

Comments on the Commerce Commission's proposed approach to estimate the cost of capital

Glenn Boyle, Tim Irwin & Tony van Zijl
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WELLINGTON

Level 9, Axon House, 1 Willeston Street
PO Box 587
Wellington 6001
Ph: (64 4) 472 0590
Fax: (64 4) 472 0596

AUCKLAND

Level 17, West Plaza Building
3-7 Albert Street
Auckland 1010
Ph: (64 9) 913 6240
Fax: (64 9) 913 6241

For information on this report please contact:

Name: Tim Irwin
Telephone: 04 915 7615
Email: tirwin@lecg.com

Table of Contents

Executive summary	1
1. Introduction	4
2. The role of estimates of the cost of capital in regulation	5
3. Gauging the precision of estimates of the cost of capital...	7
4. Possible adjustments to WACC for unsystematic risk.....	12
5. Leverage	15
6. The financial crisis and the market risk premium	17
7. Commission’s proposals for estimating betas.....	18
8. Comparing return on investment and cost of capital	20
References.....	22
Appendix – Equity and debt beta	24

Executive summary

The Commerce Commission has recently released four reports that discuss the estimation of the cost of capital and the use of estimates in the regulation of electricity distribution businesses (EDBs). The Commerce Act (the Act) requires that the Commission develop guidelines for estimating the cost of capital as part of the development of input methodologies, which will guide regulatory activity under Part 4 of the Act.

The methodology for estimating cost of capital is likely to be important for all EDBs. The Act specifies that electricity lines services, which are supplied by EDBs, are regulated under Part 4 of the Act. While the Act distinguishes between consumer owned and non-consumer owned EDBs, both are subject to information-disclosure regulation. Non-consumer owned EDBs are also subject to 'default/customised price-quality regulation'; for these EDBs the cost of capital may also be a factor in the Commission's decision making on the appropriate starting price to be used.

Our comments on the Commission's proposed approach to estimating the cost of capital concentrate on the following three central and interrelated issues:

- gauging the precision of the estimates of the cost of capital;
- adjusting estimates of the cost of capital to account for unsystematic risks; and
- comparing realised rates of return and estimates of the cost of capital.

We also comment on the Commission's proposals regarding leverage, the market risk premium, the calculation of equity betas, and the comparison of return on investment to cost of capital.

Precision of WACC Estimates

The Commission correctly emphasizes that estimates of WACC are necessarily imprecise. However, its practical recognition of this point seems to focus solely on parameter error, while ignoring the possibility of model error. Further, in quantifying parameter error, the Commission rejects the use of Monte Carlo simulation in exactly the kind of situation that Monte Carlo was designed to address. We suggest the Commission reconsiders these issues.

Allowance for Unsystematic Risks

The Commission appears to accept in principle the possibility of allowances for various kinds of unsystematic risks, while rejecting previously-submitted evidence on the magnitude of these risks as being implausibly large. However, recent literature on this topic continues to emphasize the point that commercial firms consistently and systematically employ a cost of capital many percentage points greater than their

WACC. Further, the Commission's list of conditions on the recognition of unsystematic risk appear unreasonably onerous – if similarly-strong conditions were applied to the recognition of systematic risk, this would rule out the use of the CAPM.

Leverage

The Commission proposes discouraging high leverage by estimating the firm's cost of capital on the basis of a lower 'notional' leverage. This raises several issues. First, how is 'notional' leverage to be estimated? A sample average of leverage need bear no relationship to the leverage employed by a hypothetically efficient firm. Second, while we agree that 'extreme' leverage would be a legitimate cause for concern, the Commission is silent on what is likely to be considered 'extreme'. Third, the effect of such a scheme on business incentives may well be different from that envisaged by the Commission: just as setting a low price does not encourage the firm to reduce its costs, estimating the allowed cost of capital on the basis of low leverage won't encourage the firm to choose low leverage.

The Market Risk Premium: Implications of the Financial Crisis

Changes in the market risk premium can only be estimated, and very roughly at that, but it seems likely that the market risk premium has increased as the result of recent financial market trauma. However, because they are based on averages of past returns (which have recently been negative), historically based estimates of the risk premium have actually fallen. This suggests that the Commission needs to be wary of adjusting its market risk premium estimate in response to short-run changes in historical averages.

Beta Estimates

The Commission sets out a detailed five-step procedure for getting from comparator-firm equity betas to asset betas (de-levering) to a final industry equity beta (re-levering). However, the Commission appears to be unaware that these steps ultimately offset each other: the elaborate scheme proposed by the Commission amounts to no more than calculating a simple weighted average of the comparator firm debt and equity betas. Further, while various assumptions about implementation are possible, the most likely case results in the debt beta magnitude being irrelevant. Finally, the Commission correctly recognises that its beta estimate will be subject to both sampling error and intrinsic variation, and claims that "*(t)he confidence bands around the final beta estimate should account for both these sources of error.*" But it appears to provide no indication of how these 'confidence bands' will be estimated.

Return on investment and cost of capital

The Commission has said it will compare its estimate of the EDB's return on investment (ROI) with a band of returns around a point estimate of WACC for the EDB industry. The outcome of this comparison is likely to affect the starting prices of the price quality path for regulated EDBs. Estimates of ROI cannot easily be reliably compared with estimates of WACC. Estimates of WACC and ROI can both be expected to be noisy, and errors in the estimate of WACC will be introduced by differences between firm actual and industry average beta and in the estimation of market value. Consequently,

meaningful comparison of ROI and WACC requires careful analysis, including statistical analysis, before a conclusion can be drawn that a supplier is earning a return above or below its cost of capital.

