REVIEW OF FURTHER SUBMISSIONS

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EXECUTIVE SUMMARY

This paper has reviewed three submissions from Oxera, and a memorandum from Professor Richard Schmalensee, on behalf of the regulated businesses. The only point that I agree with is as follows. Oxera notes that my earlier analysis on the merits of annual versus five-yearly updating of the regulatory allowance for the DRP used DRP data for ten-year rather than five-year bonds (because the latter were not available for a sufficiently long period), and therefore I acted as if the bonds had a life of ten rather than five years, which conflicts with the Commerce Commission's adoption of a five-year debt tenor benchmark, and this underestimates the benefit from annual rather than five-yearly updating of the DRP allowance. Oxera did not offer any estimate of the underestimation. I have therefore redone part of my earlier analysis, using the same DRP data but assuming that such data applied to bonds with a seven rather than a ten-year tenor (consistent with the average tenor of the bonds of the New Zealand businesses). When doing so, the advantage from annual updating rather than five-yearly updating grows, as Oxera claimed it would, but only slightly. Thus the argument for annual rather than five-yearly updating of the DRP allowance is not materially stronger than in my earlier analysis.

1. Introduction

This paper reviews aspects of three reports submitted to the Commerce Commission by Oxera, and a memorandum from Professor Richard Schmalensee on behalf of New Zealand regulated businesses.

2. Oxera's Report for the EDBs

2.1 The Convenience Yield

Oxera (2023b, section 2B) reports the Commerce Commission's (2023, para 4.15) statement that it is not aware of any New Zealand practitioners who use anything other than government bonds to proxy for the risk-free rate within the CAPM, which undercuts Oxera's (2023a, section 2.3) earlier proposal that the risk-free rate within the CAPM be proxied by the use of AAA corporate bonds. Oxera's (2023b, section 2B) response is that "*it is unlikely that practitioners will disclose the full details of how they build up their estimates of each parameter*", and then cites two examples of beta estimates from Forsyth Barr that diverge from the Commission's estimates. The fact that Oxera cites practitioner behavior in another area suggests that they could not find examples of New Zealand practitioners who use anything other than government bonds to proxy for the risk-free rate. Like the Commerce Commission, I am not aware of any New Zealand practitioners using anything other than government bonds to proxy for the risk-free rate, but locating publicly available documents on that matter has proved difficult. The only such documents that I could find are from PwC (2022) and Forsyth Barr (2010, Tables 1 and 5), and both firms use government bonds to proxy for the risk-free asset.

Furthermore, in an earlier paper, Oxera (2023a, Appendix A1.1) cite Berk and DeMarzo (2014, page 404), who claim that "*In mid-2012, for example, even the highest credit quality borrowers had to pay almost 0.30% over U.S. Treasury rates on short-term loans. Even if a loan is essentially risk-free, this premium compensates lenders for the difference in liquidity compared with an investment in Treasuries. As a result, practitioners sometimes use [risk-free] rates from the highest quality corporate bonds in place of Treasury rates*." In support of this latter claim, Berk and DeMarzo (2014, page 406) cite a paper by Bruner et al (1998) that surveys the behavior of practitioners. However, the latter paper reports that *all* respondents who provide the relevant details use government bonds of some term rather than corporate bonds (ibid, Exhibit 2). This evidence supports the Commerce Commission's position rather than Oxera's.

Oxera (2023b, section 2B) also reports the Commerce Commission's (2023, para 4.15) view that it will not always be possible to find sufficiently liquid AAA corporate bonds. In response, Oxera claims to have identified 104 AAA non-sovereign bonds, comprising sub-sovereign New Zealand government entities (such as the New Zealand Local Government Funding Agency) and supranational organisations (such as the World Bank). None of these are New Zealand corporates, and therefore this evidence also supports the Commerce Commission's view.

Oxera (2023b, section 2B) notes that Lally (2023a, section 2.2) critiqued Oxera's (2023a, section 2.3) earlier advocacy of AAA corporate bonds as a proxy for the risk-free rate, partly on the grounds that none of the authors cited by Oxera were advocating AAA corporate bonds, and instead favoured Baa bonds, swap rates, put and call prices on the S&P index, or REFCORP bonds. In response, Oxera claims that these cited cases support the principle of using proxies for the risk-free rate other than government bonds. This is true but Oxera requires support not simply for the principle but its specific proposal of AAA corporate bonds, and have not provided it.

Oxera (2023b, section 2B) refers to its earlier (Oxera, 2023a, section 2.3) reference to Feldhutter and Lando (2008, page 378), who note a number of factors that differentiate Treasury rates from true risk-free rates, including the extremely high liquidity of Treasury bonds. Oxera (2023b, section 2B) also note my earlier comment that the high liquidity of Treasury bonds (the US equivalent to New Zealand government bonds) makes them *more* rather than less suitable as a proxy for the risk-free rate, as the CAPM implicitly assumes that all assets have very high liquidity, because illiquidity would raise the transaction costs of buying and selling assets, and the CAPM assumes that there are no transactions costs (Lally, 2023a, section 2.2). In response, Oxera (2023b, section 2B) denies that Feldhutter and Lando (2008, page 378) were concerned with liquidity and were instead concerned with the "*..valuable and unique characteristics (such as repo specialness and regulatory requirements) of sovereign bonds*.." However, Feldhutter and Lando (2008, pp. 378-379) identify five features of Treasury rates that they claim distinguish them from the risk-free rate, of which the last is "(e) *the ability to absorb a larger number of transactions without* *dramatically affecting the price*." These words are a definition of high liquidity. Since high liquidity enhances the suitability of government bonds as a proxy for the risk-free rate within the CAPM, it cannot be part of the "convenience yield", and therefore the "convenience yield" is only part of the spread ('true' risk-free rate over government bonds) rather than all of it. Furthermore, of the remaining four features of US Treasury rates (which instead constitute the convenience yield), Oxera offers no evidence that these features apply to New Zealand government bonds, let alone to the same degree. Some of them have no relevance to New Zealand. For example, Feldhutter and Lando's (2008, page 378) point (c) is "*that Treasury securities must be purchased by financial institutions to meet regulatory requirements*". There is no parallel requirement in New Zealand.[1] So, the share of the spread ('true' risk-free rate over government bonds) due to the "convenience yield" shrinks even further. The same issue of Oxera citing papers that identify factors affecting the yield on US Treasury Bonds, but with no relevance to New Zealand, afflicts Koijen and Yogo (2020), as noted by Lally (2023a, section 2.2).

