



COMMERCE COMMISSION

# **Revised Draft Guidelines**

**The Commerce Commission's Approach to Estimating the  
Cost of Capital**

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## **FOREWORD**

In the midst of ongoing turbulence in global financial markets, regulators around the world continue to be called upon to appraise the financing costs facing firms. It is a vital part of engendering a fair rate of return for suppliers on their investments, which is a prerequisite for the delivery of better outcomes for consumers. At times of great uncertainty, as at any other, the estimation of the appropriate cost of capital requires the exercise of well reasoned judgement to achieve this goal.

Market participants must be confident that decision makers will look at each case on its merits, using the most robust techniques and the best available evidence. In 2005, we embarked on a project specifically intended to enhance the approach we use to estimate the cost of capital, and to share an improved understanding of this process with stakeholders. Following a lengthy period of revision, these Revised Draft Guidelines represent our latest thinking on the topic.

More generally, this discussion document has a role in ensuring that our regulatory regimes are predicated on consistent and transparent frameworks. Ultimately, the project aims to ensure the cost of capital will be estimated in a predictable way across a wide spectrum of regulatory functions over time. As a key part of the implementation of our regulatory regimes, we recognise that this work must be accorded priority.

This revised version has benefited from the opinions of a panel of experts, comprising Professor Julian Franks from the United Kingdom, Professor Stewart Myers from the United States and Dr Martin Lally from New Zealand. Once further submissions have been received, we will endeavour to finalise the Guidelines within the year ahead. We strongly believe that the finalised Guidelines will result in a much improved starting point for those attempting to estimate the cost of capital for suppliers in New Zealand.

This matter will feature prominently in binding methodologies that are being developed for the regulation of certain electricity lines, gas pipeline and airport services. This document is therefore a key part of that wider consultation process. However, the finalised Guidelines will also provide greater clarity on our approach to the regulation of services in other sectors, notably telecommunications and dairy. Given this broad scope, there is rightly no shortage of interest in this document.

We would welcome your views on the ways in which our proposed approach could be improved further and look forward to receiving submission on these Guidelines.

**Dr. Mark Berry**  
Commission Chair

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# 1. Introduction

## 1.1 The Role of the Commerce Commission

1. The Commerce Commission (the Commission) is an independent, quasi-judicial body with responsibility for enforcement and regulatory control under a number of New Zealand statutes. Its members have legal, economic and industry expertise and its internal staff have legal, economic, technical, accountancy and industry experience. These resources are enhanced by access to significant external expert advice.
2. The Commission's purpose is to promote dynamic and responsive markets so that all New Zealanders benefit from competitive prices, better quality and greater choice (Commerce Commission, 2008). It does this by:
  - promoting sustained competition;
  - promoting fair business practices; and
  - providing sound economic regulation.
3. This purpose statement represents the Commission's summarised view of its various statutory responsibilities. Each statute has its own purpose statement or statements. The Commission has interpreted the specific purpose of each piece of legislation or part to arrive at this overriding purpose.
4. This document relates to the Commission's regulatory control activities under Part 4 of the Commerce Act 1986; the Dairy Industry Restructuring Act 2001 and the Telecommunications Act 2001.

## 1.2 Key Statutory Provisions

5. Estimating firms' cost of capital is an important element of the Commission's regulatory responsibilities. In particular, the cost of capital is a necessary and/or useful consideration for the Commission when:
  - evaluating whether firms should be regulated;
  - implementing the various regulatory instruments; and
  - monitoring the performance of suppliers of regulated goods or services in an industry.
6. The Commission's regulatory duties are governed by a range of statutory provisions. The key provisions are:

**Part 4 of the Commerce Act 1986** Part 4 of the Commerce Act provides for the regulation of goods or services in markets where there is little or no competition and little or no likelihood of a substantial increase in competition. In implementing information disclosure and/or price quality regulation for

specified electricity lines, gas pipelines and airport services, and in assessing whether and how other goods or services should be regulated, the Commission has regard to firms' cost of capital.