1. Introduction

1. The Commerce Commission has recently released four reports that discuss the estimation of the cost of capital and the use of estimates in the regulation of electricity distribution businesses (EDBs):
 - *Revised Draft Guidelines: The Commerce Commission's Approach to Estimating the Cost of Capital*, 19 June 2009 (hereafter, *Guidelines*);
 - *Recommendations to the New Zealand Commerce Commission on an Appropriate Cost of Capital Methodology*, 18 December 2008, by Julian Franks, Martin Lally, and Stewart Myers;
 - *Input Methodologies Discussion Paper*, 19 June 2009, chapter 8 of which is entitled 'The regulatory cost of capital'; and
 - *Reset of Default Price-Quality Path for Electricity Distribution Businesses*, 19 June 2009, which among other things discusses the use of estimates of cost of capital in setting and benchmarking prices.
2. We have been asked to comment on the following issues raised by these documents:
 - the Commission's proposed method to estimate the cost of capital;
 - the Commission's proposed method to determine each year an estimate of the cost of capital relevant to the supply of each regulated service; and
 - issues that would arise if the Commission wished, as part of setting starting prices under 'default/customized price-quality control', to compare current and projected profitability of an EDB with the Commission's estimate of its cost of capital.
3. In our comments, we concentrate on the following three central and interrelated issues:
 - gauging how precise are estimates of the cost of capital;
 - adjusting estimates of the cost of capital to account for unsystematic risks; and
 - comparing realised rates of return and estimates of the cost of capital.
4. We also comment on other issues raised by *Guidelines*, including the Commission's proposals regarding leverage, the market risk premium, the calculation of equity betas and comparison of return on investment to cost of capital.
5. We note that the Commission in the *Input Methodologies Discussion Paper* also discusses a variety of possible approaches to the measurement of regulatory tax that have the potential to affect the measurement of an EDB's annual returns.

The Commission could allow for tax within the cost of capital by using a pre-tax cost of capital (the conventional post tax WACC adjusted for effective tax). Alternatively, with the use of the conventional post tax WACC or a 'vanilla' WACC, tax is allowed for as a separate cost item, although at different levels.

2. The role of estimates of the cost of capital in regulation

6. The purpose of the Part 4 of the Commerce Act (the Act) is given as follows (s 52A):

The purpose of this Part is to promote the long-term benefit of consumers ... by promoting outcomes that are consistent with outcomes produced in competitive markets such that suppliers of regulated goods or services –

(a) have incentives to innovate and to invest, including in replacement, upgraded, and new assets; and

(b) have incentives to improve efficiency and provide services at a quality that reflects consumer demands; and

(c) share with consumers the benefits of efficiency gains in the supply of the regulated goods or services, including through lower prices; and

(d) are limited in their ability to extract excessive profits.

7. The Act specifies that electricity lines services, which are supplied by electricity distribution businesses (EDBs), are regulated. The Act distinguishes two kinds of EDB: consumer-owned and non-consumer-owned. Both kinds of EDB are subject to information-disclosure regulation, whose purpose 'is to ensure that sufficient information is readily available to interested persons to assess whether the purpose of this Part is being met' (s 53A). Non-consumer-owned EDBs are also subject to 'default/customized price-quality regulation', which means that they are by default subject to price and quality paths set by the Commission, for a period of 4–5 years, but may apply to the Commission for a price and quality path that is customized to their circumstances (and applies for 3–5 years). Consumer-owned EDBs are not subject to price-quality control and are therefore called 'exempt'.
8. The Commission is developing guidelines for estimating the cost of capital as part of the development of 'input methodologies'. According to the Act, the purpose of these input methodologies '*is to promote certainty for suppliers and consumers in relation to the rules, requirements, and processes applying to the regulation, or proposed regulation, of goods or services under this Part*' (s 52R). The Act specifies that the input methodologies must include, among other things, a methodology for evaluating or determining the cost of capital (s 52T).

9. Estimates of the cost of capital are likely to be relevant to default and customised controls and to information-disclosure regulation. *Guidelines*, for example, frequently refers to ‘setting allowed rates of return’ by estimating the cost of capital. But the precise significance of the estimates for each of these kinds of regulation is not specified in the Act and is not yet clear from the Commission’s papers.
10. In setting ‘starting prices’ for default control for non-exempt EDBs, the Commission must either use the prices that applied at the end of the preceding regulatory period or new prices based ‘on the current and projected profitability of each supplier’ (s 53P(3)). The Act is silent on how current and projected profitability are to be measured and on the method by which ‘starting prices’ are to be based on these measures of profitability. In discussing default controls, the Commission writes (para 4.78; see also 8.164):
- If the prices determined by the Commission are based on the current and projected profitability of each supplier, this may therefore involve a number of input methodologies, particularly if current ROIs need to be compared against the relevant WACC estimate. However, given that ROI indicators are likely to be provided from information disclosure regulation in any event, the relationship may be an indirect one. Moreover, in keeping with the relatively ‘low-cost’ intent of default price-quality paths, any assessment of future profitability is unlikely to be undertaken using a full building blocks analysis. Rather, the Commission considers that the forecast information provided in asset management plans may assist it in assessing whether any starting price adjustments might be warranted in respect of future profitability.*
11. Customised control may depend more closely on the Commission’s estimate of an EDB’s cost of capital. It is in discussing customised control that the Commission sets out a detailed summary of its procedure for making a midpoint estimate of the weighted average cost of capital (WACC), for making an interval estimate of WACC derived from the midpoint estimate of the errors in estimates of the parameters, and for adopting a point estimate that may be above the midpoint (8.168–8.169). The Commission proposes to publish an estimate of an EDB industry average cost of capital each year, before suppliers must choose whether to propose a customised price-quality path.
12. The Act provides that EDBs that are subject only to information-disclosure regulation need not apply the input methodology determined by the Commission for calculating the cost of capital (s 53F). Nevertheless, all EDBs are likely to be required to report their actual returns on investment (8.156) and the Commerce Commission and others may compare those returns to estimates of the EDBs’ cost of capital. The Commission states that it ‘considers that it will be necessary for it to provide clarity on what a reasonable return might be’ (8.157) and that it ‘considers that the cost of capital assessment that it will make from time-to-time for use in determining price-quality paths for non-exempt EDBs represents one reasonable benchmark against which returns on investments and therefore ultimately profits can be assessed under information disclosure’ (8.158).

3. Gauging the precision of estimates of the cost of capital

13. The Commission correctly emphasises that WACC cannot be estimated precisely because parameters such as the market risk premium and asset beta cannot be estimated precisely. It also notes that the social cost of underestimating a regulated firm's cost of capital is likely to be greater than the social cost of overestimating it. The Commission proposes to make an interval estimate of the cost of capital, equal to its point estimate plus and minus an estimate of the standard error of the point estimate. It calls this interval the 'WACC range'.
14. The Commission's discussion of error concentrates on uncertainty in the estimates of the parameters of the capital asset pricing model (CAPM). Specifically, the Commission sets out the following procedure for estimating the WACC range.¹

First, estimate each of the individual WACC parameters and their associated standard errors.... In some cases the standard errors will be readily available (e.g. if the parameters have been econometrically estimated); in other instances, the Commission must rely on qualitative judgment to specify plausible values.