Oxera (2023b, section 2B) notes my concern that data on AAA bond yields is not available over the entire period for which the TAMRP has been estimated and therefore would complicate its estimation using AAA bond yields as a proxy for the risk-free rate (Lally, 2023a, section 2.2). In response, Oxera states that "*This concern can be addressed by adopting pragmatic approaches to estimating the convenience yield. For example, a long-term average convenience yield…can be estimated and added to the historical yield of government bonds*." Oxera do not explain how this would be done and, in the absence of an explanation, my concern not only remains unaddressed but Oxera's failure to explain how it could be addressed suggests that there is no solution to this problem. Furthermore, in their extensive submissions on the TAMRP (Oxera, 2023a, section 3; 2023b, section 4; 2023c, Annex; 2023d, section 6), Oxera never estimate the TAMRP using AAA corporate bonds as a proxy for the risk-free rate nor even suggest the need to do so. Instead, all of their estimates reflect the use of government bonds as the proxy, a practice that is inconsistent with them favouring the use of AAA corporate bonds when estimating the first term in the CAPM.

2.2 The Term for the Risk-Free Rate

[1] New Zealand banks are subject to minimum holdings of liquid assets, but they have a choice of many assets to meet these requirements, including government bonds (Reserve Bank, 2022). Furthermore, even without such requirements, banks would still hold some liquid assets and therefore might still hold some government bonds.

Oxera (2023b, section 2C) disputes the conclusion in Lally (2021) that the term for the risk-free rate must match that of the regulatory cycle. In particular, Oxera states that

"*The model is set on a per-regulatory-period basis (which, in the case of the EDBs' regime, is a five-year period), and Lally (2021) concludes that the RFR term should match the length of the regulatory period. However, regulators often allow revenues on an annual basis rather than estimating the allowed revenues as a single consolidated amount for all years in the entire regulatory period. The Lally (2021) model would work in the same way if it were set on an annual basis (still with the five-year regulatory periods). In that case, Dr Lally would have to conclude that the RFR term should be one year instead of five years. As a result, there would be two conflicting conclusions based on the same model – showing that the model does not prove, but rather assumes, the appropriate term for the cost of capital.*"

In order to assess this claim, it is necessary to frame it mathematically. To do so in the simplest possible way, I assume that the residual life of the asset is two years, the regulatory cycle is two years, revenues arise at the end of each year, and compensate only for depreciation (at 50% of the current regulatory asset value for each year) and the cost of capital, as there is no opex or taxes. These simplifying assumptions facilitate focusing upon Oxera's point. The revenues allowed at the end of the first year would be the current asset book value (B_0) multiplied by some allowed rate k_1 set now, plus the depreciation of $0.5B_0$. The revenues allowed at the end of the second year would be the asset book value at the end of the first year ($0.5B_0$) multiplied by some rate k_2 set now, plus the depreciation of $0.5B_0$. At the present moment in time (time 0), the value of the business is the revenues to be received in one year plus the expectation now of the residual value of the assets in one year (V_1), discounted at the prevailing one-year risk-free rate of R_{01}:

$$V_0 = \frac{B_0 k_1 + 0.5B_0 + E(V_1)}{1 + R_{01}} \quad (1)$$

In addition, the value of the business at the end of the first year (V_1) is the revenues to be received one year later, discounted using the contemporaneous one-year risk-free rate of R_{12}:

$$V_1 = \frac{0.5B_0 k_2 + 0.5B_0}{1 + R_{12}} \quad (2)$$

Presumably, Oxera believes that the allowed rate k_1 can be set equal to the current risk-free rate R_{01}, and the allowed rate k_2 can be set equal to the one-year risk-free rate prevailing at the end of the first year (R_{12}). If so, equation (2) would reduce to $V_1 = 0.5B_0$, and substitution into equation (1) would then yield $V_0 = B_0$. So, the NPV = 0 principle would be satisfied by setting the allowed rates for each of the years equal to the prevailing one year risk-free rates. The problem with this is that, by assumption, the regulatory cycle is two years rather than one. So, the allowed rate for the second year in the cycle (k_2) is set at the beginning of the cycle whilst the one-year risk-free rate prevailing at the end of the first year (R_{12}) is not known until a year later. So, it would be impossible for k_2 to be set equal to R_{12}, and therefore Oxera's argument fails. For example, suppose k_2 were set at the current two-year risk-free rate of 4% and one year later the prevailing one-year rate (R_{12}) was 6%. Equation (2) could not then reduce to $V_1 = 0.5B_0$, and substitution into equation (1) would not then yield $V_0 = B_0$. So, the NPV = 0 principle would not be satisfied.