**Part 4A of the Commerce Act 1986** Subpart 1 of Part 4A (in effect until 1 April 2009) provided for the Commission to implement a targeted control regime for large electricity lines businesses. It required the Commission to set thresholds that act as a screening mechanism to identify companies whose performance might warrant further examination through a post-breach inquiry and, if required, control by the Commission. Under transitional arrangements, the cost of capital is relevant to the analysis of returns for determining whether to declare control under Part 4A, and for control under Part 5. Following the repeal of Part 4A on 1 April 2009, the thresholds for large electricity lines businesses that expired on 31 March 2009 were deemed, under section 54J(2) of the Act, to be determinations made under section 52P of the Act that apply to each business as if the thresholds were default price-quality paths.

**Subpart 3 of Part 4A** (also in effect until 1 April 2009) provided for the Commission to require large electricity line owners and distributors to disclose information concerning their businesses. It also required the Commission to publish a summary and analysis of the publicly disclosed information. Following the repeal of Part 4A on 1 April 2009, the Commission is subject to similar obligations under Part 4 of the Act, and the information disclosure requirements that are in place under Part 4A will remain in place until the Commission publishes new requirements under Part 4. The cost of capital is likely to be used as a benchmark for assessing returns in the Commission's analysis.

**Dairy Industry Restructuring Act 2001** The Dairy Industry Restructuring Act facilitated the amalgamation of the three main dairy co-operatives in New Zealand. The dominance of the amalgamated entity (Fonterra Co-operative Group Limited) was such that some regulation of the new entity was seen as necessary. Among the measures introduced was an obligation on Fonterra to supply raw milk to independent processors at a price which - absent agreement - was to be determined by a formula set out in the Dairy Industry Restructuring (Raw Milk) Regulations 2001. An ingredient of the price-determining formula is the annualised share value. In the absence of Fonterra using a cost of capital rate in calculating the price of a co-operative share (which would then be used as the discount rate to calculate annualised share values), the Commission must (reg 9(2)) set a discount rate - which Fonterra is then required to use for calculating annualised share value. The Supreme Court has confirmed that the default discount rate fixed under reg 9(2) must relate to a proper return on equity capital. So, in this context, the Commission may be called upon to calculate the cost of (equity) capital.

**Telecommunications Act 2001** The Commission's major functions under the Telecommunications Act are to resolve access disputes between carriers; to oversee telecommunications service obligations; to monitor the regulatory regime and recommend to the Minister of Communications changes to the list

of regulated services; conduct inquiries, reviews and studies relating to the telecommunications industry, and publishes reports, summaries and information about these activities; and monitor and enforce Telecom New Zealand Limited's operational separation undertakings. The cost of capital is potentially relevant to all of these activities.

### 1.3 Process and Purpose of the Draft Guidelines

7. In October 2005 the Commission released for comment *Draft Guidelines: The Commerce Commission's Approach to Estimating the Cost of Capital* (the Draft Guidelines). This set out the Commission's present methodology for estimating firms' cost of capital.
8. Submissions on the Draft Guidelines were received in January 2006. Having reviewed these submissions, the Commission decided to appoint a panel of experts (the Panel) to:
  - evaluate the Draft Guidelines and consider the issues raised in submissions;
  - provide a report on the appropriate theory and application of cost of capital for regulatory purposes; and
  - in the report, indicate points of consensus and disagreement, and where there is disagreement, explain the reasons why.
9. The composition of the Panel was finalised in December 2006, and comprised Professor Julian Franks (London Business School), Dr Martin Lally (Victoria University of Wellington) and Professor Stewart Myers (Sloan School of Management, MIT).
10. The Panel provided its report, *Recommendations to the Commerce Commission on an Appropriate Cost of Capital Approach* (Franks, Lally and Myers, 2008) in December 2008. This set out several recommendations on an appropriate cost of capital approach for regulatory purposes in New Zealand. The Commission sought clarification from Panel members on a number of recommendations, which concluded in March 2009. Having considered the Panel's recommendations in detail, the Commission has produced these Revised Draft Guidelines.
11. The purpose of these Revised Draft Guidelines is to help parties understand the Commission's proposed approach to estimating the cost of capital in performing its regulatory responsibilities, and to seek the views of interested parties on the various elements of the approach it proposes to use in future.
12. The Revised Draft Guidelines represent the Commission's preliminary views. Following industry consultation, the Commission intends to issue Final Guidelines on its approach to estimating the cost of capital, which it will apply across all of its various regulatory functions.
13. The Final Guidelines will outline a framework that the Commission proposes to employ in estimating the cost of capital. However, they will not necessarily cover every issue that might arise under the Commission's various regulatory functions. The Commission intends to use the Final Guidelines as a starting point, and adapt



them when necessary to accommodate both variations in industry-specific and firm-specific circumstances, and the relevant regulatory framework.

