Appendix D

Response to the UT5 draft decision on the term of the risk-free rate

REPORT PREPARED FOR AURIZON NETWORK

March 2018

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1 Executive summary

1 Frontier Economics has been retained to review and respond to the Queensland Competition Authority's (QCA's) assessment of the term of the risk-free rate in its Draft Decision[1] in relation to Aurizon Network's (Aurizon's) 2017 Draft Access Undertaking for the UT5 period.

1.1 Key findings

2 The UT5 Draft Decision maintains the QCA's previous approach of setting the term of the risk-free rate equal to the length of the regulatory period, which is four years in the case at hand. Our primary conclusions on this approach are as follows:

a. The use of a 4-year risk-free rate is inconsistent with the dominant commercial and regulatory practice, which is to use a 10-year risk-free rate or even higher figure. Commercial practice is important because the regulatory framework is designed to ensure that investors receive a return that is sufficient to attract the efficient level of investment. If capital investors use a 10-year risk-free rate when determining the return that they require, the allowed regulatory return must also reflect the same rate to attract the efficient level of investment. That is, what is relevant is the return that investors actually *do* require, not a theoretical or algebraic assessment of what the regulator considers investors *should* require. Moreover, regulatory frameworks often require the regulator to ensure that the allowed return is *at least* equal to the return that investors require.[2] Such provisions are designed to recognize the asymmetry of consequences – setting the allowed return too high may encourage investment to be brought forward somewhat before it is required, whereas setting the allowed return too low may result in a lack of efficient investment, which has materially greater flow-on consequences. Because such provisions are common across regulatory jurisdictions, the approaches taken by other regulators are also relevant – providing an indication of how other regulators have assessed the evidence and made judgments about what return might be required to attract the efficient level of investment.

b. To the extent that the QCA considers it an important principle to satisfy, the NPV=0 principle is only satisfied if the regulator's

[1] QCA, Aurizon Network's 2017 draft access undertaking, Draft Decision, December 2017 (Draft Decision).

[2] See for example, s 69E and s168A of the QCA Act 1997.

allowed return on capital is equal to the market's required return on capital. In this respect, we agree with Incenta's view that:

> In this context, the NPV=0 principle says nothing more than that the discount rate should be the correct one for the cash flows being considered.[3]

However, the UT5 Draft Decision does not interpret the NPV=0 principle in terms of how capital investors actually *do* determine what return they require, but in terms of a theoretical algebraic assessment[4] of how the QCA considers investors *should* determine what return they require. As set out above, our view is that evidence of how investors actually do determine their required return is more relevant to the regulatory objectives and pricing principles and should be weighted accordingly. By contrast, the UT5 Draft Decision gives no weight to the evidence of how investors actually do go about determining their required return.

c. Since the UT5 Draft Decision does not dispute the evidence that the standard commercial practice is to use a 10-year risk-free rate, the NPV=0 principle, which "says nothing more than that the discount rate should be the correct one," requires that the allowed return should also be based on a 10-year risk-free rate.

d. The approach adopted in the UT5 Draft Decision is independent of any evidence of the returns that real world investors actually *do* require. It is instead based on algebraic derivations of what the QCA considers that investors *should* require.

e. However, those algebraic derivations begin with the *assumption* that the regulator's allowed return is equal to the market's required return, and are therefore circular. That is, the derivation assumes the result that it seeks to prove.

f. The expected real risk-free rate is used in two places in the QCA's regulatory model and two different approaches are used to estimate it:

    i. A negative expected real risk-free rate (which implies that investors are willing to invest in government bonds with the expectation that the invested funds will be able to purchase fewer goods at the end of the investment than at the beginning) is used in a part of the decision (RAB roll-

[3] Incenta, 2013, Term of the risk-free rate for the cost of equity, June, p. 6.

[4] That is based on flawed assumptions, as set out below.

forward[5]) where lower real risk-free rates lead to a lower MAR; and

ii. A different approach is used to obtain a much higher estimate in another part of the decision (Siegel[6]) where higher real risk-free rates lead to lower MAR.

g. The higher volatility associated with the 4-year yield (relative to the 10-year yield) means that price changes for customers will tend to be proportionately higher from one regulatory period to the next if the 4-year yield is used, and returns received by investors will also tend to be proportionately higher from one regulatory period to the next.

3 Our recommendation is that the dominant commercial market and regulatory practice of using a 10-year risk-free rate should be adopted. Following the standard approach of using a 10-year risk-free rate would address all of the issues set out above. Importantly, it would equate the regulator's allowed return with the market's required return given the commercial and regulatory risks involved, which is necessary for efficient investment. The standard approach of using a 10-year risk-free rate would also address many of the issues raised in our companion report[7] on issues relating to the market risk premium – including the fact that the UT5 Draft Decision seeks to average over some estimates of the MRP that have been computed relative to a 4-year rate and other estimates that have been computed relative to a 10-year rate.