Second, combine each of the estimated parameters using the relevant WACC equation (e.g. pre-tax, post-tax or vanilla WACC depending on circumstances) to obtain an overall WACC estimate (the so-called 'midpoint' of the WACC range).

Third, make some reasonable assumptions about the degree of correlation between the individual WACC parameters.

Fourth, combine the estimated standard errors and correlations to calculate a 'standard deviation' for the WACC.

Fifth, apply this standard deviation to either side of the WACC estimate to derive a plausible WACC range.

15. The Commission's emphasis on the possibility of error is welcomed. But its approach could be improved in at least two ways.

¹ *Guidelines*, para 235, which states that details of the approach are set out in Lally (2008).

16. The first is to use Monte Carlo simulation to carry out the five-step procedure set out above. Following a recommendation of the review panel, the Commission says that it won't use Monte Carlo simulation, because the problem is too simple to require it (para 238):

... the Commission sees no significant gains from employing Monte Carlo methods for the purposes of estimating WACC. Monte Carlo techniques are typically used to evaluate a system in which variables interact in a complex manner, and where obtaining a direct (closed-form) solution to the system is not feasible. The Commission does not see any complex feedback loops in the interaction between WACC variables that warrant the use of Monte Carlo simulation. The Commission considers that it is feasible to obtain direct estimates and reasonable ranges for WACC without Monte Carlo techniques; employing Monte Carlo methods would add unnecessary complexity to the estimation process.

17. We share the Commission's preference for avoiding Monte Carlo simulation unless it is necessary, and we agree that the estimation of WACC involves no complex feedback loops. But this is only half the story. Monte Carlo methods are also useful for dealing with what might be described as 'difficult distribution' problems: situations in which the equation of interest is impossible to solve analytically for any plausible joint probability distribution for the underlying random variables. In this case, some sophisticated mathematics (including Stein's lemma) will allow the Commission to obtain a closed-form formula for its WACC range, if it is prepared to assume that each parameter is normally distributed. But the resulting formula will be long and complicated, since the parameters combine multiplicatively as well as additively. *Guidelines* refers to previous work by Martin Lally (2008), which results in a formula that itself contains many terms. But Lally simplifies the problem by assuming that all correlations are zero. By contrast, the third step in the passage quoted above envisages (more realistically) the possibility of nonzero correlations. Allowing for nonzero correlations results in a closed-form solution that would take the best part of a page to write down – in other words it would be difficult for both the Commission and submitters to use.
18. Further, the errors in the estimates of some parameters cannot realistically be assumed to have a normal distribution. A normally distributed variable has no lower or upper bound. Leverage, however, lies between 0 and 1, and the risk-free rate and the market risk premium are positive. If each parameter estimate is allowed to have whatever distribution appears most realistic, and correlations among parameter estimates are not assumed to be zero, it is simply not possible to compute the standard error of the estimate of WACC analytically. As noted above, this is a type of situation that Monte Carlo simulation was designed to address. Far from adding 'unnecessary complexity' (*Guidelines*, para 238), Monte Carlo simulation actually makes it possible to address the question posed by the Commission.
19. A second way in which the Commission could improve its approach is to take model error seriously. At present, the Commission's discussion of error concentrates on parameter error to the near exclusion of model error. As a result,

the Commission risks overestimating the precision of its estimates of the cost of capital.² A footnote to the five-step passage quoted above acknowledges model error:

Sometimes, even when statistically-estimated standard errors are available, in order to account for any uncertainties (e.g. model uncertainty) that cannot readily be quantified, it may be desirable to augment or attenuate these estimates using qualitative judgment (page 51).

20. But the Commission does not say how it intends to account for model uncertainty, which suggests that the Commission may in practice ignore it. The rest of the five-step passage quoted above makes no reference to model uncertainty. Moreover, *Guidelines* frequently assumes that the CAPM is the correct model. For example, it frequently equates market risk with systematic risk. In general, however, any number of risks can be uncorrelated with the market portfolio while simultaneously being systematically related to security returns. Only in the world envisaged by the CAPM are systematic and market risk equivalent.
21. Yet the error introduced by choice of model may be at least as large as parameter error, and it is more likely to ‘augment’ than to ‘attenuate’ error in estimates of the cost of capital (it could attenuate the error only if the error introduced by model choice were negatively correlated with the error introduced by parameter estimation). Quantifying model uncertainty is harder than quantifying parameter uncertainty, on the assumption that a particular model is correct. But that does not justify ignoring or downplaying it.
22. All things considered, the Commission’s conclusion that it should use the CAPM as its primary model for estimating the cost of equity is reasonable. The CAPM reflects the benefits of diversification and thus has intuitive appeal. It is commonly used by companies, analysts, and regulators. Perhaps most importantly, no other model is widely accepted as superior. But, as the Commission recognizes, it is unwise to assume that the CAPM accurately measures a firm’s cost of equity. Early in *Guidelines*, the Commission states that ‘there is no one asset pricing model that produces a final and correct answer for a firm’s cost of equity’ (para 46). Later, it lists some of the problems with the CAPM (para 84):

² There is a similar risk that, in estimating the effect of parameter uncertainty, the Commission will estimate statistical error and ignore ‘intrinsic’ error (for example, differences between the asset beta of the regulated firm and the asset betas of comparator firms and between foreign and local market risk premia.) See Boyle, Evans and Guthrie (2006, paras 58–59).

... like all economic models, the CAPM has its limitations. For example, the actual returns of low-beta stocks have tended to be much too high relative to the CAPM's predictions, and the returns of high-beta stocks have tended to be much too low.... A number of other economic factors have been shown to explain historical average returns much better than the CAPM beta.... Myers ... observes that the CAPM's beta sometimes suffers from estimation errors so large that it can be difficult to draw any reliable conclusions; that the instability of beta over time can be problematic; and that the model does not seem to provide a comprehensive explanation of the risk-return relationship on either a theoretical or empirical level. For these reasons, it is prudent not to rely solely on the CAPM for estimation purposes.