## 1.4 The Input Methodologies Project

14. The Commerce Amendment Act 2008 (the Amendment Act) received Royal assent on 16 September 2008. This legislation has introduced significant changes to those provisions of the Commerce Act 1986 that relate to the economic regulation of goods and services in the New Zealand economy. One of the most significant changes brought about by the Amendment Act is the requirement for the Commission to determine upfront regulatory methodologies, rules, processes, requirements and evaluation criteria (collectively and/or individually referred to as “input methodologies”) that will apply (to varying degrees) to the inquiries and various regulatory instruments provided for in Part 4 of the Act.
15. Section 52T of the Act provides that these input methodologies must include, to the extent applicable to the type of regulation under consideration, methodologies for evaluating or determining the cost of capital. The process for determining the input methodologies was outlined in the discussion paper released by the Commission in December 2008, entitled *Regulatory Provisions of the Commerce Act 1986*.<sup>1</sup> In Phase I of the project, the Commission will develop and consult on the Commission’s preliminary view on how, and what, input methodologies would be applied to each of the regulated sectors. These preliminary views have been published in the form of the *Input Methodologies Discussion Paper* that covers matters relating to the methodologies for cost of capital, asset valuation, depreciation and revaluations, treatment of tax, cost allocation and pricing methodologies for each sector.
16. On the cost of capital, the approach outlined in this document provides the basis for those sector specific guidelines. However, setting the cost of capital is a complex task with significant elements of judgement, and a number of key interdependencies with other regulatory parameters. These inter-dependencies are discussed in detail in the *Input Methodologies Discussion Paper*, which has been released contemporaneously with this document.

## 1.5 Submissions, Cross-submissions, Workshop and confidentiality

17. The Commission proposes that the process for finalising the cost of capital guidelines is run in parallel to the process for input methodologies under Part 4 of the Commerce Act. Table 1 lists the key steps and dates for the process to finalise the Guidelines on the cost of capital.

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<sup>1</sup> See Commerce Commission (2008) available at <http://www.comcom.govt.nz/IndustryRegulation/ContentFiles/Documents/Regulatory%20Provisions%20of%20the%20Commerce%20Act%201986%20-%20Discussion%20Paper.pdf>

**Table 1: Commission’s Process to Final Guidelines on the Estimation of the Cost of Capital**

Key Step	Indicative Date
Release Revised Draft Guidelines	19 June 2009
Submissions Due on Revised Draft Guidelines	31 July 2009
Cross-submissions Due on Revised Draft Guidelines	17 August 2009
Workshop on Cost of Capital	TBA
Finalise Guidelines	Q1 2010

18. Due to the technical nature of this topic the Commission considers that there is merit in holding a workshop on the cost of capital. The Commission recognises that the cost of capital impacts on other sectors not affected by the input methodologies. As such, this workshop will be open to experts from all sectors.
19. The Commission will review this proposed approach once it has received submissions on the two consultation papers and will provide all interested parties with an update on the scope and timing of the workshop as soon as possible.

### 1.5.1 Submissions

20. Submissions are invited on this Revised Draft Guidelines Paper from all interested parties. Submissions should be received by the Commission no later than **5pm Friday, 31 July 2009** (‘due-date’). All submissions should be supported by documentation and evidence, where appropriate
21. To foster an informed and transparent process the Commission intends to publish all submissions received on its website ([www.comcom.govt.nz](http://www.comcom.govt.nz)). Accordingly, the Commission requests an electronic copy of each submission and requests that hard copies of submissions not be provided (unless an electronic copy is not possible). Submissions should be sent to:

[NPB@comcom.govt.nz](mailto:NPB@comcom.govt.nz)

or

Murray Reynolds  
Economist  
Economic Services Branch  
Commerce Commission  
P.O. Box 2351  
Wellington

### **1.5.2 Cross-submissions**

22. The Commission invites cross-submissions on matters raised in submissions on the Revised Draft Guidelines. The purpose of these cross-submissions is to ensure that the Commission is aware of points of agreement or disagreement on matters raised by other submitters on the Revised Draft Guidelines prior to a workshop. The Commission therefore asks that parties providing cross-submissions focus their cross-submissions in this way. The Commission expects that cross-submissions should be no more than 5 pages long. Cross-submissions are due at **5pm on Monday, 17 August 2009**.

