THE COST OF CAPITAL FOR FIBRE NETWORK LOSSES

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CONTENTS

EXECUTIVE SUMMARY

Firms engaged in the construction of the Fibre Network have not yet been regulated under the Telecommunications Act 2001, but are expected to be, and losses incurred by them in the pre-regulation phase will be added to their initial asset base (as required by the Telecommunications Act 2001). The Commerce Commission proposes to deal with this through a building block model, and this gives rise to a number of questions.

The principal conclusions are as follows. Firstly, within the pre-regulatory period, the rate used to compound forward the losses incurred by the businesses is the same as the rate used to determine the cost of capital allowance in the Commission's building block approach for losses. Secondly, firms face systematic risks within the pre-regulatory period but these risks are not identical to those faced once regulation commences. Thirdly, properly estimating the beta in the pre-regulatory period would therefore require identifying suitable comparators, and these are unlikely to be available, leaving a choice between a beta estimate of zero and that for the regulatory situation; the former would be too low whilst using the same beta applied to the regulatory situation may be too high or too low. The latter is likely to produce a smaller estimation error and is therefore preferable. Fourthly, whilst a simpler alternative to the Commission's building block formula for the compounded loss calculation that does not involve annual book value and depreciation calculations is available, these annual figures will be required once fibre regulation commences and will have been applied to assets assigned from copper to fibre before fibre regulation commences; this supports the Commission's proposed building block approach. Fifthly, the simplest means of dealing with 'free' Crown financing is to delete relevant terms from the loss calculation, whilst any Crown fees should be added to opex within the pre-regulatory period. Lastly, although at least part of the losses is different in nature to the fixed asset expenditures that normally comprise the regulatory asset base, this does not warrant a different cost of capital for the losses upon regulation commencing and for pragmatic reasons the losses should be depreciated over the same period.

1. Introduction

Firms engaged in the construction of the Fibre Network have not yet been regulated under the Telecommunications Act 2001, but are expected to be, and losses incurred by them in the pre-regulation phase must be added to their initial regulatory asset base (as required by the Telecommunications Act 2001). The Commerce Commission proposes to deal with this through a building block model, and this gives rise to a number of questions including what cost of capital should be used to determine the cost of capital allowance within the building block approach, what cost of capital should be used to compound the losses forward to the regulatory commencement date, the implications of Crown financing, and the treatment of losses incurred during the pre-regulatory phase once the regulatory process commences.

2. The Singular Cost of Capital

The Commerce Commission (2018, para 7.67) proposes using the standard building block approach to determine the costs incurred during the pre-regulation phase, in which the cost for year *t* (treated as being incurred at year end) is as follows (with B_{t-1} being the depreciated book value of investment at the end of the previous year and *k* the allowed cost of capital):

$$B_{t-1}k + DEP_t + OP_t + TAX_t$$

Deduction of the revenues for that year (REV_t) and then compounding each year's losses at some rate *d* up till the regulatory commencement date (at the end of year *T*) then produces the loss adjustment *L* to the initial asset base (Commerce Commission, 2018, para 7.69):

$$L = \sum_{t=1}^{T} (B_{t-1}k + DEP_t + OP_t + TAX_t - REV_t)(1+d)^{T-t} \qquad (1)$$

Although this formula is intuitive, it derives from a more fundamental formula for the loss. By definition, the loss at the end of the pre-regulatory period is the net cash outflows for each year within the pre-regulatory period (the investment made at the end of year *t*, plus opex and tax for that year net of revenue for that year), compounded up at the appropriate compounding rate *d* till the regulatory commencement date (at the end of year *T*), less the

depreciated book value of pre-regulatory investment at the regulatory commencement date (of B_T) because this part will already be included in the initial regulatory asset base:

$$L = \sum_{t=0}^{T} (I_t + OP_t + TAX_t - REV_t)(1+d)^{T-t} - B_T \qquad (2)$$

Since (1) derives from (2), then these formulas must be equivalent. So, the allowed cost of capital k in equation (1) must be equal to the compounding rate d. To demonstrate this, consider the case of $T = 1$, with investment occurring only in year 0 and the only other cash flows being revenues in year 1. In this case, equation (2) says

$$L = I_0(1+d) - REV_1 - (I_0 - DEP_1)$$

whilst (1) says

$$L = I_0 k + DEP_1 - REV_1$$

The latter formula derives from the former and therefore $d = k$. The same point arises in the usual regulatory situation. For example, suppose there is investment of I_0 now with a life of one year and expected revenues are set now with realisation in one year. Letting d denote the discount rate on these expected revenues, the expected revenues must then satisfy the NPV = 0 condition:

$$I_0 = \frac{E(REV)}{1+d}$$

By contrast, the usual regulatory formulation is to set the expected revenues equal to the depreciation of I_0 and an allowed cost of capital at some rate (k) on the initial investment:

$$E(REV) = I_0 + I_0 k$$

The last formula derives from its predecessor and therefore $d = k$.

