The term of the risk-free rate

REPORT PREPARED FOR DBCT MANAGEMENT PTY LTD

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Figures

1 Background and conclusions

1.1 Overview and instructions

1 Frontier Economics (**Frontier**) has been retained by DBCT Management Pty Ltd (**DBCT**) to provide our views on issues relating to the term of the risk-free rate proxy for use in the Capital Asset Pricing Model (**CAPM**) within the regulatory setting. We have been asked to consider the regulatory framework and to respond to the Market Parameters Decision and the Aurizon UT4 Draft Decision of the Queensland Competition Authority (**QCA**) insofar as they relate to the term of the risk-free rate.

1.2 Summary of conclusions

2 Our main conclusions are as follows:

a. When setting allowed returns, the QCA has the view that setting the period of the risk-free rate equal to the length of the regulatory period is the best approach;

b. The QCA has the view that its "period matching" approach is consistent with its "present value" or "NPV=0" principle;

c. The present value principle, which is not set out in any rules or legislation, is designed to ensure that the regulated firm receives *at most* a return that is commensurate with the risk involved. The QCA Act requires that the allowed return be *at least* commensurate with the risk involved.

d. In any event, the present value principle only suggests that the term of the allowed return should be matched to the length of the regulatory period in the case where the market value of the regulated asset at the end of the regulatory period is known for sure from the outset. In this case only, the asset could be valued as the present value of cash flows over the regulatory period (one of which is the known end-of-period market value of the asset);

e. If the end-of-period market value of the asset is *not* known for sure from the outset, the present value principle does *not* imply that the term of the allowed return should match the length of the regulatory period. This is because the asset cannot be valued as the present value of the cash flows over the regulatory period – cash flows beyond the end of the regulatory period would have to be considered in the analysis;

f. Where the end-of-period market value of the asset is *not* known for sure from the outset, the asset would be valued as the present value of the cash flows to be generated over the life of the asset. In this case a long-term discount rate should be used and therefore the allowed return should be set on the basis of a long-term rate. This is the standard approach for valuing assets;

g. The uniform commercial practice is to use a long-term discount rate when analysing regulated infrastructure assets – consistent with market practitioners being of the view that the end-of-period value of regulated assets is *not* known with certainty from the outset, and consequently that the use of a shorter-term rate would be inappropriate;

h. The vast majority of regulated infrastructure assets in Australia have their allowed return set on the basis of a long-term (10-year) rate – consistent with other regulators being of the view that the end-of-period value of regulated assets is *not* known with certainty from the outset, and consequently that the use of a shorter-term rate would be inappropriate;

i. If the QCA *does* adopt a short-term risk-free rate, consistency requires that the same rate must be used in the two places it appears in the CAPM formula. The QCA's current practice is to use a short-term risk-free rate in one place and a long-term risk-free rate in another place within the same formula, which is clearly untenable.

2 The term of the regulated return and the "present value principle"

2.1 The QCA's "present value principle"

3 In its Market Parameters Decision, the QCA is of the view that when estimating the risk free rate component of the regulated rate of return, it should:

> …align the term of the risk-free rate with the term of the regulatory cycle.[1]

4 The basis for the QCA's position is that the term of the risk-free rate should be aligned with the term of the regulatory period because that is consistent with the time horizon of investors and the QCA's "present value principle," which the QCA also refers to as the "NPV=0 principle."

5 The idea behind this is that investors will only consider cash flows over the term of the regulatory period because the end-of-period market value of the asset is known with certainty from the beginning of the regulatory period. Thus, there is no need for investors to consider cash flows beyond the end of the regulatory period when valuing the asset – because the end-of-period asset value is known for sure.

6 In this case, investors will have an investment horizon equal to the length of the regulatory period. The argument that follows is that, since investors have an investment horizon of five years,[2] they will discount cash flows using a five-year rate of return when valuing the regulated asset.

7 Consequently, the QCA argues that if it sets allowed cash flows on the basis of the 10-year risk-free rate, investors would be over-compensated relative to their required 5-year risk-free rate. In this case, the QCA believes that investors would receive an elevated return as opposed to an "NPV=0" return.

2.2 What does NPV=0 mean?

8 We agree that it is appropriate to estimate prices such that the present value of expected cash flows is equal to the asset value. However, we also agree with Incenta (2013) in 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]

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

[2] Or whatever the length of the regulatory period happens to be.

[3] Incenta (2013), p. 6.

9 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**.

10 In its Market Parameters Decision, the QCA recognises that the NPV=0 principle says nothing more than that the discount rate should be appropriate for the cash flows that it is applied to:

> …the Net Present Value Principle (i.e. NPV=0 Principle)…states that the present value of a regulated firm's revenue stream should equal the present value of its efficient costs.[4]

11 Thus:

a. If a discount rate is being applied to a series of cash flows that are uncertain over the next five years, it would be appropriate to adopt a 5-year rate; and

b. If a discount rate is being applied to a series of cash flows that are uncertain over a longer period, it would be appropriate to adopt a longer-term rate.