### **1.5.3 Workshop**

23. The Commission considers that a workshop will form a useful part of the consultation process for the Revised Draft Guidelines. The purpose of holding a workshop is to allow the Commission to get input from technical industry specialists in developing and/or evaluating its detailed proposals for the cost of capital.
24. Where the Commission intends to hold a workshop it will provide a detailed ‘straw-man’ proposal ahead of the workshop for parties to consider and/or provide written comments on. A workshop will be scheduled once more detailed proposals are developed.

### **1.5.4 Confidentiality**

25. The Commission discourages requests for non-disclosure of submissions, in whole or in part, as it is desirable to test all information in a fully public way. It is unlikely to agree to any requests that submissions in their entirety remain confidential. However, the Commission recognises there will be cases where interested parties making submissions may wish to provide confidential information to the Commission.
26. If it is necessary to include such material in a submission the information should be clearly marked and preferably included in an appendix to the submission. Interested parties should provide the Commission with both confidential and public versions of their submissions in both electronic and hard-copy formats. The responsibility for ensuring that confidential information is not included in a public version of a submission rests entirely with the party making the submission.
27. Parties can also request that the Commission makes orders under s 100 of the Act in respect of information that should not be made public. Any request for a s 100 order must be made when the relevant information is supplied to the Commission and must identify the reasons why the relevant information should not be made public. The Commission will provide further information on s 100 orders if requested by parties, including the principles that are applied when considering requests for such orders. A key benefit of such orders is to enable confidential information to be shared with specified parties on a restricted basis for the purpose of making submissions. Any s 100 order will apply for a limited time only as

specified in the order. Once an order expires, the Commission will follow its usual process in response to any request for information under the Official Information Act 1982.

## **1.6 Outline**

28. These Revised Draft Guidelines are structured as follows. Chapter 2 discusses some general regulatory principles that are relevant to the setting of allowed rates of return. Chapter 3 provides a discussion on the cost of capital, its use in a regulatory context, and its relationship to the allowed rate of return. Chapter 4 describes the various techniques and methodologies for estimating the individual parameters that underlie the weighted average cost of capital (WACC). Chapter 5 explores a number of issues — asymmetric risk, the costs of financial distress, and resource constraints — for which adjustments to the WACC might be warranted. Chapter 6 summarises the key conclusions presented in the paper.

## 2. Regulatory approach to the cost of capital

29. The Commission has regard to several general principles when estimating the cost of capital for regulatory purposes. A number of these principles are aimed at ensuring sound regulatory practice and include:
- consistency;
  - flexibility; and
  - cost effectiveness.
30. The principles listed above are elaborated on in greater detail in the Regulatory Provisions of the Commerce Act 1986 Discussion Paper. The Commission has had regard to these principles in formulating the proposed framework described in this document.
31. In addition to these principles, the Commission also gives consideration to a number of further issues that relate more specifically to cost of capital. These are discussed briefly below.

### 2.1 NPV = 0

32. One of the Commission's regulatory standards is the 'NPV = 0 rule', which states that firms ought to have an expectation of earning a reasonable rate of return (their cost of capital) and recovering their efficient investments, but no more.<sup>2</sup> In other words, regulation should constrain companies from earning excessive profits, as discussed in Section 3.1 below.
33. It is often argued before the Commission that NPV = 0 is too stringent. It is argued that in practice, firms (even those in workably competitive markets) do not invest simply when NPV is equal to zero; NPV must be positive to attract investment.
34. The Commission recognises that firms' profits fluctuate over time, even in regulated industries, so profits that are sometimes higher or lower than the cost of capital do not violate NPV = 0. The principle aims to rule out cases where expected profitability or long-run average profitability significantly exceeds the cost of capital.
35. As explained in Section 3.1, firms that earn their cost of capital will have earned a normal economic return (sometimes referred to in regulatory economic literature as a 'fair' rate of return). Hence, when implementing control, it is appropriate to set firms' allowed rates of return equal to the cost of capital, and to allow the present value of expected cash flows to just equal the initial value of the investment, in order to satisfy NPV = 0. This concept will also be relevant in other aspects of the Commission's work, such as assessing above normal or excess returns over time