A further and related issue concerns depreciation. Regardless of whether equation (1) or (2) is adopted for computational purposes, any increase in depreciation increases the loss calculation but this is fully offset by a lower figure at the regulatory commencement date for the depreciated book value of investment made in the pre-regulatory period (B_T), and both of

these are added to the regulatory asset value at the commencement of the regulatory period. The perfect offset point is more apparent in equation (2), in which $1 extra depreciation lowers B_T by $1, but thereby raising the loss L by $1, so that the sum $L + B_T$ (which is added to the initial asset base) is unchanged. This suggests that, in the interests of simplicity, depreciation in the pre-regulatory period should be set to zero.

To illustrate this point, suppose that the only cash flow within the pre-regulatory period is an investment of $10m, regulation commences two years later, depreciation is $1m per year, and the cost of capital d is 0.10. In this case, equation (2) says that the loss L is $12.1m - $8m = $4.1m, in which case the initial asset base at the regulatory commencement date would have been augmented by $4.1m plus the undepreciated book value of $8m, totalling $12.1m. Had depreciation been set to zero, the loss L would instead have been $12.1m - $10m = $2.1m, in which case the initial asset base at the regulatory commencement date would have been augmented by $2.1m plus the undepreciated book value of $10m, totalling $12.1m as before.

In choosing between equations (1) and (2), for implementation purposes, equation (2) is more fundamental and also appears to be simpler because it does not require book values for investment between the date of expenditure and the regulatory commencement date. However, once regulation commences in 2022, annual book values (and depreciation) will be required in accordance with the usual building block model. Furthermore, some investments into fibre prior to 2022 were allocations of capital from copper, which will have been subject to annual book values and depreciation prior to the allocation point. Thus, it would be simpler to continue with this process of determining annual book values and depreciation prior to 2022, and this favours the Commission's approach in equation (1) over (2). This is also consistent with Section 177 (1) (b) of the Telecommunications Act 2001.

3. Estimating the Cost of Capital in the Pre-Regulatory Period

Turning now to estimating this singular cost of capital to be used for compounding in the pre-regulatory period, the Commission's cost of capital model is long established and requires only project-specific choices for the risk-free rate, beta, leverage and the DRP. I respect of leverage, the usual comparators should be invoked. In respect of the risk-free rate and the DRP, the appropriate choices for the year t cash flows are the rates prevailing at that point for the period from then until the commencement of regulation. Thus, if regulation commences

in 2022, net cash flows incurred in (say) 2015 should be compounded forwards using (inter alia) the seven-year risk-free rate and DRP prevailing in 2015. If most of the pre-regulatory net cash flows have occurred in one year (say 2015), then an acceptable simplification would be to use the seven-year rates at that point for all of the net cash flows. By contrast, Chorus (2018, para 170) favours the ten-year risk-free rate to be consistent with that for the IMs, but does not explain the relevance of the IMs to the present exercise.

In respect of beta, the natural choice would be the value to be used from the commencement of regulation. Furthermore, Chorus (2019, page 21) favours this on the grounds that acting otherwise would violate the NPV = 0 principle, but does not supply any proof of this claim. Use of the same beta in the pre-regulatory period as that used once regulation commences presumes that systematic risk is equal in these two periods. To analyse this issue, suppose that the only cost incurred in the pre-regulatory period is investment of I one year before the commencement of regulation, for which a cost of capital at rate d is allowed, leading to the sum of $I(1 + d)$ being the initial asset base that is subject to regulation. If the regulator correctly sets the price or revenue caps from that point, then the present value V (at the commencement of regulation) of the future net cash flows will be equal to $I(1 + d)$, and therefore the investment of I will have given rise to the certain outcome $I(1 + d)$ one year later. Accordingly, the appropriate rate of return over this one year period would be risk-free, and d would then arise from the Commission's model with a beta of zero. However, regulators sometimes err, some of the errors are likely to be systematic, and this implies that d is not equal to the risk-free rate.

