frontier economics

The term of the risk-free rate

Report prepared for Seqwater | 17 June 2021

Disclaimer

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1 Executive Summary

1.1 Author of report

1. 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 a range of courses in finance, corporate valuation and econometrics. I have published widely in high-level academic journals, and I have more than 20 years of practical finance consulting experience.
2. My teaching, research and consulting experience extends to issues relating to statistical analysis and econometric modelling. I have published widely in the areas of financial econometrics and empirical finance, including papers in relation to the estimation of WACC parameters. I have also prepared numerus reports for firms and regulatory bodies relating to the estimation of regulatory WACC parameters.
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4. A copy of my curriculum vitae has been provided with 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 of Chapter 11 Part 5 of the Queensland Uniform Civil Procedure Rules 1999. I have read, understood and complied with the Rules.
6. I have been assisted in the preparation of this report by Dinesh Kumareswaran and James Key from Frontier Economics.

1.2 Summary of key conclusions

1.2.1 Primary conclusion

7. The primary conclusion of this report is that the QCA should maintain its current approach of adopting a 10-year term for the risk-free rate.
    a This approach is consistent with the approach adopted by other regulators, corporations, investors, independent expert valuation professionals, and is recommended in leading textbooks.

1.2.2 The evolution of the QCA's approach to the risk-free rate

8. Over the last five years, the QCA's approach to the term of the risk-free rate has evolved materially:

    a In its 2014 Market Parameters Decision, the QCA set the term of the risk-free rate equal to the length of the particular regulatory period – the so-called 'term matching' approach;

    b In its 2018 UT5 Final Decision for Aurizon Network, the QCA set the allowed return somewhere between that obtained from a term-matched risk-free rate and that obtained from a 10-year risk-free rate; and

    c In its 2019 Draft Decision for Queensland Rail, the QCA adopted a 10-year risk-free rate and did not use the term matching approach at all.

9. The reasons the QCA has given for moving to a 10-year risk-free rate include the following: [1]

    a The QCA considers that the term matching approach is no longer providing appropriate regulatory outcomes;

    b The standard practice of other Australian regulators is to use a 10-year risk-free rate;

    c Commercial market investors determine their required returns with reference to a 10-year risk-free rate; and

    d Adopting a benchmark risk-free rate below the return that commercial market investors require would have materially detrimental impacts on investment and operational efficiency.

1.2.3 Commercial practice and the role of the regulator

10. When computing the return that is required on investments in infrastructure assets, the standard approach adopted by independent expert valuation firms, corporations, investors, and other market participants is to set the risk-free rate equal to the yield on 10-year government bonds. This is relevant because:

    a The infrastructure assets that are subject to regulation by the QCA must compete for capital with other infrastructure investments; and

    b There is evidence that the market approach is to use a 10-year risk-free rate even when assessing regulated infrastructure assets, including those regulated by the QCA.

11. My view is that the objective of the regulator should be to set the allowed return equal to the return that commercial market investors require from the regulated firm. This is because, as explained in the report:

    a Setting the allowed return equal to the commercial required return creates the proper incentive for efficient investment in the regulated asset; and

    b Setting the allowed return equal to the commercial required return creates the proper incentive for efficient operation of the regulated asset.

[1] QCA, April 2019, Queensland Rail Draft Decision.

12. In summary, my view is that the regulator should adopt a 10-year risk-free rate, commensurate with the approach that market participants use to determine the required return. That approach meets the incentive-based objectives of the regulatory regime.

1.2.4 The NPV=0 principle

13. In its decisions, the QCA frequently refers to the 'NPV=0 principle' which states that the present value of the allowed cash flows should equal the value of the regulated asset.

14. In relation to the NPV=0 principle, my views are that:

    a NPV=0 says nothing more than that the allowed return should be commensurate with the return that commercial market investors require. If investors determine their allowed return with reference to the 10-year risk-free rate, that same approach should be used when setting the allowed return.

    b The use of a 10-year risk-free rate reflects the principle that a long-term rate should be used for long-lived assets. This is the standard approach recommended in textbooks and used in practice.

    c The QCA's previous term-matching approach to the risk-free rate was based on the assumption that the market value of the asset at the end of the regulatory period was known with certainty from the outset. However, of course, the market value of the regulated asset at the end of the regulated period is not known in advance, so any propositions or mathematical derivations that are based on that assumption are irrelevant. Consequently, setting the term of the risk-free rate equal to the term of the regulatory period will *not* be consistent with the NPV=0 principle.

    d Consequently, a long-term risk-free rate should be used, which is consistent with the long-term (uncertain) cash flows that determine the value of the asset.

1.2.5 Internal consistency in the application of the CAPM formula

15. The risk-free rate appears in two places in the CAPM formula. The Australian Competition Tribunal, in *GasNet*,[2] has held that the same figure must be used in both places.

16. Consequently, if a 4-year term is adopted for the risk-free rate, for example, the MRP must also be estimated relative to the same 4-year risk-free rate.

17. The QCA is able to produce MRP estimates relative to a 4-year risk-free rate for only some of its estimation methods; the QCA states that other methods are only capable of producing estimates relative to the 10-year risk-free rate.

18. If the QCA maintains its current approach of using a 10-year risk-free rate, this issue will be redundant as all MRP and risk-free rate estimates will be made using the same 10-year term.

1.2.6 Regulatory practice

19. I note that the dominant regulatory approach in Australia is to set the term of the risk-free rate equal to 10 years, consistent with the QCA's current approach.

[2] ACT, Application by GasNet Australia (operations) Pty Ltd, [2003] ACompT 6.

1.2.7 Recommendation

20. For the reasons set out above, my recommendation is that the QCA should maintain its current approach of using a 10-year risk-free rate.

2 Background and context

2.1 Overview

21. This section sets out the evolution of the QCA's approach to the term of the risk-free rate over the last five years:

    a In its 2014 Market Parameters Decision, the QCA determined that it would set the term of the risk-free rate equal to the length of the regulatory period, and that approach was adopted in the QCA's March 2018 Final Decision for Seqwater;

    b In its December 2018 Final Decision for Aurizon Network, the QCA moved to an approach somewhere between a term-matched risk-free rate and one based on a term of 10 years.

    c In its April 2019 Draft Decision for Queensland Rail, the QCA adopted a 10-year risk-free rate and concluded that a term-matched risk-free rate should not be used.

22. This section of the report sets out the reasons that the QCA has given for moving to a 10-year risk-free rate, including:

    a The QCA considers that the term matching approach is no longer providing appropriate regulatory outcomes;

    b The standard practice of other Australian regulators is to use a 10-year risk-free rate;

    c Commercial market investors determine their required returns with reference to a 10-year risk-free rate; and

    d Adopting a benchmark risk-free rate below the return that commercial market investors require would have materially detrimental impacts on investment and operational efficiency.

2.2 The approach in the QCA's 2014 Market Parameters Decision

23. Prior to its 2018 Seqwater review, the QCA's approach had been to fix the term of the risk-free rate to the length of the regulatory period. For a regulatory period of three years, for example, the QCA approach had been to set the allowed risk-free rate equal to the yield on Commonwealth government three-year bonds, measured over a 20-day averaging period shortly before the beginning of the regulatory period.