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<sup>2</sup> NPV is the 'net present value' of the investment.

(either through inquiries, investigations, price monitoring and information disclosure).

## 2.2 Industry vs. Firm-Specific Costs of Capital

36. As explained in Chapter 3, a business's cost of capital depends on its assets' exposure to non-diversifiable risk or systematic risk.<sup>3</sup> To the extent that exposure to systematic risk varies between businesses, their respective costs of capital should differ too.
37. As a practical matter, whenever the Commission estimates allowed rates of return, it intends to take as a starting point a benchmark cost of capital for the relevant industry. An industry benchmark is useful for the following reasons:
  - It provides a useful sanity check on firm-specific cost of capital estimates, which may vary for idiosyncratic reasons.
  - Firm-specific costs of capital can suffer from large estimation errors, whereas typically, industry costs of capital estimates are statistically more precise.
38. If all firms in the industry have very similar exposure to market risk—that is, if they all have similar technology, scale, cost structures, exposure to macroeconomic factors and exposure to regulation—then the Commission intends to apply the benchmark cost of capital to all firms in the industry. This approach would reduce the regulatory burden of having to set individual allowed rates of return for separate businesses, which can be especially high in industries with many regulated firms<sup>4</sup>.
39. However, if there are real, non-idiosyncratic differences between companies within the same industry, then the Commission will consider making adjustments to the industry cost of capital in order to arrive at an individual cost of capital for the businesses of interest. The three key parameters in the cost of capital that could be adjusted to accommodate intra-industry variations are the asset beta, the leverage ratio and the debt premium. Each of these parameters is discussed in further depth in later Chapters of the paper.
40. If interested parties consider adjustments to the industry benchmark are warranted, the Commission is open to receiving submissions, during consultation on particular determinations, on why and how any appropriate adjustments could be made.

## 2.3 Real vs. Nominal Cost of Capital

41. In setting regulatory determinations, or analysing company returns, the Commission acknowledges that the company should be remunerated for inflation to ensure that investors earn an appropriate return in real terms. In practical terms, this can generally be achieved in two ways. First, by annually indexing the regulatory asset

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<sup>3</sup> Also sometimes referred to as market risk, non-idiosyncratic, or non-diversifiable risk.

<sup>4</sup> In some sectors, the industry in question will be made up of a single monopoly provider. In such cases, the Commission may draw on evidence of comparable businesses both overseas and in other sectors in New Zealand to establish a suitable benchmark cost of capital for the firm.

base (RAB) by a suitable index (e.g. CPI), and applying a real cost of capital to that RAB. Alternatively, an inflation assumption can be included within a nominal cost of capital allowance, with no indexation adjustment applied to the RAB.<sup>5</sup>

42. In practice, both approaches generate a broadly equivalent revenue stream in NPV terms, which allows the firm to fully recover its investment in its asset base. As such, it might be argued that the choice between the two is merely presentational. However, there are a number of factors that should be considered in selecting the appropriate approach in each case.
43. First, it is necessary to consider factors arising from the varying revenue profiles that result from each approach. Whilst in NPV terms the two methods can be considered broadly aligned,<sup>6</sup> there are potentially significant differences between the cash flows resulting from each method. Under an indexed RAB / real WACC approach, the business is remunerated for inflation in the long run. This has two important implications. On the one hand, if the firm has debt funding, it can lead to a misalignment between the revenues it receives through its charges and the remuneration it has to provide to its investors, with potentially negative implications for the firms' financeability.<sup>7</sup> However, on the other hand, if straight-line depreciation is adopted, it means that regulatory depreciation allowances are constant in real terms, which can help remove potentially undesirable inter-generational effects.
44. Second, the two approaches can potentially expose the firm to differing levels of inflation risk. Under an indexed RAB / real WACC approach, the RAB can be indexed according to actual inflation, which can be reflected in subsequent years or regulatory periods. As such, consumers bear any costs associated with inflation risk through the long-term price profile. By contrast, under a nominal WACC approach, the firm is exposed to any deviations in outturn inflation from the level assumed in the regulatory cost of capital assumption. To the extent that the market is concerned about inflation risk, this will be reflected in a margin in the nominal risk-free rate and hence the nominal cost of capital. This, in effect, means that consumers pay the firm to bear the risks through slightly higher prices.