1.2 Author of report

4 This report has been authored by Professor Stephen Gray, Professor of Finance at the UQ Business School, University of Queensland and Director of Frontier Economics, a specialist economics and corporate finance consultancy. I have Honours degrees in Commerce and Law from the University of Queensland and a PhD in Financial Economics from Stanford University. I teach graduate level courses with a focus on cost of capital issues, I have published widely in high-level academic journals, and I have more than 20 years' experience advising regulators, government agencies and regulated businesses on cost of capital issues. I have published a number of papers that specifically address beta estimation issues. A copy of my curriculum vitae is attached as an appendix to this report.

5 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

5 UT5 Draft Decision, Section 4.

6 UT5 Draft Decision, pp. 478 and following.

7 Frontier Economics, 2018, *Response to the UT5 Draft Decision on the market risk premium*, March.

of the Federal Court's Expert Evidence Practice Note GPN-EXPT, which comprises the guidelines for expert witnesses in the Federal Court of Australia. I have read, understood and complied with the Practice Note and the Harmonised Expert Witness Code of Conduct that is attached to it and agree to be bound by them.

6 I have been assisted in the preparation of this report by Dinesh Kumareswaran and Simon Lang from Frontier Economics.

2 Inconsistency with regulatory and commercial practice

7 In this section we present evidence that the standard commercial and regulatory approach, adopted by commercial market participants and other regulators, is to use a long-term risk-free rate of 10 years or more.

8 Commercial practice is important because the regulatory framework is designed to ensure that investors receive a return that is sufficient to attract the efficient level of investment. If capital investors use a 10-year risk-free rate when determining the return that they require, the allowed regulatory return must also reflect the same rate to attract the efficient level of investment.

9 That is, what is relevant is the return that investors actually *do* require, not a theoretical or algebraic assessment of what the regulator considers investors *should* require. Moreover, regulatory frameworks often require the regulator to ensure that the allowed return is *at least* equal to the return that investors require.[8] Such provisions are designed to recognize the asymmetry of consequences – setting the allowed return too high may encourage investment to be brought forward somewhat before it is required, whereas setting the allowed return too low may result in a lack of efficient investment, which has materially greater flow-on consequences.

10 Because such provisions are common across regulatory jurisdictions, the approaches taken by other regulators are also relevant – providing an indication of how other regulators have assessed the evidence and made judgments about what return might be required to attract the efficient level of investment.

2.1 Commercial market practice

11 When computing the return that is required on investments in infrastructure assets, the standard approach adopted by independent valuation experts and other market participants in Australia is to set the risk-free rate equal to the yield on 10-year government bonds. This approach is adopted even for regulated assets, including assets regulated by the QCA.

12 Our previous report[9] presents a range of evidence to support this claim:

a. Grant Samuel in its 2014 report for Envestra Ltd, a firm that owns and operates regulated gas distribution networks, adopts the 10-

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[8] See for example, s 69E and s168A of the QCA Act 1997.

[9] Frontier Economics, 2017, *The term of the risk-free rate*, September.

year bond rate, noting that it is a widely used and recognised benchmark for the risk-free rate.

b. Grant Samuel in its 2010 report for Prime Infrastructure, a business that included the DBCT coal terminal regulated by the QCA and WestNet rail regulated by the ERA, noted that the 10-year bond is a benchmark accepted globally and used as a proxy of the long-term risk-free rate.

c. KPMG in its 2017 report for DUET Ltd, a business that owns and operates gas and electricity distribution networks, including a mix of regulated and unregulated assets, stated that the risk-free rate is calculated using the 10-year Australian government securities.

d. Deloitte in its 2015 report for Energy Developments Ltd, a business that owns and operates a number of unregulated electricity generation assets, used the yield on the 10-year government bonds to proxy the risk-free rate.

e. Incenta (2013)[10] also concluded that the dominant practice is to use a 10-year term for the risk-free rate.