24. This 'term-matching' approach was set out in the QCA's 2014 Market Parameters Decision, wherein the QCA rejected the notion that a 10-year term should be used to replicate the approach that firms, investors, and independent valuation experts use in practice. The QCA instead stated that, whereas market participants are concerned with establishing the fair market value of an asset and the return that they would require to invest in it, the QCA's task is a different one:

> *Stakeholders asserted that, as a key objective of economic regulation is to replicate competitive market outcomes, and firms in competitive markets base their returns on the 10-year rate, the 10-year term is therefore the more relevant term for setting the risk-free rate.*

> *However, the QCA Act requires the QCA to promote revenue adequacy and to 'promote the economically efficient operation of, use of and investment in, significant infrastructure by which services are provided, with the effect of promoting effective competition in upstream and downstream markets'.* [3]

25. In my view, the QCA's task is best performed by setting the allowed return equal to the fair market return that is required by market participants. As I explain in subsequent sections of this report, setting the allowed return equal to the required market return creates precisely the right incentives for efficient investment and operation of infrastructure assets and promotes competition in upstream and downstream markets. Consequently, my view is that, since all market participants use a 10-year risk-free rate, the QCA should adopt that approach. However, in its 2014 Market Parameters Decision, the QCA rejected that approach in favour of its term-matching approach.

26. The QCA noted that it had based its term-matching approach on research from Dr Martin Lally in relation to the so-called NPV=0 principle:

> *The QCA has based its decision to match the term of the risk-free bond to the term of the regulatory cycle in part on Dr Lally's research, which demonstrates that term-matching is necessary to satisfy the NPV = 0 Principle.* [4]

27. The Lally view is set out in a series of reports commissioned by the QCA. The most recent statement on this issue from Dr Lally appears in a 2015 report[5] in which he proposes that the QCA should not be concerned with the return that market participants *do* require when valuing assets, but rather with the return that he says they *should* require in satisfying the conceptual NPV=0 principle:

> *…the QCA is not engaged in valuing equities but in periodically setting the allowed rate of return in order to cover a business's efficient costs, and this is equivalent to satisfying the NPV = 0 principle. Since the exercises are different, what is appropriate in one case need not be appropriate in the other.* [6]

28. That is, Dr Lally proposes that the QCA should set the allowed return on equity according to what it considers would be required to satisfy the NPV=0 principle, rather than according to what the market evidence suggests is the actual return that investors require.

29. In subsequent sections of this report, I demonstrate that the NPV=0 principle requires nothing more than that the allowed return should be set equal to the required return from investors in the marketplace. An investment that generates a return exactly equal to the investors' required return, by definition, has an NPV=0. Indeed, it is antithetical to the definition of NPV to suggest that an NPV=0 can be obtained if the asset return is anything *other* than equal to the required return of investors.

30. Nevertheless, the approach in the QCA's 2014 Market Parameters Decision was to set the term of the risk-free rate equal to the length of the regulatory period, which is three years for Seqwater.

[3] QCA, 2014, Market Parameters Decision, p. 13.

[4] QCA, 2014, Market Parameters Decision, p. 12.

[5] Lally, M., 12 May 2015, Review of submissions on the MRP and the risk-free rate, Capital Financial Consultants Ltd.

[6] Lally (2015), p. 5.

2.3 The approach in the QCA's 2018 Seqwater Final Decision

31. In its 2017 submission to the QCA, Seqwater proposed to use a three-year term for the risk-free rate, being commensurate with the QCA's stated approach at the time. However, Seqwater noted that it did not agree with the QCA's approach to the risk-free rate at that time:

> *We have adopted, but do not agree with, the QCA's approach of aligning the term to maturity to the length of the regulatory period. For future reviews we will consider submitting that a more conventional term, such as 10 years, should be used. We note that such an approach is more consistent with regulatory and commercial practice.*[7]

32. In its March 2018 Final Decision, the QCA simply accepted Seqwater's submission:

> *We accept Seqwater's proposed methodology, as it is based on the approach we have adopted in other decisions.*[8]

33. There was no consideration in this determination of the relative merits of different approaches to setting the term of the risk-free rate.

2.4 The approach in the QCA's 2018 Final Decision for Aurizon Network (UT5)

34. In its December 2018 Final Decision for Aurizon Network (UT5), the QCA moved away from its term-matching approach. In particular, the QCA recognised that other Australian regulators adopt a 10-year term for the risk-free rate, commensurate with market practice:

> *In arriving at a WACC of 5.7 percent, the QCA has exercised judgement with reference to a bottom-up assessment of individual WACC parameters and has given consideration to approaches adopted by other Australian regulators – the use of a 10-year bond to estimate the risk-free rate, and the use of independent third-party data to estimate the debt risk premium.*[9]

35. In its UT5 Decision, the QCA set the allowed WACC to a point within the range bounded by a term-matched 4-year risk-free rate at one end and the market/commercial 10-year risk-free rate at the other.

36. The QCA accepted that its mechanistic bottom-up approach to WACC using a term-matched risk-free rate would result in:

> *the risk of Aurizon Network's legitimate business interests not being satisfied.*[10]

37. The QCA also noted that its decision:

[7] Seqwater, 31 July 2017, Submission to 2108 Bulk Water Price Review, Part B, p. 57.

[8] QCA, 2018, Seqwater Final Decision, p. 61.

[9] QCA, December 2018, UT5 Final Decision, p. ii.

[10] QCA, December 2018, UT5 Final Decision, p. 74.

> *recognises the asymmetric consequences of setting a WACC that is not commensurate with Aurizon Network's commercial and regulatory risks.* [11]

38. That is, setting the allowed return below the commercial required return has the important effect of curtailing efficient investment and creating an incentive:

> *to undertake operational decisions that adversely impact on network reliability or utilisation, or are otherwise to the detriment of the CQCN supply chain.* [12]

39. The QCA went on to note that its term-matching approach produces an allowed return that is out of step with other Australian regulators, being:

> *lower than regulatory decisions for other entities,* [13]

in which case it is important that:

> *the QCA has not bound itself to previous market parameter decisions where we consider past decisions are no longer providing appropriate regulatory outcomes for Aurizon Network and/or access seekers/holders.* [14]

2.5 The approach in the QCA's 2019 Draft Decision for Queensland Rail (QR)

40. In its April 2019 Draft Decision for Queensland Rail, the QCA:

    a Stated that it does not bind itself to its previous approaches, where those approaches are no longer providing appropriate outcomes;

    b Noted that the standard practice of other Australian regulators is to use a 10-year risk-free rate;

    c Noted that commercial market investors determine their required returns with reference to a 10-year risk-free rate; and

    d Concluded that a 10-year risk-free rate should be adopted and that a term-matched risk-free rate should not be used.

41. The QCA summarised its decision as follows:

> *The QCA does not bind itself to previous market parameter decisions where it considers past decisions are no longer providing appropriate regulatory outcomes. As part of the UT5 final decision, the QCA considered that there is merit in giving consideration to alternative approaches adopted by other Australian regulators, specifically adopting a 10-year bond term (and not a term-matched bond) to estimate the risk-free rate.*
>
> *We see merit in considering a 10-year bond term to estimate the risk-free-rate in undertaking a bottom-up WACC assessment. In estimating the term of the risk-free*

[11] QCA, December 2018, UT5 Final Decision, p. 74.

[12] QCA, December 2018, UT5 Final Decision, p. 75.

[13] QCA, December 2018, UT5 Final Decision, p. 75.