23. Perhaps even more importantly for the current situation, applications of both the classical (Bryant and Eleswarapu, 1997) and tax-adjusted (Zhang, 2008) CAPM to New Zealand capital market data have been unable to detect *any* relationship between security excess returns and beta. Moreover, Zhang finds that for electricity lines and gas pipelines businesses in New Zealand the precision of CAPM-based WACC estimates is extremely low.³ While these results do not necessarily invalidate the use of the CAPM for the purpose of cost of capital estimation (see Stein, 1996), they do suggest that New Zealand capital markets do not price securities in the manner envisaged by the CAPM. Given that the Commission's objective is to obtain a cost of capital consistent with market pricing, the results suggest that considerable caution in the use of the CAPM is warranted.⁴
24. The Commission could obtain some indication of model uncertainty in its estimate of the WACC distribution by generating estimates of the cost of equity from several models, perhaps including a forward-looking model, another

³ For example, in its 2007 Gas Distribution ruling, the Commission estimates WACC to be 8.13%. By contrast, using the return-beta relationship implied by New Zealand capital market data, Zhang estimates WACC to be 11.6% with a standard error of 2.49%. If the latter estimate is assumed to be normally distributed, then in relation to the value implied by the New Zealand capital markets data, there is only an 8% probability of finding values of WACC as low as (or lower than) the Commission's estimate of 8.13%.

⁴ Tests of the CAPM are hard to undertake because they require, for example, that the market portfolio is properly identified. It is possible, therefore, that the CAPM does correctly describe the pricing of securities in New Zealand, but that the market portfolio is not adequately represented by an index of New Zealand shares. But this does not resolve the problem with using the CAPM. On the one hand, it does not mean that the CAPM is correct, only that it is difficult to falsify. On the other hand, in using the CAPM the Commission must face the same problem of identifying the market portfolio.

version of the CAPM, and a non-CAPM model if relevant data are available. Several variations on this approach are possible. The Commission could continue to take as its estimate of WACC the estimate produced by the simplified Brennan–Lally model, but use the estimates from the different models to generate an idea of the plausible size of model error. It could quantify the dispersion by calculating the standard deviation of the estimates or it could derive its idea of the size of model error in an impressionistic fashion. Alternatively, the Commission could incorporate alternative models in the Monte Carlo simulation mentioned earlier. That is, the Commission could assign to each model a weight that reflected the Commission’s view of the reliability of the model. By also allowing for uncertainty in the parameters of each of the models, it could then generate an estimate of the WACC distribution that incorporated both parameter and model uncertainty.

25. On a couple of occasions, the Commission expresses concerns about spurious precision, which are relevant here. In discussing the possibility of attaching weights to different models, the Commission says, ‘*Such an approach would imply a false sense of precision and confidence in the weights*’ (para 95). Elsewhere, the Commission rejects a proposal for the use of an explicit loss function (van Zijl, 2007) on the grounds that it ‘*suggests a misplaced sense of precision and mathematical rigour*’.
26. Concern about spurious precision is warranted, but the Commission’s response to the concern is in these instances flawed. Ignoring uncertainty – for example, by assigning a weight of 100 per cent to one model – does not solve the problem. If uncertainty is to be considered, there are two options. One is to use a method (such as the five-step process set out by the Commission above) and the other is to rely on intuition (‘judgment’). If time and resources permit, and the decision important, using a clearly specified, well-thought-out method is likely to be better than relying on intuition. As long as the Commission does not believe, or lead others to believe, that the results are precise, the use of a method need not involve spurious precision.⁵
27. Lally (2008, 5–6 and section 9.2) offers a different reason for ignoring model uncertainty. He agrees that model uncertainty means that the true standard error of his estimate of WACC is greater than the standard error he reports. Because the social cost of underestimating WACC is higher than the social cost of overestimating WACC, he concludes that, other things equal, accounting for

⁵ Consider the rationale for the use of the CAPM (or another mathematically expressed model). Given the weaknesses of the CAPM, it might be objected that its use ‘suggests a misplaced sense of precision and mathematical rigour’. The Commission can reasonably respond to the criticism by noting that the alternative to relying on the CAPM (or other model) is to rely on intuition.

model error would lead him to choose a higher estimate of WACC. But he argues that other things are not equal because his other choices have tended to overestimate WACC. He concludes that no further adjustment of the WACC estimate is warranted. This approach is unsatisfactory, even if it is accepted that his other choices have tended to overestimate WACC. There is no reason to suppose *a priori* that the appropriate adjustment for model error is similar in size to the bias created by other choices. To conclude that the effects offset each other, it would be necessary to estimate their size. But if that can be done it is better to generate an unbiased point estimate of WACC and an unbiased estimate of the standard error of the estimate.

28. We don't mean to imply that the Commission should use Monte Carlo simulation to gauge the precision of its estimates of the cost of capital every time it makes an estimate. It might be reasonable to undertake such an analysis once and, on the basis of that analysis, form a view about the likely size of errors that it could use in subsequent applications. It might redo the full analysis only when it was revising its approach to estimating the cost of capital.

4. Possible adjustments to WACC for unsystematic risk

29. In section 5, *Guidelines* discusses several possible adjustments to WACC, each of which reflects an allowance for unsystematic risk in the cost of capital. The Commission appears to accept, in principle, the merit of arguments made in support of such allowances, while emphasizing that any adjustments in practice should only be made on a case-by-case basis. We agree that allowances for unsystematic risk are necessarily firm- (or industry-) specific, but believe that *Guidelines'* conclusions on these matters may impose unreasonably onerous conditions on the recognition of unsystematic risk.
30. The argument with respect to unsystematic risks is straightforward. When a firm invests, it incurs not only the usual direct costs of doing so, but also various indirect costs that are a consequence of the project's unsystematic risk. For example, investing destroys the flexibility to wait and invest at a future date. It may also eliminate some of the firm's growth option value, due to a greater potential for future financing constraints if the project turns out badly, or is stranded. Whatever the exact mechanism, the key point is that investment reduces the value of the firm's assets in place, and this reduction in capital is an indirect cost of the investment. Hence the firm needs to earn its WACC on total (direct plus indirect) costs, not just direct costs. Or, equivalently, it needs to earn an amount greater than WACC on direct costs alone. Here we focus on the latter approach, although our arguments apply equally well to the former.
31. In para 273, *Guidelines* states that some regulated businesses have
...submitted implausibly large claims for extinguished timing options and asymmetric risks, often with very little or no supporting analysis. In most cases, businesses have put forward qualitative arguments for regulatory

allowances with no attempt at any quantification. This is unhelpful to the Commission's deliberations.