The same reasoning would apply if the regulatory cycle were five years instead of two years, i.e., the allowed rates set at the beginning of the regulatory cycle for all years except the first year could not be set equal to the one-year risk-free rates at the beginning of each of those years. The only matching that is possible, and which satisfies the NPV = 0 principle, is setting the allowed rate of return for all years within the five-year regulatory cycle to the five-year cost of capital observable at the beginning of the regulatory cycle, as proved in Lally (2021).

Oxera (2023b, section 2C) goes on to argue that the allowed cost of capital should be for a term in excess of five years to reflect the long-term nature of the assets. However, Oxera provide no proof of this claim. Lally (2021) proves that the allowed cost of capital should be for a term matching the regulatory cycle. The only rebuttal of this proof offered by Oxera has been described and addressed in the previous paragraphs of this section, and shown to be fallacious.

Oxera (2023b, section 2C) also argues that DCF valuations of network businesses take account of expected cash flows out to infinity, and this is inconsistent with regulatory use of a five-year cost of capital. However, as discussed in Lally (2021, section 2.3), it is not the job of regulators to replicate the behavior of anyone else. Their job is to set the expected revenues for each of the next five years, and hence the expected cash flows for the next five years (CF_1, CF_2,…CF_5) so that the value now of these future payoffs is equal to the current regulatory asset book value (B_0). Letting d denote the appropriate discount rate in this situation, and B_5 the regulatory asset book value in five years, their valuation scenario is thus:

$$V_0 = B_0 = \frac{E(C_1)}{1+d} + \frac{E(C_2)}{(1+d)^2} + \cdots + \frac{E(C_5) + B_5}{(1+d)^5} \tag{3}$$

The regulator first chooses the appropriate value of d, and then the allowed rate of return within the allowed revenues. Because this valuation involves future benefits that extend only five years into the future the appropriate discount rate here (d) is the five-year rate. As shown in Lally (2021, sections 2.1 and 2.2), it follows that the allowed cost of capital within the expected revenues in the numerator is also the five-year rate.

Oxera (2023b, section 2C) also quotes from Schmalensee's (2022). Including the sentence preceding the quote, it is as follows: "*Schmalensee (1989) deals with a very idealized world without risk, competition, or taxes. It is asserted (p. 294) that 'under certainty, the period t cost of capital is just the one-period interest rate in period t' – implicitly the riskless rate for a year or some shorter period. This is obviously correct in very abstract theory but completely irrelevant for long-term investments in the real world*.." I interpret this as saying that, whilst the analysis in Lally (2021) is correct in very abstract theory, it is completely irrelevant for long-term investments in the real world due to risk, competition, and taxes. I therefore consider these features of the real world that allegedly deviate from the assumptions in the Schmalensee (1989) model. Firstly, the analysis in both Schmalensee (1989) and Lally (2021) presumes that the firm is regulated, and this is because it faces no competition, and therefore the absence of competition is not part of an idealized world but a feature of the very part of the world being examined. In respect of taxes, the analysis in both Schmalensee (1989) and Lally (2021) does omit taxes, but purely to simplify the presentation. Taxes are a deduction within the cash flows (CF) in equation (3), whilst the revenues within those cash flows are augmented to reflect the existence of taxes. The additional revenue offsets against the taxes, and therefore taxes do not affect the validity of the conclusion. Finally, in respect of risk, the analysis in Lally (2021, section 2.1) allows for risk and it does not change the conclusion. Thus, of Schmalensee's (2022) features of a very idealized world, one actually corresponds to the real-world situation, another is shown by Lally (2021) to not change the conclusion, and allowing for the third would also not change the conclusion.

Oxera (2023b, section 2C) cites cases of UK regulators who use allowed rates for a longer term than five years, and the typical rationale is that it matches the indefinite maturity of the equity. This argument was addressed in the penultimate paragraph, and shown to be fallacious.

Oxera (2023b, section 2C) notes that the AER (2023, section 6) recently decided to continue using the ten-year risk-free rate in setting the allowed cost of equity rather than switch to matching to the length of the regulatory period, because there is currently no clear gain from switching to use of the five-year rate. If this were also true for New Zealand, then there would be no clear gain from the Commerce Commission switching from the five-year rate to the ten-year rate, and such a switch is favoured by Oxera. Thus, the argument raised here by Oxera seems to support the Commerce Commission continuing to use a five-year term rather than switching to a ten-year term. However, although the AER (2023, section 6.3.1.3) concluded that regulatory use of the ten-year risk-free rate rather than the five-year rate would have had no impact on the allowed cost of equity at the current time, the result would have been as much as 1.07% higher or as much as 1.14% lower over the period since 1988. In respect of New Zealand, the Appendix investigates the impact from regulatory use of the ten-year rather than the five-year risk-free rate on the cost of equity of a New Zealand regulated firm. As shown there, at the present time (treated as February 2023 for the current purposes), use of the ten-year rather than the five-year risk-free rate would raise the allowed cost of equity by only 0.04%. Furthermore, over the period from August 2019, doing so would have raised the allowed cost of equity by as much as 0.23% and lowered it by as much as 0.39%, with the average being a reduction of 0.11%. Thus, there have been times in both Australia and New Zealand in which the regulatory choice here would significantly affect the allowed cost of equity.