[14] QCA, December 2018, UT5 Final Decision, p. 75.

rate, other regulators have generally accepted the argument that the term of the bond should be a proxy for the life of the regulated asset. A 10-year risk-free rate is adopted by other Australian regulators including the AER, ACCC, IPART, ERA, ESCOSA and ESC. A longer-term bond may better reflect the expectations of investors—given the long-term nature of infrastructure asset investment.

Adopting such a position as part of a bottom-up WACC assessment provides for a return on investment that is at least commensurate with the commercial and regulatory risks involved. [15]

2.6 The remainder of this report

42. My view is that it is entirely appropriate for the QCA to adopt a 10-year risk-free rate, commensurate with the practice of other regulators, commercial market investors, infrastructure companies, and independent expert valuation professionals.

43. I agree with the QCA's reasons (summarised above) for moving to a 10-year term for the risk-free rate. In the remainder of this report, I explain each of the reasons to support a 10-year term:

    a Section 3 establishes that standard commercial practice is to use a 10-year risk-free and proposes that the appropriate role of the regulator is to set an allowed return on the basis of commercially required rate of return – as only that approach preserves the correct incentives.

    b Section 4 documents why the 10-year risk-free rate is conceptually correct, even in light of the conceptual justifications for term-matching that appeared in previous QCA Decisions.

    c Section 5 notes that a return to term-matching would be inconsistent with other parameters used in the CAPM; and

    d Section 6 details how other regulatory bodies use a 10-year risk-free rate, consistent with the QCA's most recent decisions.

[15] QCA, April 2019, Queensland Rail Draft Decision, p. 32.

3 Commercial practice and the role of the regulator

3.1 Overview

44. When computing the return that is required on investments in infrastructure assets, the standard approach adopted by independent expert valuation firms, corporations, investors, and other market participants is to set the risk-free rate equal to the yield on 10-year government bonds. This is relevant because:

    a The infrastructure assets that are subject to regulation by the QCA must compete for capital with other infrastructure investments; and

    b There is evidence that the market approach is to use a 10-year risk-free rate even when assessing regulated infrastructure assets, including those regulated by the QCA.

45. My view is that the objective of the regulator should be to set the allowed return equal to the return that commercial market investors require from the regulated firm. This is because:

    a Setting the allowed return equal to the commercial required return creates the proper incentive for efficient investment in the regulated asset:

        i Setting the allowed return lower than the required return creates a disincentive to invest as the firm is unable to pay the return that investors require; and

        ii Setting the allowed return above the required return creates an incentive for inefficient investment as the firm is able to pay investors a return above what they require; and

    b Setting the allowed return equal to the commercial required return creates the proper incentive for efficient operation of the regulated asset:

        i Setting the allowed return lower than the required return creates an incentive to extract 'savings' from the operation of the regulated asset, such that the allowed return can be 'topped up' to meet the commercial return that investors require in the short run; and

        ii Setting the allowed return above than the required return blunts the incentive to operate the regulated asset efficiently in that excess allowed returns can be used to cover inefficient expenditure, while still providing investors with the returns that they require.

46. In summary, my view is that the regulator should adopt a 10-year risk-free rate, commensurate with the approach that market participants use to determine the required return. That approach meets the incentive-based objectives of the regulatory regime.

3.2 Commercial practice is to use a long-term discount rate even for regulated firms

47. In this subsection of the report, I show that the dominant practice of market practitioners and valuation professionals is to set the term of the risk-free rate to 10 years on the basis that this is

the longest observable term for Australian government bonds. This practice is consistent with the view that infrastructure investments, including those subject to regulation, are long-lived investments with a long period over which cash flows are uncertain. It is also consistent with the view that regulated infrastructure investments must compete for equity capital with similar unregulated investments, for which the required return is undoubtedly based on a 10-year risk-free rate.

48. For example, the standard approach used in independent expert valuation reports is to set the risk-free rate equal to the yield on 10-year government bonds. These reports usually contain a statement to the effect that the use of a 10-year term assumption is standard practice among valuation professionals in Australia.

49. Importantly, independent experts uniformly adopt a ten-year term when determining the risk-free rate for infrastructure assets, including regulated infrastructure assets across a range of different industries. In this section of the report, I present examples from a range of independent experts covering a number of different infrastructure firms including regulated and unregulated businesses. These examples indicate that the use of a 10-year risk-free rate is common practice across experts, industries, and whether or not the firm is regulated.

50. For example, in its 2014 report for Envestra Ltd, a firm that owns and operates regulated gas distribution networks, Grant Samuel noted that:

> *The ten-year bond rate is a widely used and accepted benchmark for the risk-free rate. Where the forecast period exceeds ten years, an issue arises as to the appropriate bond to use. While longer term bond rates are available, the ten-year bond market is the deepest long-term bond market in Australia and is a widely used and recognised benchmark. There is a limited market for bonds of more than ten years. In the United States, there are deeper markets for longer term bonds. The 30-year bond rate is a widely used benchmark. However, long term rates accentuate the distortions of the yield curve on cash flows in early years. In any event, a single long-term bond rate matching the term of the cash flows is no more theoretically correct than using a ten-year rate. More importantly, the ten-year rate is the standard benchmark used in practice.*[16]

51. 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, Grant Samuel included the passage above and also noted that:

> *Ten-year bonds are the accepted market benchmarks globally and are typically used as a proxy for the long-term risk-free rate where the forecast period exceeds ten years and there is no liquid market for longer term bonds.*[17]

52. 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, KPMG stated that:

> *…the risk-free rate is calculated with reference to Australian government securities with a ten-year term to maturity.*[18]

[16] Grant Samuel Independent Expert Report for Envestra Ltd, March 2014, Appendix 3, p. 4.

[17] Grant Samuel Independent Expert Report for Prime Infrastructure Ltd, October 2010, Appendix 1, p. 7.

[18] KPMG Independent Expert Report for DUET Ltd, March 2017, p. 174.

53. Similarly, in its 2015 report for Energy Developments Ltd, a business that owns and operates a number of unregulated electricity generation assets, Deloitte used the yield on 10-year government bonds on the basis that:

> *The frequently adopted proxy for the risk-free rate is the long-term Government bond rate.*[19]

54. Incenta (2013)[20] also conclude that the dominant commercial practice is to use a 10-year term for the risk-free rate:

> *In conclusion, we recommend using a 10-year risk free rate for estimating the cost of equity, and for this rate to be applied consistently to estimate the market risk premium…our view is based on achieving consistency with the practice of valuation professionals for whom the use of a 10-year term for the risk-free rate is widespread, and consistency with our observations of how investors actually value regulated infrastructure assets.*[21]

55. The KPMG 2017 Valuation Practice Report[22] sets out the results of a survey of corporations, valuation practitioners, fund managers, private equity and infrastructure investors, and investment bankers. The survey indicates that 95% of respondents adopt a risk-free rate based on the yield on 10-year government bonds. No respondents adopt a risk-free rate based on a shorter-term government bond. The remaining 5% of respondents adopt a "house view"[23] that is otherwise unexplained. In addition, more than 80% of respondents agreed that "the risk-free rate should be adjusted to a duration that matches the life of the asset."[24]

56. In summary, even if the appropriate benchmark is a regulated asset and the appropriate allowed return is one that reflects any effects of regulation itself, the evidence above suggests that investors use a 10-year risk-free rate when determining the required return on *regulated* assets.