32. But past submitters *have* provided quantitative evidence, most notably (although not exclusively) from surveys of capital investment practice indicating that unregulated firms systematically impose an investment hurdle rate significantly higher than their WACC, and that this 'hurdle rate premium' is at least partly attributable to issues related to unsystematic risk (for example, Boyle 2003).
33. Perhaps one reason why the Commission has chosen to reject the relevance of such evidence on business practice is that much of this evidence is somewhat dated. But more recent studies produce similar findings. For example, Meier and Tarhan's (2007) survey of 127 companies finds that the average hurdle rate is more than five percentage points above their estimated WACC and that this premium is strongly related to unsystematic risk (a firm with double the average level of unsystematic risk would add another three percentage points to its investment hurdle rate). And in an important recent paper, Chirinko and Schaller (2009) go beyond survey research and fit a model of optimal investment to data from 16,140 firms during the period 1980–2001. This yields four principal results of interest. First, the data reject the NPV = 0 criterion, but cannot reject the NPV > 0 criterion. Second, for a sub-sample of firms that are unlikely to be affected by unsystematic risk and irreversibility, the data cannot reject the NPV = 0 criterion. Third, the estimated WACC-plus premium ranges from 1.1 to 7.3 percentage points when firms face only one source of unsystematic risk, and from 13.6 to 33.1 percentage points when there are three unsystematic risk sources. Fourth, such premia are not due to financing constraints, an alternative source implied by the work of Whited (1992) and Boyle and Guthrie (2003). The Commission may consider these estimates to be too high, but they do provide a clear indication of the quantitative significance of unsystematic risk allowances – and hence warrant careful attention.
34. Another possible reason for discounting the theoretical and empirical evidence on unsystematic risk adjustments (see *Guidelines* section 5.1.3) is that, in the case of the real option associated with waiting to invest, investment may also give rise to other valuable options that counteract the loss of the waiting option. Hence, no adjustment to WACC is necessary. One difficulty with this argument is that it ignores the evidence noted in the previous paragraph documenting the existence of significant hurdle rate premia. If *Guidelines'* view were correct, then there should not be a hurdle rate premium, or if there is then it should not be related to unsystematic risk. Another difficulty with *Guidelines'* view on this issue is that it ignores other avenues by which unsystematic risk can be important: even if real options destroyed and created by investment exactly offset each other, other manifestations of unsystematic risk (stranding, financial distress etc) may still warrant an allowance.
35. A third possible reason for discounting evidence of the importance of options to delay investment is a belief that such options have low value in competitive markets. This issue is significant, because the purpose of regulation under the Act is *'to promote the long-term benefit of consumers ... by promoting outcomes*

that are consistent with outcomes produced in competitive markets. It is true that a firm that delays investment in a competitive market may lose business to firms that do not delay. Indeed, there is some evidence from real-estate markets that the value of the option to delay development declines with the extent of competition among real-estate developers (Bulan, Mayer, and Sommerville, 2009). On the other hand, Novy-Marx (2007) shows that the opportunity costs associated with large, irreversible investments can actually cause competition to have the *opposite* effect on the incentive to wait. For example, the competitive nature of property development means that a landowner will proceed more cautiously in converting vacant land than he would if he were a monopolist. In any case, the empirical evidence cited above about margins above WACC does not come from studies of monopolies. It comes from studies of firms in many industries and thus is representative of outcomes in workably competitive markets.

36. In para 276, *Guidelines* provides a long list of issues that need to be identified, clarified, and quantified in order for the Commission to consider an allowance for the loss of waiting value created by investment. Close inspection of this list reveals it to be essentially the explicit and implicit assumptions embedded in the investment timing model of McDonald and Siegel (1986), which would certainly provide a quantitative estimate of the delay option loss. In principle, this seems not unreasonable, although the difficulties of doing so would undoubtedly deter most submitters. However, it raises the question why *Guidelines* does not impose similar requirements on the use of the CAPM. For example, applications of the CAPM could be required to document:
- the extent to which investors in the firm or industry are long-term rather than short-term, care about parameters other than the mean and variance of returns, have human capital or other non-traded assets, and face refinancing and/or consumption risk;
 - the extent to which the firms' securities are traded in markets that are or are not frictionless, and are international or domestic; and
 - the extent to which individual and corporate tax rates are equal, and that dividend, capital gains and personal income tax rates are the same.
37. In all of these cases, the Commission has adopted, not unreasonably, simplifying procedures that entail strong assumptions. Thus, when it comes to pricing systematic risk, the Commission has chosen to pursue a pragmatic approach that ignores most theoretical complications. But when it comes to pricing unsystematic risk, no such practical accommodation is, apparently, warranted. On systematic risk the Commission seems happy to be partly right, but on unsystematic risk *Guidelines* suggests that it may opt to be precisely wrong.
38. The Commission is right to note that it is difficult to know what adjustments should be made to account for unsystematic risks. But it does not follow that the burden of proof for deciding upon any particular adjustment should lie solely with regulated firms or that the best estimate of the appropriate adjustment is zero (see van Zijl, 2007).

39. Finally, *Guidelines*' discussion of symmetric versus asymmetric risks, and of the different kinds of asymmetric risks, is not entirely clear in places. For example, paras 269–70 argue that no allowance for 'extinguished delay options' should be made when the unsystematic risk is symmetric. It transpires that 'symmetric risk' corresponds to reversible risk. But when investment can be reversed, the value of delay options is identically zero, and hence there is nothing to extinguish.

5. Leverage

40. In discussing leverage, the Commission raises the possibility that a regulated firm will choose leverage that is too high from a social perspective: '*in some instances, the regulated business ... may have adopted a very extreme gearing policy. Indeed it is possible that a regulated company may deliberately follow an extreme debt policy to shift risk to the regulator / consumer*' (para 76). Later, it writes (pages 44–45):

... the Commission recognises the potential for economic harm when regulated companies adopt extreme debt positions. For example, very high gearing ratios could damage the creditworthiness of the business (i.e. cause its rating to fall below investment grade), thereby pushing up its cost of borrowing and curtailing its ability to finance efficient and welfare-enhancing future investments. Moreover, very risky gearing policies raise the likelihood of the firm becoming financially distressed and seeking regulatory concessions.

