subsidies to appeal to the private sector. We rebutted the conventional wisdom, adopted in NSW and Victoria, that the standard valuation approach is flawed for negative-NPV projects. Furthermore, we developed a technique to incorporate systematic risk directly into expected cash flows, which are then discounted at the risk-free rate.

Litigation support

Insolvency proceedings relating to the collapse of Octaviar (Public Trustee of Queensland 2008-9)
Valuation of resource assets (Compass Resources 2007-8, Westpac Banking Corporation 2007)
Appeals against regulatory determinations (Envestra 2007-8, Telstra 2008)
Advice on whether loan repayments correspond to contract terms (Qld Dept. of Fair Trading 2005)
Advice on whether port and channel assets were contributed and hence not part of regulated assets (Comalco 2004-5)

Valuation

Management performance securities (Collins Foods Group 2006-11 & 2015, GroundProbe 2008-9)
Ordinary shares in the context of an equity raising (Auscript 2007-8)
Intangible assets (Inbartec 2007)
Resources assets (Senex Energy 2012, Chalco 2007, Bank of Queensland 2007)

Cost of capital estimation, advice and regulatory submissions

Transport (Qantas 2008, QR National 2005 & 2012)
Water (Essential Services Commission of South Australia 2012, ActewAGL 2012, IPART 2011, Metropolitan utilities in Victoria 2004 & 2006-7, QCA 2002-3)
Energy networks (Economic Regulation Authority in Western Australia 2009, Hong Kong Electric 2007, Envestra 2006-7 & 2012, Powercor 2005, AGL 2004, Energex 2003-4, Ergon Energy 2003-4)
Local government networks (Queensland Competition Authority 2009)
Electricity generation (National Generators Forum 2008)

Environmental consulting (Ecowise 2007)
Listed vs unlisted infrastructure funds across alternative European equity markets (ABN AMRO Rothschild 2007)
Forestry assets (Queensland Department of Natural Resources 2004)

Portfolio performance measurement

Performance evaluation and benchmark derivation (Friday Investments 2010-12, Zupp Property Group 2011-12)

Corporate finance

Economic impact assessment of a proposed development of a retail shopping complex (Lend Lease 2006)
Impact of an acquisition on dividend growth, earnings per share and share price (AGL 2003-4)
Estimation of the optimal capital structure for electricity generation and distribution (NSW Treasury 2001-2)
Review of the debt valuation model used by the Snowy Hydroelectric Authority (NSW Treasury 2002)
Estimation of the optimal contract terms for coal sales to an electricity generator (NSW Treasury 2001-2)

Econometrics

Scoping study into the determinants of changes in tax debt in Australia (Australian Taxation Office 2007)

Interests

I am interested in sport as a participant and spectator. I finished 3rd on three occasions in the Brisbane Half Marathon (2005 & 2009-10), 8th in the Toronto Half Marathon (2002) and 3rd in the Australian Universities Marathon Championships (2003). I have finished 22 marathons, recording a best time of 2:47:54 in the Chicago Marathon 2011. From 1994-96 I was a member of The University of Queensland tennis team, which placed 1st at the Australian University Games in 1994.

FRONTIER ECONOMICS | MELBOURNE | SYDNEY | BRISBANE
Frontier Economics Pty Ltd 395 Collins Street Melbourne Victoria 3000
Tel: +61 (0)3 9620 4488 Fax: +61 (0)3 9620 4499 www.frontier-economics.com.au
ACN: 087 553 124 ABN: 13 087 553 124