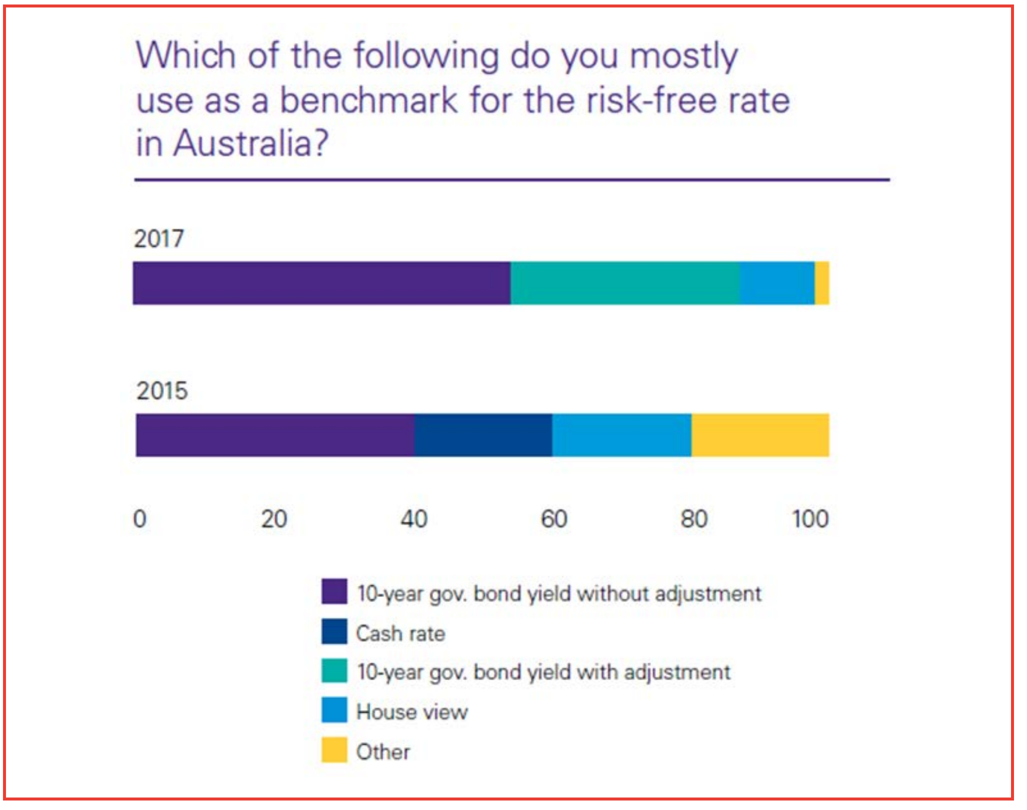
13 In addition to the previous evidence we have presented, we note that the latest survey of valuation experts in Australia—the KPMG 2017 Valuation Practices Survey—finds overwhelmingly that valuation experts in Australia use 10-year government bond yields as the basis for their estimate of the risk-free rate, for use within the Capital Asset Pricing Model (CAPM).[11]

14 In the 2017 survey, KPMG collected the views of 45 valuation practitioners from core valuation organisations across Australia on key assumptions used in the valuation processes, including benchmarks for the risk-free rate in Australia. KPMG found that 90% of the experts surveyed used the 10-year government bond yield as a benchmark of the risk-free rate in Australia, with some applying an adjustment to *increase* the figure that is used. See Figure 1 below.

[10] Incenta, 2013, *Term of the risk-free rate for the cost of equity*, June.

[11] KPMG, 2017, *For all it's worth, KPMG Valuation Practices Survey 2017*, July.

Figure 1: Survey evidence that most valuation experts in Australia use a 10-year risk-free rate for application within the CAPM



Source: KPMG (2017), p. 10.

15 Similarly, Fernandez (2017)[12] uses the 10-year government bond yield as the benchmark risk-free rate and shows that the majority of respondents currently use a risk-free rate even *higher* than the 10-year yield.

16 Thus, the commercial practice is to use a risk-free rate *at least* equal to the 10-year government bond yield.

2.2 Australasian regulatory practice

17 As noted above, the approaches taken by other regulators are relevant in that they provide an indication of how other regulators have assessed the evidence and made judgments about what return might be required to attract the efficient level of investment.

[12] Fernandez, P., V. Pershin and I. Acin, *Discount rate (Risk-free rate and market risk premium used for 41 countries in 2017: a survey*, April 17.

18 In our previous report, we demonstrated that the standard Australian regulatory practice is also to use a 10-year risk-free rate. For example, in its 2013 Rate of Return Guideline, the AER concluded that:

> On balance, we are more persuaded by the arguments for a 10 year term, than the arguments for a five year term.[13]

19 The AER also notes that the Australian Competition Tribunal advocates the use of a 10-year term.

20 IPART, which had previously adopted a 5-year term to maturity, announced in 2013 that it would henceforth adopt a 10-year term:

> We agree with stakeholder views that increasing the TTM [term to maturity] from 5 years to 10 years for all industries is more consistent with our objective for setting a WACC that reflects the efficient financing costs of a benchmark entity operating in a competitive market.[14]

21 The ESC,[15] ESCoSA[16] and the ICRC and ACT Industry Panel[17] also use a 10-year risk-free rate.

22 The ERA(WA) use a 10-year risk-free rate for rail decisions and a term-matched rate for gas and electricity decisions. The NZCC uses a term-matched risk-free rate.