The mathematics in Lally (2021, section 2.1 and 2.2) is sufficiently detailed that the intuition supporting the use of a cost of capital whose term matches the regulatory cycle might not be apparent. That intuition was offered by Lally (2001, section 3): "*The appropriate bonds are those corresponding to the review period (period 1) rather than the duration of the airports assets (period 2), and the reason is thus. If yields for the two periods differ, this is due to* *either an expected change in yields after the end of period 1 (expectations hypothesis) or a reward for bearing risk after the end of period 1. Since landing charges are set for the first period, and are intended to reflect expected costs and risks over that period, they should not be affected by expectations of interest rates or risks after that period….To illustrate this point, suppose that the period for which prices are set is five years commencing now, i.e., from time 0 till time 5. In five years, prices will be reset then for a further five years, and so on. Also, suppose that the five year bond rate is currently 5% and the ten year bond rate is currently 7.5%, the latter due to expectations that interest rates in five years will be 10%. Suppose these expectations are vindicated in the sense that, in 5 years, the bond rate is 10%, for all terms to maturity. Under the proposal presented here the rate of 5% would be used for the next five years, followed by the use of 10% thereafter. Under the LECG proposal, the rate used would be 7.5% for the first five year period, followed by 10% thereafter. The LECG proposal then leads to double-dipping in the sense of the airport being rewarded for future high interest rates not only when they occur but also in anticipation of it*."

2.3 The Debt Risk Premium

Oxera (2023b, section 3A) favours annual updating of the allowed DRP rather than the five-yearly updating favoured by the Commerce Commission. Oxera notes that Lally (2023a, section 2.7) concludes that annual updating better matches the allowed DRP to the actual DRP incurred, but only slightly. Oxera further claims that several features of Lally's analysis warrant correction. Firstly, Oxera claims that Lally assumes that DRPs are mean-reverting, and that doing so leads to underestimating the benefit of annual rather than five-yearly updating of the DRP allowance. However, no such assumption is made by Lally. As described in Lally (2023a, section 2.7), monthly DRPs (in percentage terms) are regressed on the preceding month's value, yielding the following result:

$$DRP_1 = .0451\% + .9765 DRP_0$$

This is equivalent to:

$$DRP_1 = DRP_0 + .0235(1.92\% - DRP_0)$$

and this is a mean-reverting model, i.e., if the current DRP (denoted DRP_0) is below (above) 1.92%, the expected value of the next DRP (denoted DRP_1) will be higher (lower) than DRP_0. Thus, mean reversion is exhibited by the data rather than merely assumed.

Secondly, Oxera notes that Lally (2023a, section 2.7) used DRP data for ten rather than five-year bonds (because the latter were not available for a sufficiently long period), and therefore acted as if the bonds had a life of ten rather than five years, which conflicts with the Commerce Commission's adoption of a five-year debt tenor benchmark, and this underestimates the benefit from annual rather than five-yearly updating of the DRP allowance. Oxera do not offer any estimate of the underestimation, which limits the value of their claim. The best that could be done here would be to redo the analysis in Lally (2023a, section 2.7), using the same data but assuming that such data applies to bonds of a shorter tenor. The Commerce Commission (2023) adopts a five-year benchmark but allows firm with longer term debt to use that longer tenor, and its analysis suggests the average tenor is 7.25 years (ibid, page 40). I therefore redo Lally's (2023a) analysis using a seven-year tenor. In particular, I redo the analysis for the 95th percentile case in Lally (2023a, Table 2), for the capex rates of 1%, 3% and 5%, for both annual and five-yearly updating of the DRP allowance. In respect of annual updating, the present value of the differences between the allowed and incurred DRPs, as a proportion of the present value of the debt, are slightly higher than before, but upon rounding are the same as the results reported in Lally's Table 2 (-0.1%, -0.2% and -0.2% respectively). The results for five-yearly updating are also slightly higher (-0.9%, -0.8% and -0.7% respectively versus the figures of -0.8%, -0.6% and -0.6% in Table 2). Thus, Oxera's claim that the assumption of a ten-year debt tenor (rather than a lower figure reflective of the actual situation) underestimates the benefit from annual rather than five-yearly updating of the DRP allowance is correct, but the degree of underestimation is slight. Thus the argument for annual rather than five-yearly updating of the DRP allowance is not materially stronger.

Thirdly, Oxera presents their Figure 3.2 showing the predicted path of the DRP in Lally (2023a, section 2.7) assuming a current value of 3.2% (based on US data), notes that this path is significantly different to that shown in their Figure 3.1 for bonds issued by the EDBs over the past 12 years, and implies that this difference is problematic. However, Oxera's Figure 3.1 shows the *actual* path of the DRP for these NZ bonds (and is similar to the *actual* path for the US data used by Lally) whilst Oxera's Figure 3.2 shows the *predicted* path (based on the US data). The actual path is naturally highly volatile while the predicted path smoothly converges on the long-run mean in accordance with the mean reversion pattern revealed by the actual data. Similarly, a time series of independent drawings from a normal distribution with mean zero will be volatile whilst the predicted values for all future times will be zero.

Fourthly, Oxera notes that the present value analysis in Lally (2023a, section 2.7) uses a 30 year forecast period (six regulatory cycles), which could lead to underfunding for multiple regulatory cycles followed by later compensation, and this is inconsistent with the premise that investors should recover costs within the five-year regulatory cycle. However, Oxera (2023a, section 5.3) proposed annual rather than five-yearly updating in order to better match the DRPs allowed to the DRPs incurred, and such discrepancies could persist indefinitely. The standard process for quantifying a potentially indefinite series of discrepancies is to present value the discrepancies sufficiently far into the future that any further discrepancies would have no material impact on the present value calculation. This standard practice has been followed by Lally (2023a, section 2.7), and Oxera have not suggested any alternative means of quantifying the discrepancies.