12 In summary, if the NPV=0 principle is to be adopted, the only question is whether the uncertainty over regulated cash flows persists for longer than five years:

a. The QCA says 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.

b. However, we consider 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 valuations of all other assets).

2.3 Key assumptions and their implications

13 In its Market Parameters Decision and its UT4 Draft Decision, the QCA sets out its view 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. Specifically, the QCA states that:

[4] QCA Market Parameters Decision, p. 6.

> 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.[5]

14 The QCA goes on to note that Dr Lally's research is all based on the assumption that the market value of the regulated asset at the end of the regulatory period is known with certainty right from the beginning of the regulatory period:

> In five years' time...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...[6]

15 The difference between the QCA's view and our view can be summarised as follows. We consider that there *is* uncertainty over the market value of the asset at the end of the first regulatory period. In our view, the market value of the asset at the end of the first year will be the present value of the expected cash flows to be received after the first regulatory period. That is, at the end of the first regulatory period, investors will estimate the (uncertain) future cash flows they expect the asset to produce and they will discount those expected cash flows back to a present value using a discount rate that reflects the prevailing conditions in the market at that time. This is how the market value of the asset at the end of the first period will be determined.

16 That is, if at the end of the first period, investors were forecasting higher cash flows and if market conditions were such that a lower discount rate was appropriate, the market value of the asset would be higher. Conversely, if investors were forecasting lower cash flows and if market conditions were such that a higher discount rate was appropriate, the market value of the asset would be lower.

17 By contrast, the view of the QCA is that there is no uncertainty at all over the market value of the asset at the end of the first regulatory period. 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 QCA/Lally derivation of the NPV=0 principle as it applies to the regulatory setting. If the value of the asset at the end of the regulatory period is not known with certainty, setting the term of the risk-free rate equal to the length of the regulatory period is no longer consistent with the NPV=0 principle.

18 In this regard, the QCA sets out a numerical example in its Market Parameters Decision. That example considers two one-year regulatory periods. The QCA is clear about the fact that the key assumption is that the value of the regulated asset at the end of the first regulatory period (i.e., at Year 1) is known with certainty from the outset:

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[5] QCA Market Parameters Decision, p. 12.

[6] QCA Market Parameters Decision, p. 12.

> The correct analytical process…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%.[7]

19 Thus, the key point has been crystallised:

a. If the value of the asset at the end of the regulatory period is known with certainty right from the start of the regulatory period, setting the term of the risk-free rate equal to the term of the regulatory period will be consistent with the NPV=0 principle; and

b. If the value of the asset at the end of the regulatory period is *not* known with certainty right from the start of the regulatory period, 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.

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

20 The Queensland Treasury Corporation (2014) (**QTC**) has submitted that the QCA 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 QCA disagreed with that point on the basis that it "makes no assumption about assets being sold."[8] However, this response misses the point entirely. The QCA implies that the key issue is about whether or not the asset will be sold at the end of the regulatory period – but that is irrelevant. The issue is about the *value* of the asset at the end of the period – whether the asset is sold or not.

21 That is, QTC make the point that the foundation of the QCA argument is that the market value of the asset at the end of the regulatory 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. The issue is not about whether the owner might chose to sell, but about whether the value of the asset is known with 100% certainty right from the beginning of the period.

22 We note below that it is not just ourselves and QTC who have 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:

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[7] QCA Market Parameters Decision, pp. 45-46.

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

a. Incenta (2013); and

b. Officer and Bishop (2008)

and has been accepted by:

a. The Australian Energy Regulator (**AER**); and

b. The Independent Pricing and Regulatory Tribunal (**IPART**).

23 For example, Incenta (2013) state that the argument is about whether 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.[9]

2.5 The Lally certainty assumption

24 The QCA's approach to the term of the risk-free rate (and the overall return) and to the NPV=0 principle is based on the work of Lally.[10] In a recent contribution on this issue, Lally (2012 QCA) 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[11]

such that the:

> …payoffs at time 4 [the end of the regulatory period in his example] are certain.[12]

25 Lally (2013 QCA) is even more explicit about the fact that the present value principle only requires the term of the return to be set to the length of the regulatory period if the end-of period market value of the asset is known with certainty from the outset. 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:

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[9] Incenta (2013), p. 6, emphasis added.

[10] ERA Rate of Return Guideline Explanatory Statement, Appendix 2.

[11] Lally (2012 QCA), p. 14.

[12] Lally (2012 QCA), p. 10.

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.

26 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 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.

27 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 *V1* = \$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 *V1*, plus the revenues received at the end of the first year, is \$100m as follows:[13]

$$V_0 = \frac{(50 + 100 \times 0.05) + 50}{1.05} = 100$$

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, $V_1 = 50$.