2.3 Overseas regulatory practice

2.3.1 United Kingdom

23 UK regulators generally set the risk-free rate allowance significantly *higher* than the prevailing 10-year yield gilt rate. This can be seen in Figure 2, where the risk-free rate adopted by six different regulators in the UK since 2006 are plotted together with the spot 10-year index-linked (real) gilt rate.[18]

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13 AER, 2013, Rate of Return Guideline Explanatory Statement, p. 34.

14 IPART, 2013, Review of WACC Methodology, December, p. 12.

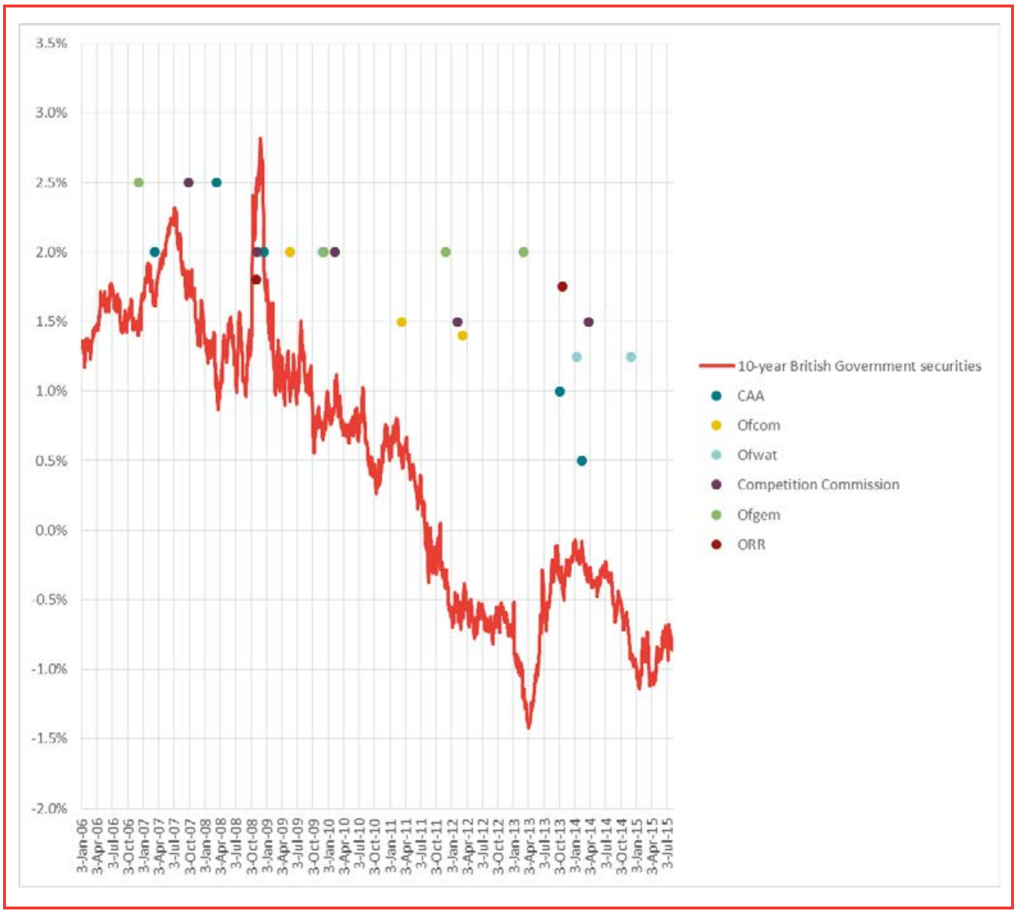
15 ESC, 2016, Melbourne Water Price Review 2016 Final Decision, June.

16 ESCoSA, 2016, SA Water Regulatory Determination 2016 Final Determination, June.

17 ACT Industry Panel, 2014, Review of the ICRC 2013 Price Direction, December.

18 Regulators in the UK typically determine a real risk-free rate allowance.

Figure 2: Comparison of 10-year yield from British Government securities and risk-free rate used by UK regulators in their cost of capital decisions



Source: Bank of England, UK regulators decisions, Frontier Economics calculations.

24 The chart shows that for 18 out of 21 decisions the risk-free rate used by the regulator is higher than the 10-year yield prevailing at the time of the decision.

25 If these regulators in the UK were using a term for the risk-free rate that matched the length of the regulatory period (which is the QCA's approach), the risk-free rate allowance would be below the prevailing 10-year government bond yield, since most of the regulatory periods in the UK range from five to eight years.