3. Oxera's Report For First Gas, Powerco and Vector

Oxera (2023c, section 2C) argues that gas distribution businesses warrant a higher DRP than electricity distribution businesses. The principal evidence offered by them in support of this is the higher DRPs for GDBs relative to EDBs in the UK (ibid, Figure 2.1 and 2.2). However, whilst the Figures show such premiums in 2023 for bonds maturing in 2040, the situation is reversed for bonds maturing in 2025 and 2027. Furthermore, the Commerce Commission's use of a five-year debt tenor benchmark implies that the shorter term bonds are more relevant, and therefore the evidence presented by Oxera supports a lower DRP for the GPBs than the EDBs. This evidence is not strong because it relates to three UK companies rather than the New Zealand companies.

4. Oxera's Report for Vector

Oxera (2023d, section 4) repeats arguments raised in their earlier submission on the question of whether the NPV = 0 test would be satisfied for any term (Oxera, 2023b, section 2C). This argument has been addressed in section 2.2 above.

Oxera (2023d, section 4) also repeats points made by Schmalensee (2023), which are addressed in the next section.

Oxera (2023d, section 5) argues that the allowed debt tenor should be raised from five to ten years, on the following bases. Firstly, Oxera notes that the Commerce Commission has determined the weighted average debt tenor amongst the New Zealand energy networks businesses to be 7.25 years. However, this is an argument for setting the debt tenor at 7.25 years rather than ten years. Furthermore, this evidence is not inconsistent with the Commission's (2023, pp. 45-50) approach, which awards a debt tenor in excess of five years for bonds with tenors exceeding five years.

Secondly, Oxera claims that the Commerce Commission's debt financing methodology discourages the issue of longer-term debt, which has reduced the weighted average debt tenor to 7.25 years, and therefore this observed figure of 7.25 years is not an observation that can be used to assess the reasonableness of the Commission's decision. The Commerce Commission's (2023, pp. 45-50) methodology is to allow a DRP for five years, subject to bonds of longer tenor receiving an allowance matching their tenor but capped at ten years. By contrast, Oxera favours a ten-year tenor for all bonds. A regulated firm presumably chooses a tenor that maximizes its allowance net of its costs (including the cost equivalent of the rollover risk). So, if the allowance is unaffected by the individual firm's behavior, as with Oxera's proposal of ten years for all firms, a firm acting rationally would choose the tenor that minimized its costs and therefore the firm's choice of tenor would not be affected by the term of the allowance. By contrast, if the allowance increases with the firm's choice of tenor, as with the Commerce Commission's approach, the firm would be motivated to choose a higher tenor to benefit from the higher allowance. So, contrary to Oxera's claim, the observed average debt tenor of 7.25 years has been raised rather than reduced by the Commission's approach, and that average tenor would be lower if Oxera's proposal of a ten-year tenor for all firms were adopted.

To illustrate these points, suppose the only relevant costs incurred by the firm are the DRP payments (which increase with debt tenor, of T years) and the cost equivalent of the rollover risk (which declines with tenor).[2] Consistent with these relationships, suppose the DRP payments (in % points) are $(1.15 + 0.07T)$ and the cost equivalent of the rollover risk is

[2] Other factors influence the tenor decision but these factors seem to be the two most significant ones, and there is a trade-off between them.

1.75/T.[3] Letting the DRP allowance be denoted A, the firm then chooses its tenor T to maximize its net allowance:

$$Net = A - \left(1.15 + 0.07T + \frac{1.75}{T}\right) \tag{4}$$

If the allowance A is unaffected by the firm's behavior, the firm minimizes its costs and therefore chooses

$$T = \left(\frac{1.75}{0.07}\right)^{0.5} = 5\ yrs$$

Its DRP costs inclusive of the rollover risk would then be 1.85%. This decision by the firm would be the same regardless of whether the allowance was for ten years bonds, five year bonds, or some other term. Any choice of T other than five years would raise the firm's costs without affecting its allowance; for example, at T = 10 years, its costs in equation (4) would be 2.02% compared to 1.85% at T = 5 years. By contrast, if the allowance A increased with the firm's choice of tenor, as with the Commission's approach, the firm would be motivated to choose a higher value for T. For example, if the allowance A matched the DRP payments of (1.15 + 0.07T) up to a tenor of ten years, then the net allowance in equation (4) would reduce to the rollover risk component of –1.75/T up to a tenor of ten years, and the firm would then choose T = 10 years to maximize its net allowance. Oxera seems to believe that a higher DRP allowance based on a longer debt tenor applied to all firms would cause firms to lengthen their choice of tenor. This is fallacious; a firm would not need to raise its debt tenor to gain the higher allowance but raising its tenor would increase its costs, so the firm could be expected to pocket the extra allowance and not change its behavior.

5. Professor Schmalensee's Memorandum

Schmalensee (2023) disagrees with the points raised by Lally (2023a, section 2.1) but he does not provide any critique of those points. Schmalensee (2023) also claims that "*there is no clear precedent academic or otherwise on the term that should be used to compute the risk-free rate*." However, the precedent appears in Lally (2004), even if Schmalensee (1989) is

[3] The choice of 0.07% per additional year of debt tenor is consistent with the Commerce Commission (2023, page 46), and the intercept of 1.15% then follows from the Commerce Commission's (2023, page 157) DRP of 1.51% for five year bonds. In addition, modelling the cost equivalent of the rollover risk as 1.75/T ensures that the cost equivalent declines as T increases, and at a reducing rate, i.e., increasing T from one to two years has a bigger effect than increasing it from 10 to 11 years.

not considered. Presumably, Schmalensee's point here is not that the precedent in Lally (2004) does not exist but that the paper is wrong. If so, he would need to demonstrate that, but has not done so.