To illustrate this with an extremely simple scenario, suppose there is no further investment upon regulation commencing, the regulator uses a price cap, there is no opex or tax, and demand and revenues arise one year later. Letting the regulator's estimates for the expected demand and the one-year cost of capital be denoted $E_R(Q)$ and k_R, the regulator sets the output price at the commencement of regulation so that the present value of the future revenues using their estimates $E_R(Q)$ and k_R is equal to the book value of investment at the commencement of regulation, being $I(1 + d)$:

$$I(1 + d) = \frac{PE_R(Q)}{1 + k_R} \tag{3}$$

However, the regulator's estimates of expected output and the cost of capital in the regulatory period may be wrong. Coupling the output price P set by the regulator as shown in equation (3) with the true values for expected demand and the cost of capital, denoted $E(Q)$ and k, the present value of the future revenues is instead V as follows:

$$V = \frac{PE(Q)}{1+k} = \frac{\left[\frac{I(1+d)(1+k_R)}{E_R(Q)}\right]E(Q)}{1+k} \qquad (4)$$

This present value V will differ from the initial regulatory book value $I(1 + d)$ if the regulator errs in estimating expected demand or the cost of capital. The biggest source of systematic risk here lies in the regulator's estimate of the MRP within the cost of capital. In particular, if market returns over the first period are high (low), the MRP is likely to be low (high) at the period end because the MRP is compensation for bearing equity risk (volatility) and volatility seems to be greatest in depressed economic conditions (French et al, 1987, Figure 1a). However, regulators do not tend to change their MRP estimates because it is too difficult to accurately estimate these changes. So, if market returns over the first period are high (low), the allowed cost of capital k_R is likely to be too high (low), and following equation (4) V will be above (below) $I(1 + d)$. So, upon investing I, the payoff one year later in the form of V is exposed to systematic risk. Accordingly, for investment I, the allowed rate d should reflect that systematic risk.

However, from the commencement of regulation, the set of systematic risks that the firm will face will expand. For example, if the regulatory regime involves a price cap (as assumed above), the regulated firm will face systematic risk arising from actual demand and opex being more or less than that expected by the regulator, as well as regulatory errors in setting the price cap. Alternatively, if a revenue cap is applied, the regulated firm will face systematic risk arising from stranding risk and opex being more or less than that expected by the regulator, as well as regulatory errors in setting the price cap. So, the set of systematic risks under regulation differ from those in the pre-regulatory period and therefore the beta within the allowed rate of return under regulation could differ from that in the pre-regulatory period. However, estimating the appropriate beta for a situation involves locating suitable comparators. It is difficult enough to do so in a regulatory situation and likely to be impossible for the pre-regulatory situation. So, the choice must be between a beta of zero and

that for the regulatory situation. Using a beta of zero would be too low whilst using the same beta applied to the regulatory situation may be too high or too low. The latter is preferable because the error from doing so is likely to be much smaller. For example, suppose the true beta applicable to the regulatory situation is 0.4 whilst that applicable to the pre-regulatory period is equally likely to be 0.2 or 0.6. Using a beta estimate of 0 for the pre-regulatory situation then has a RMSE (root mean squared error) of

$$\sqrt{0.2^2(0.5) + 0.6^2(0.5)} = 0.45$$

whilst using a beta estimate of 0.4 has the lower RMSE of

$$\sqrt{0.2^2(0.5) + 0.2^2(0.5)} = 0.2$$

In summary, systematic risks are present in the pre-regulatory period but differ from those once regulation commences. Therefore, properly estimating the beta in the pre-regulatory period would require identifying suitable comparators, and these are unlikely to be available. So, the choice must be between a beta estimate of zero and that for the regulatory situation. Using a beta estimate of zero would be too low whilst using the same beta applied to the regulatory situation may be too high or too low. The latter is likely to produce a smaller estimation error and is therefore preferable.

4. The Implications of Crown Contributions

In order to encourage firms to undertake investment in fibre, the Crown provided some financing to such firms at a zero cost of capital (Commerce Commission, 2018, paras 7.71, 7.72). Naturally, the loss calculation should not include that concession otherwise the firms will receive the concessional finance and a loss adjustment determined as if the firms had provided this capital itself and therefore incurred the cost of capital from doing so. The Commerce Commission (2018, para 7.73) presents two methods for achieving this, of which the simpler (referred to by the Commission as Method 1) is to subtract the face value of the concessional finance from the cost of the assets when determining the allowed rate of return. If equation (1) were used, this would involve defining the terms B_{T-1} in equation (1) to incorporate only investments financed by the firms. If equation (2) were used, it must be

rewritten as follows, where Z_t is the proportion of financing provided by the firm for the investment I_t:

$$L = \sum_{t=0}^{T} [(I_t(1 + Z_t d)^{T-t} + (OP_t + TAX_t - REV_t)(1 + d)^{T-t}] - B_T$$

If there were fees associated with the Crown financing, the simplest means of dealing with them would be to add them to opex (*OP*) in either equation (1) or (2). This approach is consistent with the requirement under Section 171 of the Telecommunications Act 2001 that the allowance for Crown financing reflect the *actual* costs of that financing.