2.3.2 United States

26 The consistent approach of the Federal Energy Regulatory Commission is to use the yield on 30-year government bonds as its estimate of the risk-free rate for use within the CAPM.

27 For example, FERC Opinion 531-B[19] states that:

[19] 150 FERC 61,615, Docket Nos. EL 11-66-002, EL 11-66-003, March 3, 2015.

> 30-year U.S. Treasury bond yields are a generally accepted proxy for the risk-free rate in a CAPM analysis, and are also considered superior to short- and intermediate-term bonds for this purpose[20]

and that:

> …the yield on very long-term government bonds, namely, the yield on 30-year Treasury bonds, is the best measure of the risk-free rate for use in the CAPM and Risk Premium methods,[21]

concluding that:

> ...we find 30-year Treasury bond yields to be an appropriate basis for the risk-free rate.[22]

28 This position has been recently confirmed in FERC Opinion 551[23] which states that:

> The risk-free rate is represented by a proxy, typically the yield on 30-year U.S. Treasury bonds,[24]

and which rejected arguments in favour of the use of a shorter-term risk-free rate.[25]

29 The current approach by the US Surface Transportation Board (STB) in determining the railroad industry's cost of capital is to employ the yield on 20-year government bonds to estimate the risk free rate in the use of the CAPM.

30 This input was instituted by the STB following industry consultation and agreement on a term longer than that initially proposed, with the STB noting:[26]

> Under CAPM, the cost of equity is equal to RF + β×RP, where RF is the risk-free rate, RP is the market-risk premium, and β (or beta) is the measure of systematic, non-diversifiable risk. There is consensus among the parties on the various elements of this CAPM calculation. For example, WCTL and AAR agree that we should use a constant term in the least-squares regression used to estimate beta. The parties also agree that the beta should be calculated based on monthly risk premiums using short-term interest rates. And they agree that the 20-year Treasury bond is a more appropriate measure of the risk-free rate of return than the 10-year Treasury rate proposed in the NPRM [notice of proposed rule making].

[20] FERC Opinion 531-B, Paragraph 114.

[21] FERC Opinion 531-B, Footnote 239.

[22] FERC Opinion 531-B, Paragraph 114.

[23] 156 FERC 61,234, Docket No. EL 14-12-002, September 28, 2016.

[24] FERC Opinion 551, Paragraph 138.

[25] FERC Opinion 551, Paragraph 143.

[26] STB Ex Parte No. 664, *Methodology to be employed in determining the railroad industry's cost of capital*, January 17, 2008.

3 NPV=0 algebra

3.1 Overview

31 The UT5 Draft Decision does not interpret the NPV=0 principle in terms of how capital investors actually *do* determine what return they require, but in terms of a theoretical algebraic assessment of how the QCA considers investors *should* determine what return they require. As set out above, our view is that evidence of how investors actually do determine their required return is more relevant to the regulatory objectives and pricing principles and should be weighted accordingly. By contrast, the UT5 Draft Decision gives no weight to the evidence of how investors actually do go about determining their required return.

32 In any event, we explain below that the theoretical algebraic assessment that is adopted in the UT5 Draft Decision is flawed in that it begins by assuming the result that is to be proved.

33 In our previous report, we noted that:

a. The standard market practice is to use a 10-year risk-free rate when calculating the required return for infrastructure assets, including for regulated infrastructure assets (even those regulated by the QCA);

b. The dominant practice of other regulators is to use a long-term risk free-rate with maturity of 10 years or more; and

c. The NPV=0 criterion is that the regulator must set the allowed return equal to the return that is required by the providers of capital. If the allowed cash flows are set on the basis of the same return that investors require, then (self-evidently) the present value of the allowed cash flows to investors will be zero. Similarly, Incenta (2013) conclude that:

> In this context, the NPV=0 principle says nothing more than that the discount rate should be the correct one for the cash flows being considered.[27]

34 Consequently, our view is that the term of the risk-free rate should be set to 10 years to match the standard market practice. Only if there is such a match would the NPV=0 principle be satisfied; only then would the present value of the allowed 'return on capital' cash flows to investors be equal to zero.

35 The UT5 Draft Decision does not dispute the evidence that the standard commercial practice is to use a 10-year risk-free rate when calculating the required

[27] Incenta, 2013, Term of the risk-free rate for the cost of equity, June, p. 6.

return. That is, there does not appear to be any dispute about the fact that real world providers of capital are using a 10-year risk-free rate when computing required returns.

36 Rather, the approach adopted in the Draft Decision, and in previous QCA decisions, is independent on any evidence of the returns that real world investors actually *do* require. It is instead based on algebraic derivations of what the QCA considers that investors *should* require.