3.3 The role of the regulator

57. My view is that the objective of the regulator should be to set the allowed return equal to the return that commercial market investors require from the regulated firm. This is because:

    a Setting the allowed return equal to the commercial required return creates the proper incentive for efficient investment in the regulated asset:

        i Setting the allowed return lower than the required return creates a disincentive to invest as the firm is unable to pay the return that investors require; and

        ii Setting the allowed return above the required return creates an incentive for inefficient investment as the firm is able to pay investors a return above what they require; and

[19] Deloitte Independent Expert Report for Energy Developments Ltd, September 2015, p. 57.

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

[21] Incenta (2013), p. 13.

[22] Available at: https://assets.kpmg/content/dam/kpmg/au/pdf/2017/valuation-practices-survey-2017.pdf.

[23] KPMG 2017 Valuation Practices Survey, p. 10.

[24] KPMG 2017 Valuation Practices Survey, p. 11.

b Setting the allowed return equal to the commercial required return creates the proper incentive for efficient operation of the regulated asset:

i Setting the allowed return lower than the required return creates an incentive to extract 'savings' from the operation of the regulated asset, such that the allowed return can be 'topped up' to meet the commercial return that investors require in the short run.

ii For example, by reducing preventative maintenance expenditure, the regulated firm can increase free cash flow in the short run to cover a temporary shortfall in allowed returns. However, this is likely to be inefficient in the long run as assets depreciate at a faster rate and repairs expenses increase.

iii Setting the allowed return above than the required return blunts the incentive to operate the regulated asset efficiently in that excess allowed returns can be used to cover inefficient expenditure, while still providing investors with the returns that they require.

3.4 Conclusion in relation to commercial practice and the role of the regulator

58. My view is that the regulator should adopt a 10-year risk-free rate, commensurate with the approach that market participants use to determine the required return. That approach meets the incentive-based objectives of the regulatory regime.

4 The NPV=0 principle

4.1 Overview

59. The NPV=0 principle is that the discount rate should be the correct one for the cash flows being considered. In my view, this is self-evident – if the correct discount rate is applied to the cash flows, the correct present value will be obtained. An investment that generates a return exactly equal to the investors' required return, by definition, has NPV=0. Indeed, it is antithetical to the definition of NPV to suggest that NPV=0 can be obtained if the asset return is anything *other* than equal to the required return of investors.

60. As set out above, investors and other market participants determine their required return with reference to the 10-year risk-free rate, in which case NPV=0 is obtained by using the same approach to set the allowed return.

61. The reason the commercial practice is to use a 10-year term for the risk-free rate is that the assets being financed have long lives and it is common to match the term of the risk-free rate to the life of the asset in question.

62. When it was using the term matching approach, the QCA argued that the relevant period was the length of the regulatory period because the value of the asset at the end of that period was known with certainty from the outset. Thus, the QCA argued that the cash flows after the end of the regulatory period were irrelevant because the asset could be valued by discounting the cash flows over the regulatory period and the known value at the end of that period.

63. However, of course, the market value of the regulated asset at the end of the regulated period is not known in advance, so any propositions or mathematical derivations that are based on that assumption are irrelevant.

4.2 A long-term risk-free rate for long-lived assets

64. The long-term risk-free rate, used when evaluating long-lived assets, is usually estimated as the yield on 10-year government bonds, those bonds having the longest-term available in the Australian market.

65. This is the standard approach adopted in finance textbooks. For example, Koller et al (2015) provide the following advice:

> *Use longer-term bonds; they will be better in line with the time horizon of corporate cash flows.*[25]

66. Similarly, Damodaran (2001) recommends that:

> *In practice, using a long-term government rate (even on a coupon bond) as the riskless rate on all the cash flows in a long-term analysis will yield a close approximation of the true value.*[26]

[25] Koller, T., M. Goedhart and D. Wessels, 2015, Valuation: 6th University Edition, Wiley, p. 290.

[26] Damodaran, A., 2001, Corporate Finance: Theory and Practice: 2nd Edition, Wiley, p. 188.

67. Pratt (2001) also recommends the use of a long-term risk-free rate (20 years in the US market) because:

> *It most closely matches the often-assumed perpetual lifetime horizon of an equity investment,*

and because:

> *It matches the longest-term bond over which the equity premium is measured in the Ibbotson Associates data series.*[27]

68. That is, Pratt also links the term of the risk-free rate to the term that was used when estimating the MRP.

4.3 What does NPV=0 mean?

69. In its 2014 Market Parameters Decision, the QCA concluded that when estimating the risk-free rate component of the regulated rate of return, it would:

> *…align the term of the risk-free rate with the term of the regulatory cycle.*[28]

70. The basis for this position is that aligning the term of the risk-free rate with the term of the regulatory period means that the net present value of expected cash flows to a regulated entity is equal to the regulated asset base. Dr Lally refers to this as the NPV = 0 principle. I agree that it is appropriate to estimate prices such that the present value of expected cash flows is equal to the asset value. However, I agree with Incenta (2013) 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.*[29]

71. That is, the NPV=0 principle does not say that the term of the risk-free rate must be equal to the length of the regulatory period. Rather, the NPV=0 principle says that the term of the risk-free rate should be appropriate for the cash flows that are being considered by investors.

72. The approach set out in the 2014 Market Parameters Decision is based on the notion that investors need only consider the cash flows through to the end of the regulatory period because the end-of-period market value of the regulated asset is known with 100% certainty from the outset – thus, there is no need to consider any subsequent cash flows. However, as set out above, it now seems accepted that the end of period market value of the assets is *not* certain, and that investors will consider *all* cash flows that the asset might generate over its life (as is the case with all other assets).

4.4 Key assumptions and their implications

73. The 2014 Market Parameters Decision and the 2015 UT4 Decision assume that the only way in which the NPV = 0 principle is satisfied is if the term to maturity of the risk-free rate proxy is set equal to the term of the regulatory period. This is said to follow from the notion that investors

[27] Pratt, S.P., 2002, Cost of Capital: Estimation and Applications: 2nd Edition, p. 60.

[28] QCA, 2014, Market Parameters Decision, Sub-section 3.5, p. 14, Paragraph 2.

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

need only consider the cash flows through to the end of the regulatory period because the end-of-period market value of the regulated asset is known with 100% certainty from the outset.

74. The second last paragraph of the example set out in the Market Parameters Decision makes this clear:

> *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%.*[30]

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

4.5 The NPV=0 principle and the end-of-period market value

76. The Queensland Treasury Corporation (QTC) (2014)[31] has submitted that the Market Parameters approach is analogous to assuming that the asset can be sold at the end of the regulatory period for an amount equal to the regulatory asset base. The Market Parameters Decision disagrees with that point on the basis that it "makes no assumption about assets being sold."[32] However, QTC was making a quite different point. The issue is not about whether or not the asset will be sold at the end of the regulatory period. The issue is about the market *value* of the asset at the end of the period – whether the asset is sold or not. One way to conceptualise what the market value of the asset would be at the end of the period would be to consider what price that asset would fetch, were it to be sold at the end of the period.