A number of UK regulators have addressed such concerns by requiring – through license provisions – regulated businesses to maintain an investment grade credit rating. Failure to meet this condition may result in penalties set out in the firms' licenses, which are issued by the regulators.

Unfortunately, as discussed below, the Commission considers that it does not have the ability to impose and contractually enforce similar provisions on regulated New Zealand firms.

41. The Commission considers imposing a financial penalty on a firm whose leverage it considers too high (206), but rejects this approach. Instead it says it will discourage high leverage by estimating the firm's cost of capital on the basis of lower leverage:

The Commission considers that a more attractive scheme is to set the firm's allowed cost of debt – specifically, the debt premium – at a level consistent with the cost of debt paid by a corporate with an investment-grade rating.... If the businesses adopt very risky policies that move them into "junk" territory, thereby significantly raising financing costs, the allowed cost of debt will be insufficient to cover actual borrowing rates. In much the same way as efficient cost allowances (in the setting of regulated cash flows) induce firms to produce cost savings, this scheme should

provide firms with incentives to borrow prudently while preserving the flexibility to exploit the benefits of issuing debt (para 208).

42. Read in conjunction with the rest of *Guidelines*, this suggests that the Commission's plan is to calculate each firm's cost of the capital on the basis of a 'notional' degree of leverage, (largely) independent of the firm's actual leverage and, in line with this, estimate the debt premium that would be paid by a firm with that degree of leverage. The Commission's discussion and proposal raise several issues.
43. One is the nature of the Commission's view of the way regulation affects firms' incentives. Simple economic analysis suggests that the strength of a firm's incentive to reduce costs depends on the link between the firm's costs and the prices it can charge. If prices are independent of costs, the firm has a strong incentive to reduce costs. If lower costs lead to a lower price, the firm's incentive is weakened. Accordingly, the firm's incentives to reduce costs do not depend on the level of prices. In particular, lower prices don't encourage efficiency; fixed prices do.⁶ On this view, cost-based price regulation necessarily weakens a firm's incentives to reduce costs, but regulators can mitigate this problem by attenuating the link between price and the firm's actual costs. One way to do this is set prices on the basis of an estimate of costs that is more or less independent of the firm's actual costs. Another is to reset prices infrequently.
44. In any case, this logic implies that, if a firm believes that high leverage lowers its cost of capital (or its total costs), the Commission's proposal will not have the effect the Commission thinks it will have: the firm will continue to choose high leverage. Just as setting a low price does not encourage the firm to reduce its costs, estimating the allowed cost of capital on the basis of low leverage won't encourage the firm to choose low leverage.
45. If the Commission's proposal has an advantage, it is that by delinking the price a firm can charge from its choice of leverage, the Commission reduces the incentive to choose high leverage to justify a high price, which may occur if the Commission's method of estimating the cost of capital has the result that the estimated cost of capital increases with leverage.
46. The Commission's proposal raises a second issue as well. If the Commission believes that the cost of capital increases with leverage, the Commission's approach to estimating the cost of capital on the basis of leverage lower than the firm's actual leverage is equivalent, other things equal, to choosing a point

⁶ This simple view may of course be wrong or incomplete. If the Commission thinks so, however, it should set out its view.

estimate of the firm's cost of capital that is below the Commission's estimate of the firm's actual cost of capital. It will thus offset any decision to choose a point estimate higher than the midpoint.

47. Thirdly, the Commission's discussion raises the issue: how much leverage is too much from the perspective of the Commission? We would agree that 'extreme' leverage is a legitimate cause for concern. But it is not clear what degree of leverage is extreme. We note that the Commission has recently used estimates of leverage (e.g. 40%) that are well below anything that might be considered extreme and also below leverage values adopted by regulators in Australia and the United Kingdom (e.g. 60% in the case of the Australian Energy Regulator and 57.5–62.5% in the case of Ofgem – see the *Input methodologies* paper, tables 8.3 and 8.4).
48. Finally, para 198 suggests that the Commission is likely to estimate the 'notional' leverage level by taking the sample average of leverage within the relevant industry or other comparator firms. But surely the point of choosing a 'notional' leverage is to link this with the leverage of a hypothetical efficient business in the relevant industry – and there is no obvious reason why a sample average should yield a desirable estimate of this. Deviations of actual leverage from optimal leverage will depend on individual firm characteristics and need not average out to zero.

6. The financial crisis and the market risk premium

49. In para 164, *Guidelines* notes that it intends to adopt "a figure of 7 per cent" for the "MRP". This is the figure recently adopted by the Commission for the tax-adjusted risk premium, but para 81 of *Guidelines* defines "MRP" to be the simple difference between the expected market return and the riskless rate, i.e., non-tax-adjusted. As the difference between a 7% tax-adjusted market risk premium and a 7% non-tax-adjusted premium is significant, it would be useful if *Guidelines* clarified the form of the premium the Commission has in mind.
50. Whichever version of the risk premium is envisaged to be 7%, this figure is potentially affected by the recent financial crisis. This event has been associated with lower risk-free rates and higher risk premia. Changes in debt premia can be observed, and in New Zealand debt premia have increased sharply. Changes in the market risk premium can only be estimated, and very roughly at that, but it seems likely that the market risk premium has increased.
51. The fall in equity prices has *lowered* historically based estimates of the risk premium. But as discussed above, the fall in equity prices very likely reflects in part an *increase* in the true market risk premium during the crisis. This can be seen in estimates of the premium derived from forward-looking models. First, dividend yields have increased, which suggests, according to the dividend-growth model, that the cost of equity has increased. Second, the volatility of

equity markets has increased, which again suggests (Merton, 1980) that the cost of equity has increased. An increase in the market risk premium during the crisis is also suggested by recent survey evidence (Graham and Harvey 2009).

52. Estimates of the current market risk premium based on these models are very imprecise. If the crisis dissipates and financial markets return to normal, the best estimate of the market risk premium may place little weight on them. But, if the crisis persists or worsens, ignoring the evidence from forward-looking models would be imprudent.⁷ The appropriate approach, we believe, is for the Commission to maintain an open mind about the market risk premium and to stand ready to change its estimate according to conditions. That is, *Guidelines* does not in our view need to fix a numerical value of the market risk premium. Instead, it can state how the Commission will determine what the premium is and the Commission can leave itself the flexibility to alter the estimate it uses in the light of market conditions.