Schmalensee (2023) also refers to Myers (1972, footnote 38): "*If a regulatory commission decides to allow a return R, and adjusts the utility's prices frequently enough that the utility always earns R on a book basis, then the utility will always earn the same true R*." Schmalensee (2023) then claims that Myers's use of the word "*always*" means that the statement is true regardless of how depreciation is computed. In addition, he argues that the words "*the utility will always earn the same true return R*" is equivalent to NPV = 0, and that both points are consistent with Schmalensee (1989). I do not disagree with any of this, but it does not relate to the question at issue here: in a regulatory situation in which the cost of capital differs by term, which term should the regulator use to set the allowed rate of return?

Myers (1972) sheds no light on this question because all his references to the cost of capital presume that the term structure is flat. In particular, the section of Myers (1972) in which this footnote 38 appears (section 6) commences by considering an all-equity financed regulated firm with a book asset value per share of \$100, a market value per share of \$200, and earnings per share of \$16, which are all paid as dividends and expected to remain at this level forever. Myers then estimates the cost of equity capital at

$$R = \frac{\$16}{\$200} = 0.08$$

This is the DCF method for estimating the cost of equity, and it presumes that the cost of equity is the same for all future periods. Myers then proposes that this cost of capital of 0.08 be applied to the book asset value of \$100 to yield allowed earnings per share of \$8, whereupon the value per share would fall to \$100:

$$P = \frac{\$8}{0.08} = \$100$$

Again, this valuation formula presumes that the cost of capital of 0.08 is the same for all future periods. Using the result in the last equation, Myers notes that the regulator's actions drive the share price of the company to its asset book value per share. Myers then notes that this outcome may not prevail at all times for a variety of reasons. The first reason noted by Myers is regulatory lag, i.e., the regulated firm may earn more or less than $8 per share until the regulator intervenes to reset the allowed earnings per share to $8. Shortly afterwards, Myers (1972) presents the footnote 38 quoted above. Given the context described here, the footnote seems to be claiming that deviations of share price from asset book value per share decline as the frequency of regulatory resets rises. This seems correct, but it does not assist in addressing the issue in question: in a regulatory situation in which the cost of capital differs by term, which term should the regulator use to set the allowed rate of return? Schmalensee (1989) proves that the term must match the regulatory cycle, unintentionally in the course of seeking to prove a different proposition, as argued in Lally (2023a, section 2.1). Schmalensee (2023) denies this but does not address the points raised by Lally (2023a, section 2.1).

6. Conclusions

This paper has reviewed three submissions from Oxera, and a memorandum from Professor Richard Schmalensee, on behalf of the regulated businesses. The only point that I agree with is as follows. Oxera notes that my earlier analysis on the merits of annual versus five-yearly updating of the regulatory allowance for the DRP used DRP data for ten-year rather than five-year bonds (because the latter were not available for a sufficiently long period), and therefore I acted as if the bonds had a life of ten rather than five years, which conflicts with the Commerce Commission's adoption of a five-year debt tenor benchmark, and this underestimates the benefit from annual rather than five-yearly updating of the DRP allowance. Oxera did not offer any estimate of the underestimation. I have therefore redone part of my earlier analysis, using the same DRP data but assuming that such data applied to bonds with a seven rather than a ten-year tenor (consistent with the average tenor of the bonds of the New Zealand businesses). When doing so, the advantage from annual updating rather than five-yearly updating grows, as Oxera claimed it would, but only slightly. Thus the argument for annual rather than five-yearly updating of the DRP allowance is not materially stronger.

APPENDIX: Impact on the Cost of Equity from Using Ten-Year Risk-Free Rates

This Appendix investigates the impact on the allowed cost of equity of New Zealand regulated businesses from regulatory use of ten-year rather than the five-year risk-free rates. The assumed point in time for the analysis is February 2023, consistent with the earlier estimate of the TAMRP in Lally (2023b).

I start with the estimate of the TAMRP in Lally (2023b) and adjust this where required. In respect of the Ibbotson estimate using New Zealand data, this involves averaging the results from equation (2) in Lally (2023b) for each of the years 1931-2022, and using ten-year rather than five-year risk-free rates. The initial analysis in Lally (2023b, pp. 4-6) involved use of the ten-year risk-free rates, and yielded an estimate of .073. This requires no adjustment, since it used ten-year rates.

In respect of the Ibbotson estimate using data from foreign markets, this involves averaging over the results from equation (6) in Lally (2023b), for each of the years 1900-2022. The terms within equation (6) requiring the ten-year risk-free rate are the across country and time averages for ($R_{mt} - R_{ft}$) and R_{ft}. Using ten-year risk-free rates, these averages are .062 and .062 as reported in Lally (2023b, page 9). Substitution into equation (6) along with the existing values for the remaining parameters yields an estimate for the TAMRP of a typical foreign market of .072 as follows:

$$\widehat{TAMRP} = .062 + .062(.75)(.29) - .049(.25)(.29) = .0719$$

In respect of the Siegel version 1 estimate using New Zealand data, shown in Lally (2023b, pp. 10-12), the only adjustment required is to replace (for the years 2003-2022) the long-term expected real risk-free rate for five years ahead for New Zealand, denoted $E(R_5)$, by the long-term expected real risk-free rate for ten years ahead, denoted $E(R_{10})$. The best estimate for the latter is the average yield on inflation-protected New Zealand government bonds from their inception in 1995 till 2022, for a ten-year term to maturity. This suggests use of the following inflation-protected New Zealand government bonds to create the best proxy for a "ten-year constant maturity" series:

(a) From November 1995 till October 2012, the yield on the Feb 2016 bonds is used, because these are the only inflation-protected bonds on issue during this period.