77. If the asset owner knew what cash flows would be received for each year of the regulatory control period, and if they also knew with certainty what the market value of the asset would be at the end of the regulatory period, the present value of the asset could be computed without considering cash flows beyond the end of the regulatory period. Two points are relevant here:

    a It is the *market* value of the asset that must be known at the end of the regulatory period. Knowing the RAB (or any other input that is one of the relevant considerations in determining cash flows beyond the current regulatory period) will be insufficient. To effectively convert the regulated asset into a bond requires that the market value of the asset must be known; and

    b The market value is the same whether the investor chooses to sell or retain the asset. That is, the question is about whether the market value at the end of the regulatory period is known with certainty, not about whether investors might, or might not, choose to sell at the end of the regulatory period.

78. QTC makes the point that the foundation for setting the term of the risk-free rate equal to the length of the regulatory period is that the market value of the asset at the end of the regulatory

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

[31] Queensland Treasury Corporation, 2014, The risk-free rate and the market risk premium, 20 January.

[32] QCA, 2014, Market Parameters Decision, Appendix B, p.47.

period is known with 100% certainty right from the beginning of the regulatory period. The asset has the same value whether or not the owner chooses to sell it.

79. I note that it is not just QTC who has submitted that setting the term of the risk-free rate to the length of the regulatory period is only consistent with the NPV=0 principle if the end-of-period market value of the asset is 100% certain from the outset. The same submission has been made by:

    a Incenta (2013); and

    b Officer and Bishop (2008)[33]

and has been accepted by the AER[34] and IPART.[35]

80. For example, Incenta (2013) state 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.*[36]

4.6 The Lally certainty assumption

4.6.1 End-of-period market value must be known with certainty

81. The term-matching approach to the risk-free rate is based on the research of Dr Lally. In particular, Lally (2012)[37] is 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*[38]

such that the:

> *…payoffs at time 4 [the end of the regulatory period in his example] are **certain**.*[39]

[33] Officer R. and S. Bishop, 2008, "Term of the Risk-Free Rate – Commentary," *Value Advisor Associates*, September.

[34] The AER addressed this specific question in its 2013 Draft Rate of Return Guideline Explanatory Statement pp 181-184. This led the AER to adopt a 10-year risk-free rate in its Draft Guideline. The AER affirmed that approach, and the reasoning that led to it, in its Final Rate of Return Guideline Explanatory Statement at p. 49. The AER has adopted a 10-year risk-free rate in every subsequent decision.

[35] IPART addressed these issues in its 2013 WACC Review Final Decision at pp. 11 and 19. IPART has adopted a 10-year risk-free rate in every subsequent determination.

[36] Incenta, 2013, p. 6, emphasis added.

[37] Lally, M., 2012, The risk-free rate and the market risk premium, Report for the Queensland Competition Authority, 23 August.

[38] Lally (2012), p. 14, emphasis added.

[39] Lally (2012), p. 10, emphasis added.

82. Lally (2013)[40] is even more explicit about the fact that the present value principle only supports term matching if the end-of period market value of the asset is known with certainty from the outset. Dr Lally sets out a two-period example in which the regulated asset has a two-year life, the initial RAB is $100, depreciation is $50 in each period, and the allowed return in the first period is 5%. Consequently, investors will receive cash flows of:

    a In period 1: $50 depreciation plus a return on capital of $100×5%; and

    b In period 2: $50 depreciation plus a return on capital of $50×$R_{12}$, where R_{12} is the allowed return for the second period, set by the regulator at the end of the first period.

83. Dr Lally then assumes that the market value of the asset at the end of the first period is known for sure right from the beginning of the first period. At the beginning of the first period no one knows what market conditions will prevail at the end of the first period. Consequently no one knows what return investors will require over the second period or what the regulator might allow over the second period. But Dr Lally assumes that the regulator will set the allowed return precisely equal to whatever it is that investors require. This ensures that the market value of the regulated asset at the end of the first period is known for sure right from the outset. Lally (2013, Eq. 1) states that:

$$V_1 = \frac{50 + 50\tilde{R}_{12}}{1 + \tilde{R}_{12}} = 50$$

where the R_{12} in the numerator is the regulator's allowed return and the R_{12} in the denominator is the investor's required return.

84. Given that the market value of the asset at the end of the first regulatory period is guaranteed from the outset, the current market value of the asset can be found by discounting the first period regulatory cash flows, plus the known end-of-period market value back over the first regulatory period. Lally (2013) explains that:

> *At the end of the first year, the regulated business will therefore receive V_1 = $50m plus revenues to cover regulatory depreciation of $50m and the cost of capital for the first year of $100m (.05).* ***Since this sum is known at the beginning of the first year*** *it can be valued using the prevailing risk-free rate, which is 5%. So the value now of V_1, plus the revenues received at the end of the first year, is $100m as follows:*[41]
>
> $$V_0 = \frac{(50 + 100 \times 0.05) + 50}{1.05} = 100$$

where the term in brackets is the regulatory allowed cash flow for the first period and the end-of-period market value is known for sure, $V_1 = 50$.

85. In summary, the assumption that the value of the asset at the end of the regulatory period is already known with 100% certainty at the beginning of the regulatory period is the basis for the derivation of the conclusion that the NPV=0 principle requires the term of the risk-free rate (and the overall return) to be set to the length of the regulatory period. If the market value of the asset at the end of the regulatory period is *not* known with certainty right from the outset, setting

[40] Lally, M., 2013, Response to submissions on the risk-free rate and the MRP, Report for the Queensland Competition Authority, 22 October.

[41] Lally (2013), p. 47, emphasis added.

the term of the risk-free rate equal to the length of the regulatory period is no longer consistent with the NPV=0 principle.

4.6.2 What if the end-of-period market value is not certain?

86. Of course, the market value of the regulated asset at the end of the first period (V_1) is *not* known with certainty from the outset. It is impossible for investors to know with certainty what the market value of an asset might be at the end of the regulatory period three, or four, or five years later. Rather, the market value of regulated assets varies up and down with market conditions. This is obvious from observing volatility in the share prices of firms that own predominantly regulated infrastructure assets.

87. In this case, the opening market value of the firm would be computed in the standard manner by discounting the expected cash flows over the life of the asset using a discount rate that is appropriate for those cash flows (in terms of risk and duration). The standard valuation calculation in this case is:

$$V_0 = \frac{CF_1}{(1+R_{02})^1} + \frac{CF_2}{(1+R_{02})^2}$$

where R_{02} is the investor's required return for a two-period horizon beginning at time 0.[42]

88. That is, if the market value of the regulated asset at the end of the first period (V_1) is *not* known with certainty from the outset, investors would value the asset by discounting the expected cash flows over the two-period life of the asset using the two-period discount rate. In this case, the "present value principle" would require the regulator to set allowed returns based on the two-period rate, not the (usually lower) one-period rate.

4.6.3 There is a difference between the horizon of uncertain cash flows and the quantum of risk

89. As set out above, Lally (2015) accepts that the end-of-period asset value is not known with certainty and states that the derivations in his reports for the QCA had made that assumption to simplify the analysis. He then suggests that this uncertainty is accommodated in the risk premium that is added to the risk-free rate.[43]

90. However, there are two quite separate issues:

    a The *horizon* of the cash flows, which is determined by the time over which the future cash flows are uncertain; and

    b The *risk* of the cash flows, which is determined by the extent to which those cash flows are uncertain.

91. That is, there is the horizon over which cash flows are uncertain and then there is the quantum of that uncertainty. For regulated assets there are long-term uncertain cash flows and that is what determines the horizon of the risk-free rate.