7. Commission's proposals for estimating betas

53. *Guidelines* discusses how the Commission plans to estimate an industry average equity beta by delevering comparator betas to get an asset beta and then relevering the asset beta. Our analysis, presented in appendix 1, suggests that the Commission's proposal is unnecessarily complicated. Instead of following the five-step process outlined in *Guidelines*, a simple weighted average of the comparator firm debt and equity betas will yield exactly the same estimate of the industry equity beta. Furthermore, if the Commission eschews trying to estimate debt betas for individual comparator firms and instead simply adopts a 'one-size-fits-all' debt beta – the most likely case – then the chosen value of the debt beta has no effect at all on the equity beta estimate. In short, *Guidelines* makes life more complicated for both the Commission and submitters than is necessary. Alternatively, if steps three through five are indeed necessary and

⁷ *Guidelines* briefly considers the merit of the dividend-growth model for estimating the market risk premium and states (para 158) that the model 'suffers from the limitations discussed in Section 3.4'. It is true that the dividend-growth model requires estimates of the future growth rates of dividends that can be estimated only very approximately and that the results of the model will therefore be very imprecise. But the criticisms of the dividend-growth model made in Section 3.4 are for the most part criticisms of the model's use in estimating a cost of equity for an individual firm, not for the market.

debt betas *are* important for the industry equity beta estimate, then vital information is missing from *Guidelines*.⁸

54. Having estimated the industry equity beta, *Guidelines* recognises (para 179) that this estimate will be subject to both sampling error and intrinsic variation, and claims that “(t)he confidence bands around the final beta estimate should account for both these sources of error.” But it appears to provide no indication of how these ‘confidence bands’ will be estimated. This is important information for all parties, particularly given the Boyle et al. (2006) demonstration of how ad-hoc approaches to estimating such bands can lead to significant overstatements of the precision with which beta is estimated.
55. A related issue concerns multi-divisional betas and the use of comparator firms. In paras 181–186, *Guidelines* outlines methods by which it may deal with the former problem, but it is unclear whether these techniques will be applied to individual comparator firms or only to the final industry beta. As Boyle et al. (2006) point out, many so-called electric utilities in the United States are diversified firms with non-electric business segments, so their estimated firm betas may differ substantially from the betas associated with their electricity business component. Without appropriate adjustments (or the careful selection of comparator firms), the two steps outlined in paras 170–172 are likely to yield misleading results.

⁸ Incidentally, the Commission justifies its choice of formula for conversion of equity beta to asset beta and vice versa ((7), *Guidelines*, p 39) by reference to Chapter 9 of the 2003 edition of *Brealy and Myers* (the current edition, published in 2008 is the 9th edition). However, Chapter 9 deals with the no tax case. In Chapter 19 it is explained that the formula continues to hold with corporate tax provided that there is continuous rebalancing to maintain the capital structure. Furthermore, the formula ignores personal taxes. The Commission should discuss the issue of rebalancing and explain how the approach to investor taxes is consistent with its choice of CAPM which reflects investor taxes (Cooper and Nyborg, 2008).

8. Comparing return on investment and cost of capital

56. In *Reset of Default Price-Quality Path for Electricity Distribution Businesses*, the Commission discusses the comparison of an EDB's return on investment (ROI) with estimates of the cost of capital. It says that it will compare its estimate of the EDB's ROI with a band of returns around a point estimate of WACC for the EDB industry. If an EDB's ROI is above the band, the Commission will be inclined to reduce starting prices to the point where ROI will be at the top of the band. If an EDB's ROI is below the band, the Commission will be inclined to allow the EDB to increase starting prices to the point where ROI will be at the bottom of the band. But decisions about price changes will also take account of the qualitative analysis of projected profitability. The band is likely to be asymmetric around the point estimate of WACC. In an illustrative figure, the point estimate of WACC is about 8.25%, the upper bound of the band is about 9.25%, and the lower bound of the band is about 7.75%. The Commission makes clear that it hasn't decided how to set the band.
57. The Commission's approach to setting the band will, we presume, be determined, or least heavily influenced, by its judgments about the size of the errors in its estimate of the cost of capital, any other adjustments it makes to WACC, and its view on the social cost of setting prices too high and too low.
58. As the Commission recognizes,⁹ estimates of ROI cannot easily be reliably compared with estimates of WACC. First, estimates of ROI will be noisy in the sense that reported (realized) ROI will depend on surprises in demand and costs as well as plans, so a firm can be expected to achieve its WACC only on average. Second, estimates of WACC will be noisy because of model and parameter estimate error. Third, if a firm's WACC is approximated by an estimate of an industry average WACC, further error will be introduced because, for example, each firm's beta will in general be different from the industry average beta. Fourth, because WACC is estimated as the cost of capital at its market value, errors are introduced by comparing WACC against accounting-based rates of return. (Boyle and Guthrie 2002 discuss these issues in more detail.)

⁹ See, for example, *Reset of Default Price-Quality Path for Electricity Distribution Businesses*, paragraph 240.

59. These points do not mean that meaningful comparisons of ROI and WACC are impossible, but they do imply that careful analysis, including statistical analysis, is needed before a conclusion can be drawn that a supplier is earning a return above or below its cost of capital (see van Zijl, 2007).

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THE COMMISSION'S APPROACH TO ESTIMATING EQUITY BETAS AND THE ROLE OF THE DEBT BETA

1. The General Case: Firm-Specific Leverage and Debt Betas

On pp37-39 of the *Draft Guidelines*, the Commerce Commission sets out a five-step process for estimating an industry-wide equity beta. This detailed procedure involves delevering firm-specific equity betas, averaging the resulting asset betas and then relevering this average, all the while allowing for a non-zero debt beta. However, the same result can be obtained in a simpler way.

The first two steps are (relatively) uncontroversial. In the first stage, a sample of n comparator firms is identified. Ideally these would be NZ-based firms in the same industry as the firm subject to regulation, but practical considerations are likely to mean that this sample will also include (perhaps exclusively) foreign firms.

Having identified this sample, the second step involves estimating the equity beta for each firm in the sample by regressing the time series of excess equity returns on the market excess return, i.e., estimating the market model. Let β_{ei} denote the estimated equity beta for firm i obtained via this procedure.¹

The third step removes the effect of leverage from the equity beta estimate by converting it to an asset beta estimate using the equation:

$$\beta_{ai} = \beta_{di}L_i + \beta_{ei}(1 - L_i) \quad (1)$$

where L_i is the debt ratio of firm i , β_{ai} is firm i 's estimated asset beta, and β_{di} is its estimated debt beta.