37 In this section of the report, we explain the assumptions on which the algebraic derivations are based and demonstrate that they do not apply in the real world. This is why the observed real world market practice is inconsistent with those algebraic derivations.

3.2 The certainty assumption relied on in previous decisions

38 In our previous report,[28] we noted that the QCA's approach to the term of the risk-free rate is based on submissions from Dr Lally that are very clear about the assumption that serves as the foundation for all of his derivations. He assumes that the regulatory process is such that the market value of the regulated assets at the end of each regulatory period is not subject to any risk:

> …the output price will be reset to ensure that the value at that time of the subsequent payoffs on the regulatory assets equals the regulatory asset book value prevailing at that time[29]

such that the:

> …payoffs at time 4 [the end of the regulatory period in his example] are certain.[30]

39 The QCA follows this approach in its Market Parameters Decision, explicitly relying on the certainty assumption:

> The correct analytical process (i.e. underlying equations 5-7 above) recognises that the revenues to be received at the end of the second year **will be known** at the end of the first year, and therefore will have a value at the end of the first year of $.20m – **regardless of what the one-year risk free rate is in one year.** So, the discount rate to be applied now to this $.20m value arising in one year **with certainty** is the current one-year risk-free rate of 5.0%.[31]

[28] Frontier Economics, 2017, *The term of the risk-free rate*, September, Section 3.5.

[29] Lally (2012), p. 14.

[30] Lally (2012), p. 10.

[31] QCA, 2014, Market Parameters Decision, pp. 45-46. Emphasis added.

40 Thus, the analysis in the Market Parameters and UT4 decisions relies on the value of the asset at the end of the regulatory period being known with certainty from the outset.

41 Incenta (2013) have also recognised that the argument is that the regulatory cash flows have:

> …similar characteristics to a 5 year bond, in that an investment exists at the start of the period, delivers coupons during the period and **delivers a certain residual value** (equivalent to a return of principal from a bond) at the end of the period.[32]

42 However, it is precisely because the end-of-period asset value is *not* known with certainty that real world investors do *not* limit the risk-free rate to the length of the regulatory period.

3.3 Developments in the UT5 Draft Decision and Lally (2017)

The new set of algebraic derivations

43 The UT5 Draft Decision now proposes that the certainty assumption that was relied on in the Market Parameters Decision is no longer required to support the practice of limiting the risk-free rate to the length of the regulatory period:

> Our view is that term-matching will satisfy the NPV=0 principle even if there is *ex ante* uncertainty about the value of the regulatory assets at the end of the regulatory period[33]

44 This conclusion is based on a new set of algebraic derivations presented in Lally (2017).[34] These new derivations consider a special case where a specific type of uncertainty about the end-of-period asset value is considered.

45 Lally (2017) introduces uncertainty in the form of a random change to the RAB made at the end of each regulatory period. The situation considered there is one in which the RAB at the end of each regulatory period is changed by an amount of $Z, where Z has a mean of zero and is uncorrelated with market returns. Specifically, the RAB is equally likely to be increased or decreased by a random amount (that is unrelated to the state of the economy or market returns) to re-set it to the replacement cost at that time.

46 In our view, there are three main problems with this example:

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32 Incenta, 2013, p. 6, emphasis added.

33 UT5 Draft Decision, p. 73.

34 Lally, M., 2017, *Review of submissions from Frontier Economics on the WACC for Aurizon Network*, 8 November.

a. It is irrelevant to the case at hand because the Aurizon Network RAB is *not* re-set to replacement value at the end of each regulatory period;

b. Logically, it does not follow that because *one specific* (irrelevant) form of uncertainty can be accommodated within the QCA's current framework, that framework is robust to *all* forms of uncertainty about the end-of-period asset value; and

c. The example that is presented assumes the result that it is said to prove.

47 In relation to the third point above, Lally (2017, Equation 3) is as follows:

$$V_1 = \frac{(.5B + Z)(1 + R_{12})}{1 + R_{12}} = .5B + Z.$$

48 In this formula:

a. The numerator represents the cash flow allowed by the regulator. It is the product of the RAB (which has been depreciated and then adjusted by the random Z) and the allowed return on capital denoted by R_{12}; and

b. The denominator represents the return that is required by investors, also denoted by R_{12}.

49 The R_{12} terms then cancel out, because they are *assumed* to be the same. But if the regulator's allowed return is equal to the return that investors require, the NPV=0 principle is automatically satisfied – that is the very definition of the NPV=0 principle.