[42] Note that it is also theoretically appropriate to discount the first cash flow at the one-period zero-coupon discount rate and the second cash flow at the two-period zero-coupon discount rate. But this is equivalent (by construction) to discounting both cash flows at the two-period coupon rate R_{02} as above. Using a single rate for all cash flows over the life of the asset is also consistent with the uniform market practice.

[43] Lally (2015), p. 7.

92. The quantum of that uncertainty determines the amount of risk premium to be added. The adding of a premium for risk has no bearing on the horizon over which there are uncertain cash flows.

93. There are two ways to highlight the difference between the time over which cash flows are uncertain or risky and the quantum of that uncertainty or risk:

    a If it is correct to "cut off" a series of long-run risky cash flows on the basis that the uncertainty after (say) year 4 is all picked up in the beta, that approach could be applied to *any* series of long-run risky cash flows – on the basis that the beta somehow makes up for the fact that the wrong risk-free rate has been used. But such an approach is never used because there is no way of knowing whether or not a particular adjustment to the beta is sufficient to offset the use of a risk-free rate that does not match the horizon of the risky cash flows; and

    b The QCA's process for estimating beta is independent of its choice of the term of the risk-free rate – if the QCA adopted a 10-year or a 1-year risk-free rate, there would be no change to its beta estimate. Consequently it cannot be the case that the beta somehow makes up for the fact that the wrong risk-free rate has been used (i.e., a shorter-term risk-free rate has been applied to cash flows that are uncertain and risky over the long-term).

4.7 Conclusion in relation to the NPV=0 principle

94. For the reasons set out above, my view is that:

    a NPV=0 says nothing more than that the allowed return should be commensurate with the return that commercial market investors require. If investors determine their allowed return with reference to the 10-year risk-free rate, that same approach should be used when setting the allowed return.

    b The use of a 10-year risk-free rate reflects the principle that a long-term rate should be used for long-lived assets. This is the standard approach recommended in textbooks and used in practice.

    c The QCA's previous term-matching approach to the risk-free rate was based on the assumption that the market value of the asset at the end of the regulatory period was known with certainty from the outset. However, of course, the market value of the regulated asset at the end of the regulated period is not known in advance, so any propositions or mathematical derivations that are based on that assumption are irrelevant. Consequently, setting the term of the risk-free rate equal to the term of the regulatory period will *not* be consistent with the NPV=0 principle.

    d Consequently, a long-term risk-free rate should be used, which is consistent with the long-term (uncertain) cash flows that determine the value of the asset.

95. In summary, these conclusions support the QCA's current use of a 10-year risk-free rate.

5 Consistency between the risk-free rate and the market risk premium

5.1 Overview

96. In the CAPM, the market risk premium represents the extent to which the expected return on the market portfolio exceeds the risk-free rate:

$$r_e = r_f + \beta(r_m - r_f).$$

97. Thus, the risk-free rate appears in two places in the CAPM formula:

    a As the base rate of return; and

    b As the rate against which the market risk premium is measured.

98. Internal consistency (obviously) requires that the same risk-free rate must be used in the two places where it appears in the same formula.

5.2 The 2014 Market Parameters Decision

99. In its 2014 Market Parameters Decision, the QCA adopted a term-matched risk-free rate where it appears for the first time in the CAPM formula, but then measured the MRP relative to a 10-year risk-free rate – resulting in a clear internal inconsistency.

100. The QCA estimated the market risk premium to be 6.5%, that figure being estimated as the expected market return in excess of the 10-year risk-free rate. This estimate is formed on the basis of historical market returns, figures reported in survey evidence and independent expert reports, an estimate formed from applying the dividend discount model to analyst dividend expectations, and other market-based information.[44] In all cases, the premium was computed relative to the 10-year risk-free rate.

101. The important implication of the above is that the Market Parameters Decision made it clear that the market risk premium was estimated with reference to the yield on 10-year bonds.[45] But the term matching approach then uses a shorter-term risk-free rate where it appears for the first time in the CAPM formula. The two different risk-free rates are then inserted in different places in the same CAPM equation, for example:

$$r_e = r_{f,4-year} + \beta(r_m - r_{f,10-year}).$$

102. To the extent that the term matching risk-free rate is below the 10-year risk-free rate at the time of a regulatory determination, investors in the regulated firm will be undercompensated. This is made most obvious when considering a regulated firm with a beta of 1. The CAPM implies that for such firms the required return on equity is equal to the required return on the market portfolio, by definition, so that:

[44] QCA, 2014, Market Parameters Decision, Sub-section 4.3.4, p. 23, Paragraph 3.

[45] QCA, 2014, Market Parameters Decision, Sub-section 4.3.1, p. 20, Footnote 18; and Appendix C, p. 52, Paragraph 4.

$$r_e = r_m.$$

103. However, the inconsistent use of two different risk-free rates in the same equation would result in the allowed return being set as:

$$r_e = r_m - \left(r_{f,10-year} - r_{f,4-year}\right)$$

104. which results in a firm of average risk receiving less compensation than the CAPM benchmark for a firm of average risk – in the case where the 10-year rate is above the term matching rate.

5.3 *GasNet* inconsistency

105. In explaining its reasons for adopting a 10-year term for the risk-free rate, the AER recently had regard to the *GasNet* decision of the Australian Competition Tribunal:

> *The Australian Competition Tribunal (the Tribunal) decided in its 2003 GasNet decision that 10 years is the appropriate term of the risk-free rate in the CAPM. The Tribunal came to this view on the basis of two reasons:*
>
> - *As the MRP was estimated using a 10-year risk free rate, consistency demands that a 10-year risk free rate be used in the CAPM, and*
> - *It is a convention of economists and regulators to use a relatively long-term risk-free rate where the life of the assets is relatively long.*[46]

106. In its *GasNet* decision, the Tribunal stated that:

> *The position of the ACCC was that it was required to make an evaluative judgment for the purposes of s 8.30 as to what the appropriate Rate of Return should be. Its position was that although consistency was desirable, best estimates have to be used when perfect information is not available, and that at various stages of the CAPM, approximations and estimates are required. The ACCC contends that such a use of estimates and approximations does not invalidate the use of the CAPM. While it is no doubt true that the CAPM permits some flexibility in the choice of the inputs required by the model, it nevertheless requires that one remain true to the mathematical logic underlying the CAPM formula. In the present case,* ***that requires a consistent use of the value of r_f in both parts of the CAPM equation where it occurs*** *so that the choice was either a five-year bond rate or a ten-year bond rate in both situations.*[47]

107. The Tribunal went on to conclude that:

> *The ACCC erred in concluding that it was open to it to apply the CAPM in other than the conventional way to produce an outcome which it believed better achieved the objectives of s 8.1. In truth and reality,* ***the use of different values for a risk-free rate in the working out of a Rate of Return by the CAPM formula is neither true to the formula nor a conventional use of the CAPM****. It is the use of another model based on the CAPM with adjustments made on a pragmatic basis to achieve an outcome which reflects an attempt to modify the model to one which operates by reference to the regulatory period of five years. The CAPM is not a model which is*

[46] AER, 2013, Rate of Return Guideline Explanatory Statement, p. 48.

[47] ACT, Application by GasNet Australia (operations) Pty Ltd, [2003] ACompT 6, Paragraph 46, emphasis added.