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<sup>5</sup> The Commission has on occasions in the past adopted a third approach, whereby a nominal WACC is applied to an indexed RAB, with the RAB revaluation gains treated as income and deducted from annual cash flows. In the long run, the cash flows arising from such an approach are broadly equivalent to an indexed RAB, real WACC approach.

<sup>6</sup> There can be minor differences in NPV terms depending on the inputs used in assessing the cost of capital and approach adopted to remunerating for tax within the broader regulatory framework.

<sup>7</sup> In general, most companies will issue the bulk of their debt on a nominal basis (i.e. at an interest rate that includes inflation, with no indexation of the principle. This front-loads the interest payments, when considered against the revenue profile resulting from an indexed RAB, real WACC approach. In practice, this issue is overcome if the firm maintains a constant leverage level, as the cash inflow from increasing debt in line with the indexation of the RAB offsets the inflation component of the interest payment. The financeability issue may arise in situations where the firm has a step increase in leverage to fund a major investment and does not add to its debt in cash terms during the life of the project.

45. Where an indexed RAB and real WACC are used and this contributes to short-term financeability concerns, the Commission may reduce the misalignment between costs and revenues by adjusting the revenue profile (as discussed below).

## 2.4 The Use of Sanity Checks and Financeability Tests

46. The Commission recognises that the tools it must use in estimating firms' cost of capital are imperfect and often require compromises and adjustments. For example, there is no one asset pricing model that produces a final and correct answer for a firm's cost of equity. Several methods for estimating market risk premiums (MRPs) exist, each with its own strengths and weaknesses. There are several approaches to estimating betas for multi-product firms.
47. Furthermore, estimation error and intrinsic variation can add to the uncertainty around individual parameter values.

### 2.4.1 Sanity Checks

48. Given these constraints, the Commission cannot avoid exercising judgement in many areas, including the selection of models used to set allowed rates of return, and the parameter values that are inputs into the cost of capital.
49. In recognition of this, the Commission intends to subject its individual parameter estimates, and overall cost of capital estimates, to sanity checks whenever it is feasible to do so. This may involve cross-checking parameter estimates using competing economic models, and where a firm-specific cost of capital is estimated, comparison both against an industry benchmark and across industries.
50. The Commission recognises that some economic models are more amenable to application in some industries than others, due to certain industry features. In addition, the use of some models in certain industries may be constrained by the availability of usable data. (For example, see the discussion in Section 3.4 on a selection of models that could be used to estimate the cost of equity.) Nonetheless, the Commission recognises the value in employing sanity checks.

### 2.4.2 Financeability Tests

51. UK regulators have been concerned that increased levels of investment under a standard RAB-based building block price control may be deleterious to the creditworthiness of regulated firms in the short term, which would hinder the ability of those firms to raise finance on reasonable terms (e.g. Ofwat and Ofgem, 2006). This in turn may undermine regulated firms' ability to undertake efficient, welfare-enhancing investments.
52. The regulators' response to these concerns has been to apply *financeability tests*, which check "whether the cash flow generated by operations in each year, after subtracting certain additional investment costs excluded from the cash from operations calculation, is sufficient to meet fixed financing costs" (Ofgem, 2007, Appendix 10).