Chorus (2018, para 176) claims that there are some additional costs to the businesses associated with Crown financing, in the form of obligations over phasing of the roll out, restrictions on the actions of the businesses, and penalties for failing to meet connection targets. However, these do not seem to be quantifiable and therefore cannot be incorporated into the loss calculation. Again, this is consistent with the requirement under Section 171 of the Telecommunications Act 2001 that the allowance for Crown financing reflect the *actual* costs of that financing.

5. Further Issues

The adding of the pre-regulatory losses to the initial regulatory asset base raises the question of whether they should be subsequently treated in the same fashion, i.e., that the same cost of capital will be applied to them and that they will be depreciated over the same period. Both issues are now examined.

In respect of depreciation, Duignan (2018, page 2) argues that the possibility of stranding presents the only clear argument for depreciating these losses whilst depreciation of the usual fixed asset expenditures constituting the regulatory asset base is warranted by their finite life. However, as is clear from equation (1) or (2), some of these losses arise from investments into fixed assets, and these must be depreciated in the usual way. Duignan's point then applies only to the residual components in the loss calculation. Since stranding risk is present, some depreciation scheme is warranted for these residual components. However, the

optimal such scheme is not apparent, and therefore applying the same depreciation process used for fixed assets is a pragmatic solution.

In respect of the applicable cost of capital, it might be thought that these losses warrant a different cost of capital to the usual regulatory asset base once regulation commences because their nature is fundamentally different. However, as noted in the previous paragraph, part of the losses arises from expenditures on fixed assets that are no different in principle to those undertaken at or after the commencement of regulation. In respect of the rest of the losses, they are still cash outlays and therefore warrant the same cost of capital allowance as those on fixed assets because the cost of capital allowance arises from the risk and timing of the regulatory revenues rather than the nature of the initial outlays. To demonstrate this, suppose there is investment of I_0 now into fixed assets with a life of one year and expected revenues are set now with realisation in one year. Letting d denote the discount rate on these expected revenues, which reflects their risk and timing, the expected revenues must then satisfy the NPV = 0 condition:

$$I_0 = \frac{E(REV)}{1+d}$$

It follows that the expected revenues are equal to the depreciation of I_0 and an allowed cost of capital at rate d on the initial investment:

$$E(REV) = I_0 + I_0 d$$

So, the cost of capital d applied to the initial investment reflects the risk and timing of the revenues received rather than the nature of the initial investment. Thus, if some of the initial investment is earlier losses rather than fixed asset expenditures, the same discount rate is warranted. By contrast, the nature of the initial investment might affect the period over which it should be depreciated, but this is a different point and has been addressed in the previous paragraph.

6. Conclusions

The principal conclusions are as follows. Firstly, within the pre-regulatory period, the rate used to compound forward the losses incurred by the businesses is the same as the rate used

to determine the cost of capital allowance in the Commission's building block approach for losses. Secondly, firms face systematic risks within the pre-regulatory period but these risks are not identical to those faced once regulation commences. Thirdly, properly estimating the beta in the pre-regulatory period would therefore require identifying suitable comparators, and these are unlikely to be available, leaving a choice between a beta estimate of zero and that for the regulatory situation; the former would be too low whilst using the same beta applied to the regulatory situation may be too high or too low. The latter is likely to produce a smaller estimation error and is therefore preferable. Fourthly, whilst a simpler alternative to the Commission's building block formula for the compounded loss calculation that does not involve annual book value and depreciation calculations is available, these annual figures will be required once fibre regulation commences and will have been applied to assets assigned from copper to fibre before fibre regulation commences; this supports the Commission's proposed building block approach. Fifthly, the simplest means of dealing with 'free' Crown financing is to delete relevant terms from the loss calculation, whilst any Crown fees should be added to opex within the pre-regulatory period. Lastly, although at least part of the losses is different in nature to the fixed asset expenditures that normally comprise the regulatory asset base, this does not warrant a different cost of capital for the losses upon regulation commencing and for pragmatic reasons the losses should be depreciated over the same period.

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