> *intended to operate in this way.* ***The timescales are dictated by the relevant underlying facts in each case and for present purposes those include the life of the assets and the term of the investment***.[48]

108. In summary, the practice of using the 10-year yield to estimate the risk-free rate in one part of the CAPM formula, and the term matching yield to estimate the risk-free rate in another part of the same CAPM formula would be inconsistent with the Tribunal's *GasNet* ruling.

5.4 The QCA's 2014 response to *GasNet* inconsistency

109. In response to submissions that this represented an inconsistency, the 2014 Market Parameters Decision set out the following conclusion:

> *[T]he QCA has considered the arguments presented for applying a five-year rate for consistency with the first term in the CAPM and re-estimated the market risk premium using a five-year rate. The results of this analysis reinforce the QCA's conclusion that a market risk premium of 6.5% is reasonable.*[49]

110. This implies that the QCA considered that the average difference between the ten-year and term matching risk-free rates is within the rounding margin that the QCA applied when setting the allowed MRP. However, there are two further issues to consider in relation to this conclusion:

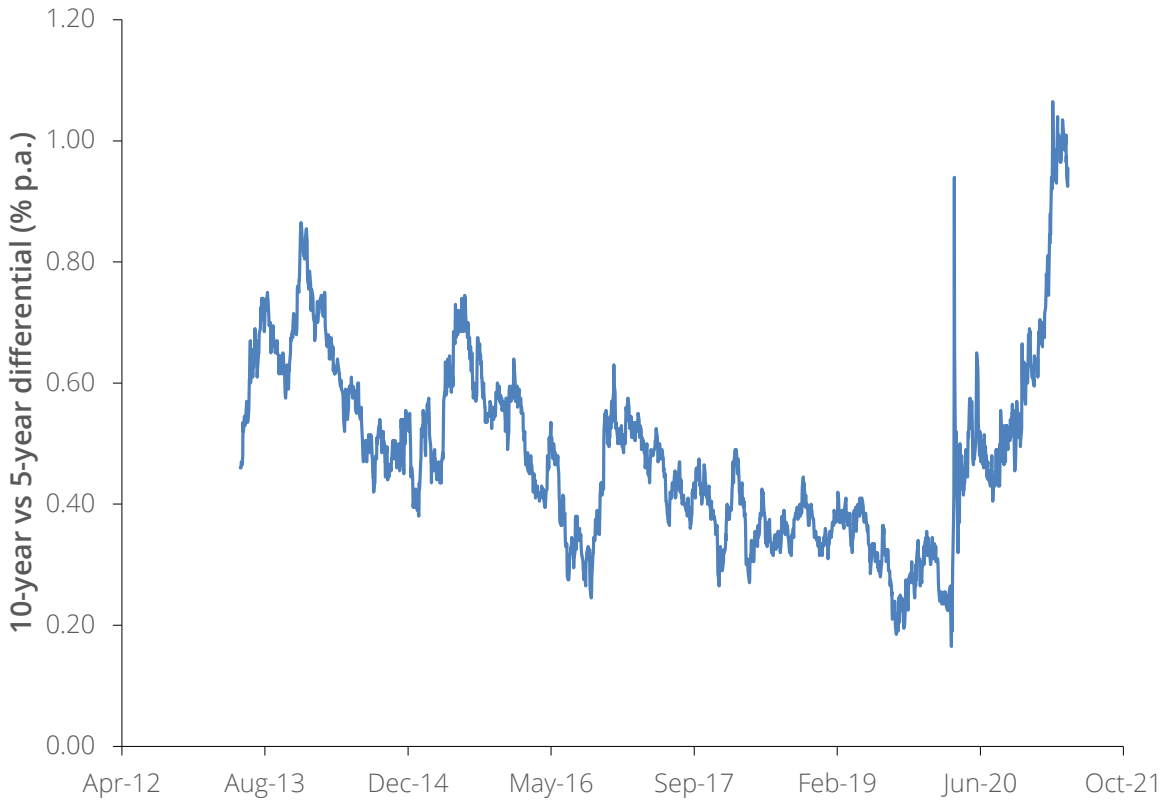
    a. There is no need to have any inaccuracy or any inconsistency at all. If the MRP is estimated with reference to the 10-year government bond yield, the 10-year government bond yield would simply be used throughout the CAPM equation; and

    b. Even if the difference between the regulatory-term and 10-year government bond yields are small *on average*, they can be very large at the time of a particular determination. For example, since 2013 the difference between the 10-year and the 5-year bond yields have differed between 20 and 105 basis points as illustrated in **Figure 1** below.

[48] ACT, Application by GasNet Australia (operations) Pty Ltd, [2003] ACompT 6, Paragraph 46, emphasis added.

[49] QCA, 2014, Market Parameters Decision, p. 52.

Figure 1: Spread between 10-year and 5-year Commonwealth Government bond yields



Source: RBA Table f02d.xls

111. **Figure 1** shows that since 2013, the 10-year government bond yield has exceeded the 5-year government bond yield by 20-105 basis points and is currently approximately 100 basis points. This difference is even greater when considering 4-year government bonds. As set out above, internally-consistent application of the CAPM requires that the same risk-free rate must be used in both places in the CAPM formula. Thus, where the MRP is estimated relative to the 10-year rate, the 10-year rate must be used elsewhere in the formula. The inconsistent use of a term matching rate, rather than the consistent use of a 10-year rate, would result in a material mis-estimation in the order of 100 basis points in the current market conditions.

5.5 Inability to estimate MRP for term other than 10 years

112. Since its 2014 Market Parameters Decision, the QCA has accepted that the use of two different risk-free rates in the same CAPM formula gives rise to a problematic inconsistency. For example, in its December 2018 UT5 Final Decision, the QCA stated:

> *The QCA has considered Aurizon Network's concern regarding the perceived inconsistency between using a four-year risk-free rate in the first term of the cost of equity and a 10-year risk-free rate to estimate the MRP. As a result, the QCA has made an explicit adjustment to most of the MRP estimates to address this matter.* [50]

[50] QCA, December 2018, Aurizon Network Final Decision, Appendices, p. 45.

113. This has led the QCA to consider consistent estimates, so that where a 4-year risk-free rate is used in the CAPM, the MRP is consistently estimated relative to the 4-year risk-free rate. [51]

114. However, in its UT5 Final Decision, the QCA was able to produce MRP estimates relative to the 4-year risk-free rate for only some of its methods and maintained MRP estimates relative to the 10-year risk-free rate for others.[52] The resulting MRP allowance was therefore an amalgam of 4-year and 10-year risk premiums that continued to violate the *GasNet* consistency principle.

115. Of course, if the QCA maintains its current approach of using a 10-year risk-free rate, this issue will be redundant as all MRP and risk-free rate estimates will be made using the same 10-year term.

5.6 Conclusions in relation to internal consistency

116. The risk-free rate appears in two places in the CAPM formula and the *GasNet* consistency principle requires that the same figure must be used in both places.

117. Consequently, if a 4-year term is adopted for the risk-free rate, the MRP must also be estimated relative to the same 4-year risk-free rate.

118. The QCA is able to produce MRP estimates relative to a 4-year risk-free rate for only some of its estimation methods; the QCA states that other methods are only capable of producing estimates relative to the 10-year risk-free rate.

119. If the QCA maintains its current approach of using a 10-year risk-free rate, this issue will be redundant as all MRP and risk-free rate estimates will be made using the same 10-year term.

[51] QCA, December 2018, Aurizon Network Final Decision, Appendices, p. 45.