28 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 only 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

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

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

29 Thus, the key point is very clear:

a. If the value of the asset at the end of the regulatory period *is* known with certainty right from the start of the regulatory period, setting the term of the return equal to the term of the regulatory period will be consistent with the NPV=0 principle – because the asset can be valued with reference to cash flows over the regulatory period only; and

b. If the value of the asset at the end of the regulatory period is *not* known with certainty right from the start of the regulatory period, setting the term of the return equal to the term of the regulatory period will *not* be consistent with the NPV=0 principle – because the asset would be valued with reference to cash flows extending beyond the end of the regulatory period, in the standard manner. If the cash flows that would be considered when valuing the asset extend beyond the five-year period, they would be discounted back to present value using a rate that is longer than the five-year rate. Thus, the present value of the cash flows will not be consistent with the use of a five-year rate.

30 Finally, we note that in all of the derivations above, the whole point is to show that the end-of-period market value of the regulated asset was certain from the outset. The RAB was, by definition, certain to be $50 at time 1 – no other value was even possible. What Lally shows is that if the time 1 *market value* of the firm is known for sure, then there is no need to consider subsequent cash flows when estimating the market value of the firm.

31 Indeed, the RAB is not a *value* at all. It is simply one of a number of inputs that the regulator inserts into a formula to determine what prices the firm is allowed to charge. It is the present value of the future cash flows that will determine the value of the firm.

32 Moreover, it is generally recognised that for assets that have been subject to regulation for some time, there can be quite a difference between the RAB (a regulatory construct) and the market value of the asset. Standard regulatory practice is to establish an initial opening asset value when regulation is first invoked, typically based on a Depreciated Optimised Replacement Cost approach. This value is then "locked in and rolled forward" for inflation, capex, depreciation and asset disposals/transfers. Thus, the RAB is persistent and relatively predictable. However, the market value of the assets depends upon the cash flows that investors forecast for the indefinite future and the discount rate

that they consider to be appropriate. Since both of these components vary over time and can change materially over a short period (e.g., consider the dramatic increase in required returns and the consequential dramatic fall in equity prices at the peak of the global financial crisis – including for regulated firms), there is no sense in which the end-of-period market value is known for certain from the outset.

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

33 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, 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 (continuing with Lally's two-period example) 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.[14]

34 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 one-period rate.

2.7 The end-of-period market value is either certain or it is not

35 What we have established so far is that the QCA's derivation of the NPV=0 principle relies on the end-of-period asset value being certain from the outset. If the end-of-period asset value is *not* known with certainty right from the start of the regulatory period, the QCA's derivation does not hold and setting the term of

[14] 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.

the risk-free rate equal to the term of the regulatory period will *not* be consistent with the NPV=0 principle.

36 In particular, the QCA notes that it seeks to properly compensate firms for all relevant systematic and non-systematic risks through its regulatory process. However, the only point that is relevant to the current issue is whether the QCA's regulatory process can guarantee the market value of the asset at the end of the regulatory period. If it cannot, then 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.

37 For example, the QCA states that:

> The QCA does not consider that the presence of perceived systematic or non-systematic risk applying to recovery of the RAB should suggest the term chosen for measuring the risk-free rate.
>
> Investors might perceive that recovery of the RAB could entail some residual regulatory risk. However, to the extent such risk is systematic, it will be compensated through an appropriate estimate of the regulated firm's asset beta. The QCA's view is that providing a firm with a longer term risk-free rate as some kind of compensation for this perceived risk would be double-counting. If such risks are nonsystematic, they must relate to the expectation of a loss from uncompensated risks implicit in the regulatory contract. Such risks can be dealt with through other mechanisms.[15]

38 That is, the QCA makes the clear point here that the end-of-period asset value is not 100% certain, but rather that it may vary. This variation will either be related to market movements (i.e., systematic) or it will be independent of market movements (i.e., non-systematic). This point is obviously true, but it is also irrelevant.

39 It does not matter whether the variation in the end-of-period asset value is systematic or non-systematic. If there is *any* variation in the end-of-period asset value, 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.

40 The QCA's discussion about compensation for systematic risk is a red herring. The QCA provides compensation for systematic risk via the equity beta, which it estimates with reference to comparable commercial firms.[16] That is, the regulated firm receives the same compensation for systematic risk as do comparable commercial firms. Indeed, the only thing that might separate the regulated firm from the comparable commercial firms is the possibility that the regulated firm might have a known market value at the end of the regulatory period whereas a commercial firm does not. If the end-of-period market value of

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[15] QCA Market Parameters Decision, Appendix B, p. 47, Paragraphs 5-6.

[16] Or at least with reference to commercial firms that the QCA considers to be comparable.

the regulated firm *is* known with certainty from the outset, there is an argument for aligning the term of the risk-free rate to the length of the regulatory period. If the end-of-period market value is *not* guaranteed, the regulated firm is not materially different from the commercial firm and the regulated firm should use the same long-term risk-free rate, and the same compensation for systematic risk, that is used by the comparable commercial firms.

41 In summary, the QCA may well seek to provide proper compensation for all sorts of risks. But, after all of that, the end-of-period market value of the asset is either known with 100% certainty or it is not. If not, there is no basis for setting the term of the risk-free rate to the term of the regulatory period.