(b) From November 2012 till September 2015, the yields on the Feb 2016 and Sept 2025 bonds are used, as the desired ten-year term to maturity lies between the terms to maturity on these two bonds. In particular, at the midpoint of this period (April 2014), the terms to maturity on these two bonds are 1.8 and 11.4 years, implying weights of 15% and 85% on the yields of these two bonds during this period.

(c) From October 2015 till Sept 2020, the yields on the Sept 2025 and Sept 2030 bonds are used, as the desired ten-year term to maturity lies between the terms to maturity on these two bonds. In particular, at the midpoint of this period (March 2018), the terms to maturity on these two bonds are 7.5 and 12.5 years, implying weights of 50% on each bond during this period.

(d) From October 2020 till December 2022, the yields on the Sept 2030 and Sept 2035 bonds are used, as the desired ten-year term to maturity lies between the terms to maturity on these two bonds. In particular, at this midpoint of this period (Nov 2021), the terms to maturity on these two bonds are 8.8 and 13.8 years, implying weights of 76% and 24% on the yields of these two bonds during this period.

The average yield on this "ten-year constant maturity" series over 1995-2022 is .029. This is almost identical to the average yield on the "five-year constant maturity series" over the same period, and therefore does not affect the estimate for the Siegel version 1, of .060.

In respect of the Siegel version 1 estimate using data from foreign markets, shown in equation (10) in Lally (2023b), the only adjustment required is that in the preceding paragraph, i.e., replace E(R_5) by E(R_{10}), for the years 2003-2022. The estimate of E(R_{10}) is then .035 for 1931-2002 and .029 for the years 2003-2022, yielding a time-weighted average of .034. Substitution of this into equation (10) along with the existing parameter values for the remaining parameters yields an estimate of the TAMRP for a typical foreign market of .064 as follows:

$$\widehat{TAMRP} = .075 + (.020 - .034)(1 - .22) = .0641$$

In respect of the Siegel 2 estimate using New Zealand data, as discussed in Lally (2023b, pp. 15-16), this involves estimating the current expected real market return from the historical average of .078, converting this to its current nominal counterpart using a current inflation forecast for ten rather than five years, and then deducting the current (February 2023) ten-year rather than the five-year risk-free rate (net of tax) in accordance with equation (1). The inflation forecasts are shown in Lally (2023b, Table 4), and do not extend beyond five years. So, the forecasts for the sixth to tenth years ahead are set at the midpoint of the RBNZ's target band (2%), which is similar to the forecast of 1.8% for the fifth year ahead. The resulting geometric average forecast over the ten years is then the geometric average for the first five years (2.73% as noted in Lally, 2023b, page 15) and that for the last five years (2%), which is 2.36%. So, for the next ten years, the nominal expected market return for New Zealand is 1.078*1.0236 – 1 = .1034. In addition the current New Zealand ten-year risk-free rate is .0431 (February 2023 average)[4]. Substitution of these figures into equation (1), along with the current corporate tax rate of 0.28, yields a Siegel version 2 estimate for the TAMRP of .072 as follows:

$$\widehat{TAMRP} = .1034 - .0431(1 - 0.28) = .0724 \qquad (5)$$

In respect of the Siegel 2 estimate using data from foreign markets, as discussed in Lally (2023b, pp. 16-18), this involves estimating the current expected real market return for foreign markets from the historical average, of .071, converting this to its current nominal counterpart using a current inflation forecast for ten rather than five years, and then deducting the current (February 2023) ten-year rather than the five-year risk-free rate (net of tax) in accordance with equation (5). The inflation forecasts for the four foreign markets examined are shown in Lally (2023b, Table 5), and do not extend beyond five years. So, the forecasts for the sixth to tenth years ahead are set at the midpoint of the target band for each country, shown in the penultimate column of Table 1 below. These are similar in all cases to the forecast for the fifth year ahead in Lally (2023b, Table 5). The geometric means for the first five years are shown in Lally (2023b, Table 5), and reproduced in Table 1 below. For each market, the geometric mean for the first five years is combined with its inflation target to generate a geometric mean forecast over the next ten years, shown in Table 1 below. The cross-country average is 2.25%. So, for the next ten years, the nominal expected market return averaged over these foreign markets is 1.071*1.0225 – 1 = .0951. In addition the current (February 2023) ten-year risk-free rates in these foreign markets are as shown in Table 1 below[5]. The average is 3.59%.

[4] Data from Table B2 on the website of the Reserve Bank of New Zealand (www.rbnz.govt.nz).

[5] Data from the same sources as before (Lally, 2023b, pp. 16-17).