[52] QCA, December 2018, Aurizon Network Final Decision, Appendices, p. 45.

6 Consistency with regulatory practice

6.1 Leading regulatory practice is to adopt a 10-year term

120. The current Australian regulatory practice is to use a ten-year term to maturity when estimating the risk-free rate. This practice is consistent with the view that infrastructure investments, including those subjects to regulation, are long-lived investments with a long period over which cash flows are uncertain. It is also consistent with the view that regulated infrastructure investments must compete for equity capital with similar unregulated investments, for which the required return undoubtedly begins with a 10-year risk-free rate.

121. 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.*[53]

122. The AER also notes that the Australian Competition Tribunal advocates the use of a 10-year term, as set out above.

123. 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.*[54]

124. The ESC,[55] ESCOSA[56] and the ICRC and ACT Industry Panel[57] also use a 10-year risk-free rate. The ERA of WA uses a 10-year risk free rate of return for railway assets,[58] although it currently maintains the use of a 5-year risk-free rate for electricity and gas assets. But for the ERA's approach to energy assets, the 10-year risk-free rate is uniformly adopted by Australian regulators.

[53] AER, 2013, Rate of Return Guideline Explanatory Statement, p. 34.

[54] IPART, 2013, Review of WACC Methodology, December, p. 12.

[55] ESC, 2016, Melbourne Water Price Review 2016 Final Decision, June.

[56] ESCOSA, 2016, SA Water Regulatory Determination 2016 Final Determination, June.

[57] ACT Industry Panel, 2014, Review of the ICRC 2013 Price Direction, December.

[58] ERA, May 2019, Draft Determination 2018 Weighted Average Cost of Capital at 30 June 2018.

6.2 Regulatory practice is to adopt a 10-year term because the end-of-period market value of the asset is not guaranteed

125. As set out above, the AER has rejected the term-matching approach. The AER recognised that aligning the term of the risk-free rate to the term of the regulatory period is only justified in the case where the end-of-period market value of the asset is known with certainty from the outset:

> *In Lally (2012), the argument for a five-year term relies on the 'present value principle'—the principle that the net present value (NPV) of cash flows should equal the purchase price of the investment.*
>
> *Lally stated that the present value principle is approximately satisfied only if the term of equity matches the regulatory control period. Lally illustrated this point using a numerical example in which there is no risk, so the return on equity equals the risk-free rate. The example sets allowed revenues at the beginning of the regulatory control period using the yield to maturity on a five-year risk-free bond. Lally showed that in this example, the 'present value principle' is approximately satisfied: the NPV of the cash flows is approximately equal to the book value of the assets.*
>
> *The reason why the principle is satisfied is that the structure of the bond payments and the structure of the regulatory payments are similar…The core intuition behind the argument for a five-year term is that the cash flows from the building block model have a similar structure to the cash flows from a five-year bond. Put simply, the argument is that an equity investment in a regulated business is—at least in respect of its term—like an investment in a five-year bond.*
>
> *The central issue in the debate about the term of equity, therefore, is the extent to which the cash flows from an equity investment in a regulated business are like the cash flows from a five-year bond.*[59]

126. However, the AER went on to note that the cash flows from an equity investment in a regulated business are *not* like the cash flows from a five-year bond in a very important respect – whereas a bondholder receives a known payment at maturity, the infrastructure equity owner does not. Rather, infrastructure equity (like all equity) is risky and the value of shares five years into the future cannot possibly be known with certainty. Using the same Lally derivation on which the QCA now relies, the AER notes that this necessary precondition does not hold in practice, but only under certain theoretical assumptions:

> *In Lally's calculation above, the cash flow in each year is the allowed revenue net of opex and capex, except in the final year, where the closing value of the regulatory asset base (RAB) is included in the cash flow. That is,* ***the assumption is that the investor receives a cash payment equal to the RAB in the final year of the regulatory control period****. While under certain assumptions, the market value of equity is equal to the residual value of the RAB,* ***these assumptions may not hold in reality****.*[60]

127. The AER then cited a report by Incenta (2013) which explains that:

[59] AER, 2013, Draft Rate of Return Guideline Explanatory Statement, p. 183.

[60] AER, 2013, Draft Rate of Return Guideline Explanatory Statement, p. 183, emphasis added.

c. The argument that the term of the risk-free rate should be set equal to the length of the regulatory period relies on the end-of-regulatory-period market value of the asset being known with certainty from the outset; and

d. Since this necessary precondition does not hold, the term of the risk-free rate should *not* be set to the length of the regulatory period:

> *…investors are unlikely to evaluate regulated assets with reference to a 5-year bond because – unlike the case of the bond – **the residual value at the end of each 5-year period is inherently risky**. This is because the residual value is not returned in cash, but rather comprises a 'value' whose recovery remains at risk from future regulatory decisions and changes in the market (both technological changes and changes to customer preferences).*[61]

128. The AER also noted that the same point has been made by Officer and Bishop (2008):

> *Officer and Bishop said that the argument for a five-year term would be correct only if after five years, in the event that 'they [the owners of the regulated business] choose to walk away from the asset, they would be fully compensated'. Officer and Bishop propose, however, that the owners are not, in reality, guaranteed of such compensation—the problem is that **there is no guarantee** that the secondary market will deliver a price equal to the value of the equity component of the RAB.* [62]

129. The AER concluded that the term of the risk-free rate should be set to 10 years and not to the length of the regulatory period.

6.3 Other issues raised by Incenta

130. In concluding that the term of the risk-free rate should be set to 10 years, the AER also cited two other points raised by Incenta. Incenta provided evidence (consistent with that set out above) that the commercial practice is to set the term of the risk-free rate to 10 years:

> *First, Incenta presented the results of a survey of market practitioners which asks them whether they use a 10 year or a five-year rate for valuing regulated equity. In this survey, 12 practitioners and two independent experts were asked specifically about 'the term of the risk-free rate in a CAPM valuation of regulated infrastructure assets with a five-year regulatory cycle'. All of those surveyed stated they used a 10-year rate.*[63]

131. Incenta also advised that if the term of the risk-free rate was set to less than 10 years, the MRP would need to be re-estimated on a consistent basis:

> *Second, Incenta observed that a move to a five-year term for equity would have implications for our estimates of the MRP. For example, the evidence relating to historical estimates of the MRP have been calculated using a 10-year risk free rate. If we were to move to a five-year term, this historical average may need to be recalculated (or approximated) using a five-year risk-free rate. The data we currently use to calculate historical averages of the MRP covers a significantly longer period*

[61] AER, 2013, Draft Rate of Return Guideline Explanatory Statement, p. 183, emphasis added.

[62] AER,2013, Draft Rate of Return Guideline Explanatory Statement, p. 183, emphasis added.

[63] AER,2013, Draft Rate of Return Guideline Explanatory Statement, p. 184.

than the data available for the five-year risk-free rate (which only extends back to the 1970s). [64]

132. The AER concluded that these:

...additional considerations support not adopting a five-year term.[65]

133. The AER then confirmed that it will maintain its use of a 10-year term.

6.4 Conclusions in relation to regulatory practice

134. I note that the dominant regulatory approach in Australia is to set the term of the risk-free rate equal to 10 years, consistent with the QCA's current approach.

[64] AER,2013, Draft Rate of Return Guideline Explanatory Statement, p. 184.

[65] AER, 2013, Draft Rate of Return Guideline Explanatory Statement, p. 184.

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