42 Our point is that it is not appropriate to assume that the asset base has a certain value at the end of the regulatory period. Because there is risk associated with the market value at the end of the regulatory period, the cost of capital reflects expectations for all future cash flows. And since the asset is valued using all future cash flows a long-term risk-free rate must be used.

2.8 Potential regulatory responses

43 If a regulator argues that the derivation of the NPV=0 principle does *not* require that the end-of-period asset value must be known with 100% certainty right from the beginning of the period, they would be demonstrably wrong. A mathematical proof, and the above numerical example from Lally, establishes this point.

44 Consequently, we assume that the regulator accepts that the NPV=0 principle requires that the end-of-period asset value must be known with 100% certainty, as the AER and IPART have done. In this case, the NPV=0 principle would only be relevant if the regulator considered that the end-of-period asset market value *was* known with 100% certainty. This would be the case, for example, if the regulator considered that its regulatory process was such that it could guarantee that at every regulatory determination it would set allowed revenues such as to *exactly* compensate investors for every one of the building block components.

45 If a regulator really did believe that its regulatory process guaranteed the end-of-period market value of the asset with 100% certainty, that certain value should be set out in the regulatory determination for the benefit of all stakeholders.

2.9 Conclusion

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

a. The market value of the regulated asset at the end of the regulatory period is *not* certain right from the beginning of the regulatory period;

b. 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; and

c. A long-term risk-free rate should be used, which is consistent with:

    i. The long-term (uncertain) cash flows that determine the value of the asset; and

    ii. Commercial practice.

3 Commercial practice and the role of the regulator

3.1 Overview

47 In this section of the report we establish that the dominant approach in commercial practice is to use a 10-year term when estimating the risk-free rate, to use a single long-term required return on equity, and to use a single long-term required return on debt – especially when valuing long-lived infrastructure assets.

3.2 Commercial practice is to set the term of the risk-free rate to ten years

48 There is broad agreement 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. For example, SFG (2013 IER) note that the overwhelming majority (94%) of expert assessments in their 2012/13 sample group employed a term assumption for the risk-free rate of ten years. Several reports indicate that the use of a 10-year term assumption is standard practice amongst independent experts in Australia. For example, in its report to ING Real Estate Community Living Group, Deloitte stated that:

> The 10-year bond rate is a widely used and accepted benchmark for the risk free rate in Australia.[17]

49 In its report for Hastings Diversified Utilities Fund (a firm with regulated infrastructure investments), 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

[17] Deloitte (2012), ING Real Estate Community Living Group – Independent expert's report and Financial Services Guide, 24 April 2012, p.93.

> rate. More importantly, the ten year rate is the standard benchmark used in practice.[18]

50 Grant Samuel also included the above paragraph in its recent report for Envestra.[19]

51 In summary, the independent expert evidence supports the use of a 10-year term to maturity when estimating the risk-free rate:

a. 94% of the relevant reports adopted a 10-year term assumption; and

b. The few reports that did not use a 10-year term assumption explained that the reason for not doing so was that they were adopting a term assumption that matched the lives of the assets being valued.

52 Incenta (2013) 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. [20]

53 Other regulators have also noted that the commercial practice is to use a 10-year risk-free rate. For example, in its ATCO Gas Draft Decision, the ERA refers to evidence that has also been considered by IPART:

> The long term approach is consistent with that adopted by equity analysts, who use the longest term bonds available when evaluating the performance of equities vis-àvis government bonds. IPART, for example, highlighted survey evidence by Brotherson et al (2013) that financial advisors unanimously responded that they use bond maturities of 10 years or longer in cost of capital estimations. [21]

54 The ERA also notes that the market practice is to use a 10-year discount rate when valuing regulated firms even if the regulator uses a 5-year risk-free rate to determine the allowed cash flows:

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[18] Grant Samuel (2012), Hastings Diversified Utilities Fund – Independent Expert's report, 3 August 2012, Appendix 3, p.4.

[19] Grant Samuel (2012), Envestra Ltd – Independent Expert's report, 4 March 2014, Appendix 3, p.4.

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

[21] ERA ATCO Gas Draft Decision, p. 148, Paragraph 640.

> Incenta stated that interviewed valuation professionals were unanimous that regulators' application of a 5 year risk free rate would not change their use of the 10 year rate in valuations. [22]

55 There appears to be broad agreement about the fact that the dominant commercial practice is to estimate required returns based on a 10-year horizon and to apply a single discount rate to all future cash flows that are expected to be produced by the asset.

56 The only point of disagreement is about whether the regulator should estimate required returns in the same way they are estimated in commercial practice and by independent expert valuation professionals, or whether regulators should estimate required returns in a different way that is inconsistent with commercial practice. We explore that point of disagreement in the following subsection.