50 Thus the NPV=0 principle is shown to be satisfied by assuming that it is true.

51 The key point is that the uncontested evidence (summarised above) clearly shows that real-world investors set their required return using a 10-year risk-free rate, but the QCA proposes to use a different risk-free rate. This can be shown by augmenting the above equation as follows:

$$V_1 = \frac{(.5B + Z)\left(1 + R_{12}^{Allowed}\right)}{1 + R_{12}^{Required}}.$$

52 In summary, the new set of algebraic derivations rely on the allowed return being set equal to the return that investors require. The simplest way to equate these two terms is for the regulator to set the allowed return using the same 10-year risk-free rate that investors use when computing their required return. The alternative is to base the allowed return on the 4-year risk-free rate on the basis that that is what real-world market participants *should* be using.

53 It is important to note that the formula above does not show that investors should be using a 4-year risk-free rate. It simply shows that:

a. If investors are using a 4-year risk-free rate, the NPV=0 principle requires that the allowed return should also be based on the 4-year risk-free rate; and

b. If investors are using a 10-year risk-free rate, the NPV=0 principle requires that the allowed return should also be based on the 10-year risk-free rate.

A premium for systematic risk

54 Lally (2017) also briefly addresses the case where the uncertainty at the end of the regulatory period *is* correlated with market returns. In this case, he concludes that the allowed return must be increased to provide appropriate compensation for this risk:

> …the appropriate discount rate on the payoffs on the regulatory assets at the end of the first year should now be the one-year risk-free rate augmented by a risk premium (p_{01}). This premium is therefore also added by the regulator to its allowed cost of capital in the first year.[35]

55 However, the UT5 Draft Decision does not consider the extent to which there is any end-of-period uncertainty about the market value of the regulated asset or the extent to which any such uncertainty might be systematic. Moreover, there appears to be no place within the QCA's regulatory model to accommodate any such premium.

56 That is, even if all of the issues we have raised are set aside, the premium for uncertainty about the end-of-period market value is not accommodated in the UT5 Draft Decision.

Existence of systematic risk

57 The analysis above shows that the key issue is whether there is a correspondence between the regulator's allowed return and the market's required return. One area where these two quantities might differ is in relation to the term adopted for the risk-free rate.

58 Another area is in relation to the market risk premium, where the QCA's approach of applying predominant weight to historical averages from 1958 produces very stable MRP allowances. By contrast, the actual MRP required by market participants might vary more with changes in market conditions, and it is possible that this mis-match between the market requirement and the regulatory allowance might create a systematic risk.

59 In this regard, Lally (2016) concludes that the (relatively constant) allowed MRP is likely to be:

[35] Lally, 2017, p. 7.

a. Above the true MRP when market conditions are favourable; and

b. Below the true MRP when market conditions are unfavourable.

60 He notes that if a relatively constant MRP is adopted:

> …one consequence is that values are likely to be too high at certain times and too low at other times[36]

such that regulated firms are over-compensated in good times and under-compensated in bad times. These:

> MRP estimation errors[37]

are clearly a source of systematic risk.

61 Although Lally (2016) goes on to note that the MRP estimation errors might be somewhat offset by debt risk premium estimation (DRP) errors that go in the opposite direction, our view is that this whole analysis demonstrates that there are a number of reasons why the regulator's allowed return might differ from the return that actual market investors might require. The sources of differences include the use of different risk-free rates and the MRP and DRP estimation errors identified by Lally (2016). Consequently, there is likely to be a systematic element to the mis-match between the allowed return and the required return, which would warrant a premium that is not provided for in the QCA's regulatory model.

Conclusions

62 For the reasons set out above, our view is that:

a. The NPV=0 principle is satisfied only when the regulator's allowed return is set equal to the market's required return;

b. There is clear evidence that the market sets required returns with reference to the 10-year risk-free rate; and consequently

c. The QCA should set the allowed return with reference to the 10-year rate, in accordance with mainstream commercial and regulatory practice.

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[36] Lally, 2016, *Review of further WACC issues*, 22 May, pp. 8-9.

[37] Lally, 2016, p. 9.

4 Inconsistency in real risk-free rates

63 The expected real risk-free rate is used in two places in the QCA's determinations:

a. RAB roll-forward: The QCA first sets the allowed nominal return on capital. The expected real return flows into the MAR calculation after the estimated inflationary component has been subtracted. The RAB is then increased by actual inflation over the regulatory period with a view to it being returned to investors in future periods;[38] and

b. Siegel estimate of the MRP: The Ibbotson estimate of the MRP is adjusted by adding the observed real return on government bonds and then subtracting an estimate of the expected real risk-free rate.

64 The impact on Aurizon Network of different estimates of the real risk-free rate works in the opposite direction in the two places where it appears:

a. For the RAB roll-forward, Aurizon Network is disadvantaged by a *low* expected real-risk free rate. In this case, the MAR is lower and more of the return is pushed further into the future; and

b. For the Siegel estimate of the MRP, Aurizon Network is disadvantaged by a *high* expected real risk-free rate. This is because the expected real risk-free rate is subtracted when implementing the QCA's Siegel approach.