Table 1: Parameter Values for Foreign Markets (%)

Country	R_{f10}	GM_5	*Target*	GM_{10}
Australia	3.71	3.25	2.5	2.87
US	3.75	2.34	2.0	2.17
UK	3.52	1.79	2.0	1.89
Canada	3.37	2.12	2.0	2.06
Average	3.59			2.25

Substitution of these figures into equation (5), along with the cross-country average current corporate tax rate of 0.26 (Lally, 2023b, Table 5), yields a Siegel version 2 estimate for the TAMRP of 6.5% as follows:

$$\widehat{TAMRP} = .0951 - .025(.07) - .0359(1 - 0.20) = .0646$$

In respect of the DGM estimate using New Zealand data, this only requires substitution of the current (February 2023) New Zealand ten-year risk-free rate (4.31%) for the five-year rate in equation (16) in Lally (2023b), yielding an estimate for the TAMRP of 5.3% as follows

$$\widehat{TAMRP} = .0835 - .0431(1 - .28) = .0525$$

In respect of the DGM estimate using Australian data, this only requires substitution of the current (February 2023) Australian ten-year risk-free rate (3.71%) for the five-year rate in equation (17) in Lally (2023b), yielding an estimate for the TAMRP of 6.5% as follows:

$$\widehat{TAMRP} = .0904 + .041(.075) - .0371(1 - .225) = .0647$$

In respect of the survey estimate using New Zealand data, this only requires substitution of the March 2023 New Zealand ten-year risk-free rate (4.35%) for the five-year rate in the last equation of Lally (2023b, page 23), yielding an estimate for the TAMRP of 7.1% as follows

$$\widehat{TAMRP} = .059 + .0435(0.28) = .0712$$

Finally, in respect of the survey estimate using data from foreign markets, this only requires substitution of the March 2023 New Zealand ten-year risk-free rate (4.35%) for the five-year rate in equation (19) of Lally (2023b), yielding an estimate for the TAMRP of 7.1% as follows:

$$\widehat{TAMRP} = .064 - .025(.07) + .0435(.21) = .0714$$

The estimates determined above are summarised in Table 2 below. Using only New Zealand data, the median estimate is .071. Using foreign data, the median estimate is .065. All of this suggests that, when rounded to the nearest 0.5%, an appropriate estimate of the TAMRP at the present time is .070, for a ten-year term. This is the same result as obtained for the five-year term in Lally (2023b).

Table 2: Estimates of the TAMRP in 2023 with Ten-Year Risk-Free Rates

	New Zealand	Other Markets
Ibbotson estimate	.073	.072
Siegel estimate: version 1	.060	.064
Siegel estimate: version 2	.072	.065
DGM estimate	.053	.065
Surveys	.071	.071
Median	.071	.065

Turning now to the overall cost of equity, this is as follows:

$$k_e = R_f(1 - .28) + \beta_e TAMRP \qquad (6)$$

As shown above, using ten-year rather than the five-year risk-free rates does not alter the TAMRP. So, using equation (6) above, the impact on the cost of equity from using the ten rather than the five-year risk-free rate would be to change the cost of equity by 72% of the change in the risk-free rate. At the current time (treated as February 2023 for the present purposes), the five and ten-year risk-free rates are 4.25% and 4.31% respectively. So, using the ten rather than the five-year risk-free rate would raise the cost of equity by 0.04%.

As with the AER (2023, Figure 6.3), this issue could be investigated at various earlier times. I therefore consider the Commission's current estimate of the TAMRP, based upon Lally (2019). Within Lally (2019, Table 4), I focus upon the Ibbotson and DGM estimates using New Zealand data (.074 and .073 respectively), and the Ibbotson estimate using data from foreign markets (.073), as only changes in these estimates are likely to affect the medians in that Table 4. In respect of the Ibbotson estimate using New Zealand data, the estimate using ten-year risk-free rates is .073 (Lally, 2019, page 6). In respect of the DGM estimate using New Zealand data, this appears in equation (16) in Lally (2019) and requires substitution of the contemporaneous ten-year risk-free rate (.0113: August 2019 average) for the three-year rate of .0084, yielding an estimate of the TAMRP of .071. In respect of the Ibbotson estimate using data from foreign markets, this appears in equation (7) of Lally (2019) and requires the first two terms on the RHS (.0656 and .062) to be replaced by their counterparts using ten-year risk-free rates (.060 and .064 respectively: see Lally, 2019, pp. 7-8), and this yields a TAMRP estimate of .071. These substitutions into the third and sixth rows of Lally (2019, Table 4) are shown in Table 3 below (*), with the remaining entries in this table being the original TAMRP estimates using five-year risk-free rates. As the table shows, these remaining estimates are sufficiently far from the median for the relevant column that revising them to reflect the use of ten-year risk-free rates is very unlikely to change the column median. The medians for the two columns then become .071 each, and therefore the estimate for the TAMRP rounded to the nearest 0.5% and using ten-year risk-free rates becomes .070.

Table 3: Estimates of the TAMRP in 2019

	New Zealand	Other Markets
Ibbotson estimate	.073*	.071*
Siegel estimate: version 1	.060	.066
Siegel estimate: version 2	.094	.083
DGM estimate	.071*	.082
Surveys	.064	.066
Median	.071	.071

This estimate of the TAMRP in 2019 using ten-year risk-free rates is a reduction from the estimate of .075 in Lally (2019) using five-year risk-free rates and, had ten-year rates been used to estimate it in August 2019, this lower estimate of .070 would have prevailed since then. Over that period from August 2019, the monthly average ten-year risk-free rate less the five-year rate has ranged from 0.8% to -.06%, with an average of 0.29%.[6] Assuming an equity beta of 0.7, along with the reduction in the TAMRP estimate of 0.5% estimated above, it follows from equation (6) above that use of the ten-year risk-free rates rather than the five-year rates (from August 2019 till August 2023) would have raised the cost of equity by as much as 0.8%(0.72) – 0.7(0.5%) = 0.23%, and reduced it by as much as 0.06%(0.72) + 0.7(0.5%) = 0.39%, with an average being a reduction of 0.11%.

[6] Data from Table B2 on the website of the Reserve Bank of New Zealand (www.rbnz.govt.nz).

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