3.3 The role of the regulator

3.3.1 The QCA focus on economic efficiency

57 The QCA has stated that its objective is *not* to replicate competitive market outcomes, but rather to achieve economic efficiency.[23] The QCA does not disagree with the general notion that benchmarking to a competitive market outcome has some validity, but highlights that its overriding objective is economic efficiency (our emphasis added below):

> For purposes of determining rates, the QCA Act does not require the QCA 'to estimate the price that would prevail in a competitive market'. Section 168A of the Act does require, inter alia, revenue adequacy. Benchmarking a competitive market outcome is valid in the sense that unregulated firms in competitive markets charge a price to just cover their efficient costs, including the cost of capital, and regulation should do the same with respect to costs. However, unregulated firms face advantages and disadvantages that cannot be readily replicated in a regulated environment.
>
> The Act also requires the QCA 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' (s.69E). Section 168A(b) specifically allows for multipart pricing and price discrimination when they aid efficiency. Price discrimination is generally not a feature of highly competitive markets.
>
> More generally, regulation involves choosing a form of regulation and ancillary mechanisms, for example cost pass-throughs, review triggers, and the frequency of resets, to achieve ***economic efficiency*** and meet specific

[22] ERA ATCO Gas Draft Decision, p. 149, Paragraph 641.

[23] QCA Market Parameters Decision, Appendix B, p. 49, Paragraph 1.

> statutory objectives. The package of regulatory arrangements affects risk and the cost of capital and is designed to compensate the firm to support ***efficient investment***.[24]

58 The QCA has emphasised that, in achieving its objective of economic efficiency, it conducts regulation to satisfy its NPV = 0 principle, and this has led the QCA to align the term of the risk-free rate with the length of the regulatory period.

59 That is, the QCA does not dispute the fact that the commercial practice is to use a 10-year risk-free rate when analysing infrastructure assets, including regulated infrastructure assets. Rather, the QCA contends that it is not legally required to set allowed returns that are commensurate with what commercial investors require. However, s 168A(a) of the QCA Act states that:

> The pricing principles in relation to the price of access to a service are that the price should generate expected revenue for the service that is at least enough to meet the efficient costs of providing access to the service and include a return on investment commensurate with the regulatory and commercial risks involved.

60 The evidence shows that the dominant commercial practice is for market practitioners to compute required returns for regulated infrastructure businesses with reference to the 10-year risk-free rate. Market practitioners are obviously seeking to determine the return that is commensurate with the regulatory and commercial risks involved in the investment in regulated infrastructure. Thus, it follows that a return based on the 10-year risk-free rate reflects the return on regulated infrastructure assets that would be required by investors, commensurate with the regulatory and commercial risks involved.

61 In its Market Parameters Decision, the QCA rejects the market practice evidence on the basis that there may be a difference between regulated and unregulated infrastructure firms.[25] The QCA appears to be unaware of the evidence, summarised above, that market practitioners also uniformly adopt a 10-year rate for *regulated* infrastructure assets.

62 Thus, other things being equal, an allowed return based on a 5-year risk-free rate would generally be insufficient to meet a commercial required return that is based on a 10-year rate.

63 This begs the question of why market practitioners evaluate regulated infrastructure investments using a 10-year rate, when the QCA is of the view that a 5-year rate should be used. The answer is straightforward – the basis for the QCA's 5-year rate is the assumption that the end-of-period asset value is known with certainty from the outset, whereas market practitioners (and other regulators

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[24] QCA Market Parameters Decision, Appendix B, pp. 48-49.

[25] QCA Market Parameters Decision, pp. 48-49.

including the AER and IPART) consider (correctly in our view) that the end-of-period asset value is uncertain – in which case a longer-term rate is to be used.

3.3.2 Implications for allocative efficiency

64 We now consider the case where a regulator aligns the term of the allowed return with the term of the regulatory period on the basis of the regulator's belief that the end-of-period market value of the asset *is* known with 100% certainty – but where investors do not believe that the market value of the asset is guaranteed, but is uncertain. In this case, investors will assess their required return using a long-term required return (consistent with their standard commercial practice) whereas the regulator will set the allowed return on the basis of the (generally lower) shorter-term risk-free rate and risk premiums.

65 In our view, setting the allowed return on regulated assets below the return that investors expect to receive on comparable assets in a commercial setting has clear implications for allocative efficiency. Setting the allowed return below the investor's required return will act as a disincentive for investment and result in allocative inefficiency. This aspect of allocative efficiency concerns the allowed return relative to the return that investors require. Another consideration is the relative returns available on comparable investments. For example, setting allowed returns for Queensland regulated businesses that are materially below the returns that are allowed to other highly-comparable Australian regulated businesses has obvious consequences for investment incentives.

66 Consequently, one consideration that is relevant to the question of economic efficiency is whether investors do consider the end-of-period market value of the asset to be guaranteed, such that a short-term return would be appropriate. However, we note that there is no evidence to support the notion that investors consider the end-of-period asset value to be guaranteed. Rather, for example, the practice of independent experts and equity research analysts is to use a long-term return when valuing regulated assets – the same approach that they apply to unregulated assets.