The Commission's approach becomes somewhat unclear at this third stage as it gives no indication of how its estimates of L_i and β_{di} for use in

¹The Commission's notation is a little misleading here as, strictly speaking, β_{ei} should have a 'hat' or similar to indicate that it's an estimate of the true beta. However, the Commission doesn't do so and instead uses 'hats' to denote the estimates of its final industry-wide betas. To avoid one possible source of confusion (but at the risk of creating another), we adopt the Commission's convention.

(1) will be obtained. For example, will it directly estimate β_{di} for each firm using the market model? This seems unlikely. Alternatively, it might back out the industry-wide debt beta implied by its chosen debt premium and use this in equation (1), i.e., the debt beta will be assumed the same for all comparator firms. Similarly, does it intend to estimate the debt ratio for every comparator firm or simply use its ‘notional’ debt ratio? Since the former should, in most cases, be directly observable for comparator firms, there seems no good reason not to make use of this information. The answers to these questions are not directly revealed in *Guidelines*, so we deal first with the most general case where the debt betas and leverage values used in equation (1) are firm-specific, before turning to arguably more plausible special cases.

The fourth step then consists of estimating the industry asset beta by calculating the sample average of the asset betas in (1). That is

$$\begin{aligned}\hat{\beta}_a &= \frac{\sum_{i=1}^n \beta_{ai}}{n} \\ &= \frac{\sum_{i=1}^n \beta_{di} L_i}{n} + \frac{\sum_{i=1}^n \beta_{ei} (1 - L_i)}{n}\end{aligned}\quad (2)$$

where $\hat{\beta}_a$ is the estimated industry-wide asset beta.

In the fifth step, equation (1) is reversed to back out the industry-wide equity beta using the industry parameter estimates for asset and debt betas and for leverage. That is

$$\hat{\beta}_e = \hat{\beta}_a + (\hat{\beta}_a - \hat{\beta}_d) \frac{\hat{L}}{1 - \hat{L}}\quad (3)$$

where $\hat{\beta}_a$ is given by (2). The Commission is silent on how it plans to obtain $\hat{\beta}_d$ and \hat{L} , but it seems reasonable to assume that if firm-specific values β_{di} and L_i are available (as we are currently assuming), then sample averages of these firm-specific estimates will be used as proxies for $\hat{\beta}_d$ and \hat{L} . In other words

$$\hat{\beta}_e = \hat{\beta}_a + (\hat{\beta}_a - \bar{\beta}_d) \frac{\bar{L}}{1 - \bar{L}}\quad (4)$$

where \bar{X} denotes the sample average of X .

Substituting (2) into (4) and rearranging then yields

$$\hat{\beta}_e = \left(\frac{1}{n}\right) \left[\sum_{i=1}^n \lambda_i \beta_{di} + \sum_{i=1}^n (1 - \lambda_i) \beta_{ei} \right]\quad (5)$$

where $\lambda_i \equiv \frac{L_i - \bar{L}}{1 - \bar{L}}$ is the percentage ‘excess’ of firm i leverage over and above the sample average. Equation (5) expresses the industry equity beta as a weighted average of the comparator firm debt and equity betas. The implications of this result are worth stressing: *there is no need to delever, average and relever comparator firm betas in order to obtain the industry equity beta (i.e., steps three through five in Guidelines are redundant); having obtained the comparator firm information, all that is required is the single step given by equation (5).*²

2. Special Case I: Fixed Debt Beta

It is likely that even further simplification is possible. As noted above, it seems improbable that the Commission will estimate firm-specific debt betas in stage three. Instead, it seems more likely that it will use a single ‘industry’ debt beta (possibly obtained by reverse engineering the CAPM with respect to the debt premium) in implementing (1). Let that debt beta be denoted by β^* . In this case, $\sum_{i=1}^n \lambda_i \beta_{di} = \beta^* \sum_{i=1}^n \lambda_i = 0$ and so

$$\hat{\beta}_e = \left(\frac{1}{n}\right) \sum_{i=1}^n (1 - \lambda_i) \beta_{ei} \quad (6)$$

Equation (6) shows that the industry equity beta can be calculated as a simple weighted average of the comparator firms’ equity betas, i.e., without reference to the assumed debt beta β^* . That is, if a single debt beta is used throughout, *the value of that parameter is irrelevant for determining the industry equity beta.*

3. Other Special Cases

Obviously other special cases could be considered – where debt betas are firm-

²Another way of writing (5) is

$$\hat{\beta}_e = \bar{\beta}_e - \frac{\hat{c}ov(\beta_{ei}, L_i)}{1 - \bar{L}} + \frac{\hat{c}ov(\beta_{di}, L_i)}{1 - \bar{L}}$$

where $\hat{c}ov(x, y)$ is the sample covariance of x and y . In this form, the industry equity beta equals the sample average of the firm-specific equity betas plus two ‘adjustment’ terms that account for sample correlation between leverage and the debt and equity betas respectively.

specific but leverage is fixed across firms (unlikely), or where both debt betas and leverage are fixed (possible). In both these cases, the outcome is

$$\hat{\beta}_e = \left(\frac{1}{n}\right) \sum_{i=1}^n \beta_{ei}$$

which is just the sample average of the comparator firm equity betas. In this case, firm-specific leverage – as well as debt betas – are irrelevant for determining the industry equity beta.

4. The Bottom Line

The above analysis suggests that the *Guidelines* discussion of equity beta estimation is either incomplete or unnecessarily complicated. As currently described, *steps three through five are simply unnecessary*. Moreover, if the Commission eschews trying to estimate debt betas for individual comparator firms and instead simply adopts a ‘one-size-fits-all’ debt beta – the most likely case – then *the chosen value of the debt beta has no effect at all on the equity beta estimate*. In short, *Guidelines* makes life considerably more difficult and complicated for both the Commission and for submitters than is necessary. Rather than going through the five-step process, all one needs to do is calculate a weighted average of the comparator firm equity betas: this is *equivalent* to the five-step process outlined in *Guidelines*. Alternatively, if steps three through five and debt betas are truly important for the industry equity beta estimate, then vital information is missing from *Guidelines*.