65 There are two methods for estimating the expected real risk-free rate:

a. It can be observed as the yield on inflation-protected government bonds. This approach currently produces a figure of 1.1%;[39] and

b. It can be estimated by removing expected inflation from the nominal government bond yield using the Fisher relation. In the UT5 Draft Decision, the QCA adopts a nominal risk-free rate of 1.9% and expected inflation of 2.4%, which jointly imply an expected real risk-free rate of -0.5%.

66 We note that a negative real risk-free rate implies that investors are willing to invest in government bonds with the expectation that the invested funds will be able to purchase fewer goods at the end of the investment than at the beginning, which seems implausible.

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[38] We note that there is under-compensation if the actual inflation that is used to increase the RAB is less than the expected inflation figure that is used to reduce the MAR. But that is not the point being made here. Rather, we simply note that the allowed MAR in the current regulatory period depends on the estimate of the expected real return (i.e., the expected nominal return net of expected inflation).

[39] RBA, Table F2.

67 However, the point in this section relates to the consistency between estimates. The UT5 Draft Decision uses:

a. The Fisher relation method when computing the MAR vs. RAB roll-forward allocation. This produces a lower estimate in circumstances where a low estimate results in a lower MAR; and

b. Inflation-indexed government bond yields when applying the Siegel approach. This produces a higher estimate in circumstances where a higher estimate results in a lower MAR.

5 Price shocks driven by risk-free rate changes

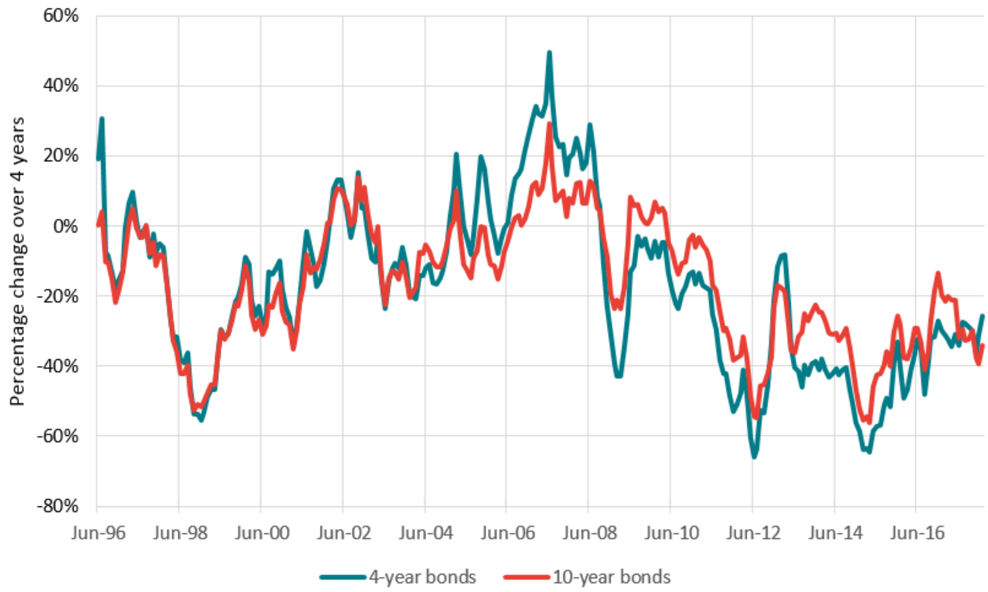
68 Figure 3 below shows the percentage change over four years in the yields on 4-year and 10-year Commonwealth Government bond yields. This provides an indication of the relative changes in risk-free rate estimates from one 4-year regulatory period to the next.

69 The figure shows that the 4-year yield is more volatile than the 10-year yield:

a. When rates are rising, the 4-year yield tends to rise proportionally more than the 10-year yield (e.g., in the run-up to the GFC in 2007); and

b. When rates are falling, the 4-year yield tends to fall proportionally more than the 10-year yield (e.g., the peak of the GFC in late 2008).

Figure 3: Percentage change over four years in yields on 4-year and 10-year Commonwealth Government bond yields



Source: Reserve Bank of Australia, Frontier Economics calculations.

70 The higher volatility associated with the 4-year yield means that:

a. Price changes for customers will tend to be proportionately higher from one regulatory period to the next if the 4-year yield is used. This makes it more difficult for customers to forecast and budget for future costs.; and

b. Returns received by investors will also tend to be proportionately more volatile from one regulatory period to the next, thereby inhibiting capital investment.

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