67 Also, consider the investors that are now preparing to bid on the regulated assets to be offered for sale by the NSW government. The suggestion that those bidders would use materially lower discount rates if the term of the regulatory period were shortened is fanciful. One of their main concerns is regulatory due diligence, and it is certainly not the case that they consider more frequent involvement of regulators as something that would *decrease* risk and their required return.

68 In our view, setting the allowed return on regulated assets below the return that investors expect to receive on comparable assets in a commercial setting has clear implications for allocative efficiency. Suppose a regulator believes that their regulatory process de-risks an investment such that the required return should be commensurately low. If investors do not share the regulator's views about the

extent to which the regulatory process de-risks the asset, the lower allowed return will act as a disincentive for investment and allocative inefficiency.

69 In this setting, it is hard to imagine that the lower regulatory return could be considered to:

> …generate expected revenue for the service that is at least enough to meet the efficient costs of providing access to the service and include a return on investment commensurate with the regulatory and commercial risks involved.[26]

3.4 Regulatory practice

3.4.1 Most regulated assets have returns based on a 10-year term

70 The vast majority of Australian regulated infrastructure assets have an allowed return based on a ten-year term.[27] For example, in its recent Draft 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.[28]

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

72 IPART, which has previously adopted a 5-year term to maturity, has recently announced that it will now 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.[29]

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[26] QCA Act s 168A(a).

[27] All of the electricity and gas transmission and distribution networks regulated by the AER have the allowed return on equity set with reference to the 10-year risk-free rate. So to do all of the infrastructure assets regulated by IPART in NSW, the Essential Services Commission in Victoria and the Essential Services Commission of South Australia. The ACCC has also used a 10-year risk-free rate for assets such as the National Broadband Network, Australian Rail Track Corporation, and Telstra's fixed line network. It is also the standard practice of regulators in the United States and the United Kingdom to adopt long-term risk-free rates, with maturities of at least 10 years.

[28] AER Draft Rate of Return Guideline Explanatory Statement, p. 181.

[29] See IPART (2013), Review of WACC Methodology, December, p. 12.

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

73 As set out above, the AER has rejected the QCA approach of setting the term of the risk-free rate equal to the term of the regulatory period. The AER recognises 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.[30]

74 However, the AER goes 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

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

> 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.[31]

75 The AER then cites a report by Incenta (2013) which explains that:

a. 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-period market value of the asset being known with certainty from the outset; and

b. 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).[32]

76 The AER also notes 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. [33]

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

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[31] AER Draft Guideline, Explanatory Statement, p. 183.

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

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

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

4.1 The current practice of the QCA

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

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

79 The QCA has adopted an estimate of the market risk premium of 6.5% in its Market Parameters Decision and in its UT4 Draft Decision. 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.[34]

80 The QCA makes it clear that its analysis of the market risk premium is made with reference to the yield on 10-year bonds.[35] The 10-year government bond yields adopted in the Market Parameters Decision and the UT4 Draft Decision, and the associated estimates of the required return on the market portfolio, are set out in Table 1 below.

Table 1. QCA MRP estimates

QCA Decision	Estimation Date	10-year Government Bond Yield	MRP	Required Market Return
Market Parameters	Sep-13	4.29%	6.50%	10.79%
UT4 Draft	Oct-13	4.06%	6.50%	10.56%

Source: QCA Market Parameters Decision and UT4 Draft Decision.

81 In its UT4 Draft Decision, the QCA then implements the CAPM using a fixed 6.5% MRP and an estimate of the four-year risk-free rate of 3.21%.[36] A four-year rate is used to match the length of the regulatory period. This implies an estimate of the required return for the average firm of:

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

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

[36] QCA UT4 Draft Decision, p. 211.

$$r_e = r_f + \beta(r_m - r_f)$$
$$= 3.21\% + 1 \times 6.5\% = 9.71\%.$$

82 That is, having determined that the required return for the average firm is 10.56%, the QCA then sets the allowed return for Aurizon Network as though the required return for the average firm is 9.71%.

83 Similarly, in its Market Parameters Decision, the QCA relied upon bond yields from December 2013 to reach its conclusions. The 10-year bond yield from December 2013, used by the QCA, was 4.29%.[37] The corresponding yield to maturity on Commonwealth government bonds with maturity of five years to maturity was 3.49%. This means that if the QCA was to regulate an entity using a five-year regulatory cycle it would do so as if the required market return was 9.99%.[38] But the QCA's own analysis is that its estimate of the required market return is 10.79%.[39]

4.2 GasNet inconsistency

84 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.[40]

85 In its GasNet decision, the Tribunal stated that:

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[37] QCA Market Parameters Decision, Sub-section 4.3.1, p. 20, Footnote 18; and Appendix C, p. 52, Paragraph 4. We have verified that the average annualised yield to maturity on 10-year Commonwealth Government bonds, as reported by the Reserve Bank of Australia (**RBA**), for the 20 trading days ending 31 December 2013, was 4.29%. We computed the corresponding average annualised yield over the same time period for bonds with maturity of five years.

[38] Expected market return = risk free rate estimated with a five year term to maturity + market risk premium = 3.49% + 6.50% = 9.99%.

[39] Expected market return = risk free rate estimated with a ten year term to maturity + market risk premium = 4.29% + 6.50% = 10.79%.

[40] AER Draft Rate of Return Guideline Explanatory Statement, p. 182.

> 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.[41]

86 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 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**.[42]

87 In summary, the practice of the QCA in using the 10-year yield to estimate the risk-free rate in one part of the CAPM formula, and the 5-year yield to estimate the risk-free rate in another part of the same CAPM formula is inconsistent with the Tribunal's *GasNet* ruling.

4.3 The internal inconsistency in the QCA approach

88 In response to submissions that this represents an inconsistency the QCA has reached 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.[43]

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

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

[43] QCA Market Parameters Decision, p. 52.

89 The QCA has determined that a market risk premium of 6.5% is reasonable, regardless of whether the market risk premium is applied to a risk-free rate with a term to maturity of one year, five years or ten years. The QCA does not report exactly what is the basis for its conclusion, but our inference is that the QCA considers the difference between the yields on bonds of different maturities to be small. In particular, the QCA appears to mechanistically round its MRP estimate to the nearest 0.5%. If this rounding involved an upward adjustment that was of the same order of magnitude as the difference between the 10-year and five-year government bond yields, that would explain the QCA's conclusion above.[44]

90 For example, we computed the average yield to maturity on bonds of two, three, five and ten years to maturity from 3 January 1995 to 2 October 2014. These average figures are 5.20%, 5.32%, 5.51% and 5.78%. That is, on average there has been an upward-sloping yield curve over the last 20 years. Investors require a premium to encourage them to invest in bonds with a longer term to maturity. The average yields on Commonwealth Government bonds with different terms to maturity are presented in Figure 1.

91 The difference between the average yield to maturity on 10-year bonds and bonds with a shorter term to maturity is 0.59% in comparison to the two-year bond, 0.47% in comparison to the three-year bond and 0.27% in comparison to the five-year bond. The QCA may well have an opinion that these differences in average yields are small. This might then lead the QCA to conclude that the inaccuracy in having inconsistent estimates of the risk-free rate in the same CAPM equation is likely to be relatively small, on average. However, there are two problems with this conclusion:

a. There is no need to have any inaccuracy at all. The QCA could still estimate the MRP in exactly the same way as it currently does. It would then add the contemporaneous 10-year government bond yield to produce an estimate of the required return on the market portfolio. That estimate would then be inserted into the CAPM equation as r_m. The QCA would then insert whatever value it believes is appropriate for the risk-free rate – but would insert the same value in both places. This is no more complex and involves no additional cost relative to the QCA's current approach. It does, however, have the benefit of being internally consistent; and

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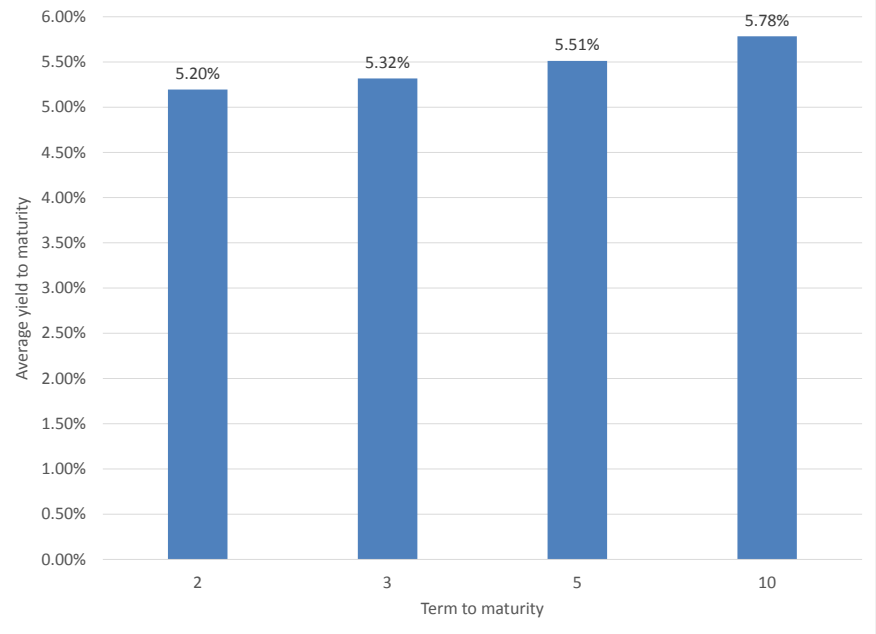
[44] However, this would leave the QCA in the position of having to explain (a) whether this leaves any room at all for the QCA to have regard to any evidence other than its four usual approaches for estimating MRP, and (b) why the same conclusion would apply to the UT4 Draft Decision where there was no rounding of the mean MRP estimate.

b. Even if the difference between the 5-year and 10-year government bond yields are small *on average*, they can be very large at the time of a particular determination.

Figure 1. Average yield to maturity on Commonwealth government bonds 1995 to 2014



Source: RBA.

92 Even if the QCA reaches the conclusion that the differences in average yields across bonds of different maturities is small, the differences in yields that prevail at particular points in time are much larger. In Figure 2 we present the difference between the 20 day average of 10-year bond yields and yields on bonds with five, three and two years to maturity. Over the last 20 years the figures show the following ranges for the difference between yields on 10-year bonds and bonds with different terms to maturity. All figures reported below are based upon 20 day averages, consistent with the QCA approach.

a. The difference between 10-year bond yields and two-year bond yields ranges from –0.67% to +1.75%.

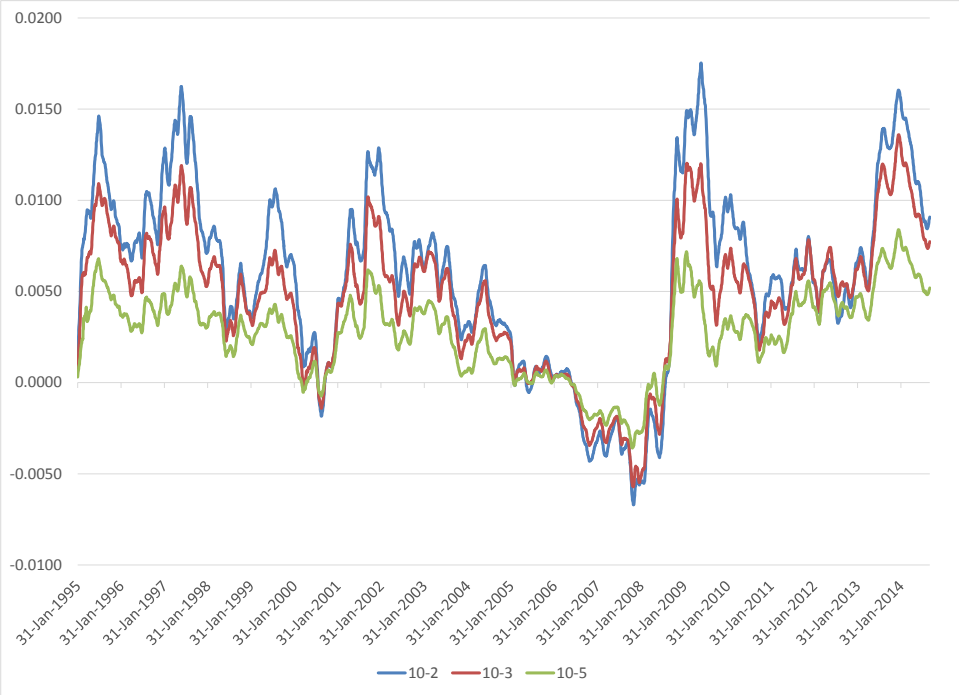
b. The difference between 10-year bond yields and three-year bond yields ranges from –0.57% to +1.36%.; and

c. The difference between 10-year bond yields and five-year bond yields ranges from –0.36% to +0.84%.

93 Figure 2 illustrates that the difference between 10-year bond yields and five-year bond yields fluctuates substantially over time. The section of the graph above zero on the horizontal axis represents periods in which the yield curve is upward-sloping, which is the majority of the time. In particular, 10-year bond yields

exceeded 5-year bond yields 88% of the time. So if the QCA makes its best estimate of the market risk premium with reference to 10-year bond yields, and applies that premium to a five-year bond yield for an entity with a five-year regulatory period, there is a 5-in-6 chance the QCA will under-estimate the market return.

Figure 2. Difference between 20 day average of 10 year yields and 5, 3 and 2 year yields



Source: RBA.

94 The UT4 Draft Decision provides an ideal illustration of the effect of the QCA's internal inconsistency, as it coincides with a steep upward-sloping yield curve. The ten- and four-year bond yields that prevailed for the UT4 Draft Decision were 4.06% and 3.21%, respectively, estimated as 20-day averages. Every estimate of the market risk premium compiled by the QCA was made with reference to the 10-year bond yield. The analysis has the clear implication that the QCA's best estimate of the required market return was the 10-year bond yield plus 6.50%, or 4.06% + 6.50% = 10.56%. Yet, as set out above, it is equally clear that the QCA has set the allowed return as for Aurizon as though the required market return was 9.71%. That is, having determined that the required return for the average firm is 10.56%, the QCA then sets the allowed return for Aurizon as though the required return for the average firm is 9.71%.

4.4 Conclusion

95 In our view, the same estimate of the risk-free rate should be used in the two places it appears in the CAPM formula. As set out above, the use of a different risk-free rate in the two places where it appears in the same formula violates the basic requirement for internal consistency and introduces a bias into the estimate of the allowed return on equity.

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