53. Some regulators outside the UK have employed similar financeability tests. For example, when setting electricity transmission tariffs, the ACCC has routinely considered whether debt ratings under the regulated prices would be sufficient for the firms “to obtain credit” (e.g. ACCC, 2005a, Appendix C; ACCC, 2005b, Appendix B). Similarly, when setting maximum charges for Dublin Airport, the Irish Commission for Aviation Regulation assessed the likely ability of the Dublin Aviation Authority to raise capital on reasonable terms, in order to proceed with its planned investment programme (CAR, 2007, Section 3.6).
54. The financeability tests applied by these various regulators have involved:
- computing a number of financial ratios used by rating agencies, which measure the ability of regulated firms to service debt;<sup>8</sup>
  - taking into account various qualitative factors that rating agencies consider (e.g. the stability of the regulatory regime, the state of the economy, the firm’s ownership structure, etc); and
  - seeking the opinion of rating agencies on the likely impact of allowed cash flow profiles on firms’ credit ratings.
55. If prices are being set using a building blocks approach, the Commission will leave it open to interested parties to submit financeability analysis for the Commission’s consideration, where parties consider it appropriate to do so.
56. The purpose of the financeability test would be to ensure that a reasonably efficient firm is able to operate and finance the regulated services within the constraints of any maximum limit on prices or revenues. Where the regulated business unit belongs to a company that supplies multiple sectors, the financeability analysis must be applied solely to the regulated business unit, rather than the entire company or ultimate holding group. This will ensure that end users are not required to pay higher charges to fund any costs that are not shared by the regulated business that may arise from unrelated or off-shore investments, and also provide comfort to firms that price controls will not be set unreasonably tightly on the basis of a strong group financial position. The Commission will evaluate the analysis submitted by parties on a case-by-case basis.
57. If the Commission concludes from the analysis that financeability is an issue, there are a number of courses of action that it could pursue. In order of preference, these include:
- First**, the Commission could revisit its various regulatory inputs to check if they have been appropriately set. For example, if the Commission is setting prices

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<sup>8</sup> Ederington, Yawitz and Roberts (1987) find that publicly available financial statistics, such as interest coverage ratios, leverage, and profitability measures, have a role in explaining corporate bond yields, as do credit ratings. Examples of some potentially useful financial measures are the post-maintenance interest cover ratio (PMICR), funds from operation (FFO) to interest, retained cash flow to debt, debt to regulatory asset value, EBIT to revenues, EBITDA to revenues, EBIT to funds employed. Oxera (2006) provides a summary of the financial indicators used by various overseas regulators, regulated companies and rating agencies.

using a building blocks approach, it could re-examine the building blocks for any errors.

**Second**, the Commission could consider whether it would be desirable to reduce the notional gearing assumption adopted within its estimate of the cost of capital<sup>9</sup>.

**Third**, the Commission could consider whether the profile of the business's allowed revenues should be accelerated, to allow earlier cost recovery than would otherwise occur, ensuring that NPV-neutrality is maintained (i.e. revenues in later years would be lowered commensurately).<sup>10</sup> One drawback with this approach is that if the life of the business's assets spans regulatory periods, all else equal, consumers in earlier periods would face higher prices than consumers in later periods, thus raising intergenerational inequities.<sup>11</sup> For this reason, the Commission does not favour the acceleration of cash flows as a first course of action.

**Fourth**, and only as a last measure, the Commission could consider adjusting the cost of capital to ensure financeability. The Commission views this response as the least desirable course of action. As discussed in Chapter 3, the cost of capital is a market-determined rate. The Commission estimates the cost of capital using market data, therefore, in principle, there should be no compelling reasons to adjust the cost of capital. As such, adding a financeability margin to the allowed rate of return would violate the NPV = 0 principle. However, the Commission recognises that the estimates of the parameters that make up the cost of capital are subject to errors, and in situations where conditions are very uncertain, financeability analysis can inform judgements on the appropriate conclusions. As a result, there may be occasions where an adjustment to the cost of capital could be appropriate.

## 2.5 The Asymmetric Costs of Errors in Rate Allowances

58. The Commission recognises that if the allowed rate of return is set too high, consumers and access seekers (where an access regime applies) will be charged too much, and there is a risk that the firm may over-capitalise. On the other hand, if the allowed rate of return is set too low, incentives for firms to undertake efficient, welfare-enhancing investment will be distorted.
59. As a general principle, the Commission considers that the social costs of setting allowed returns too low likely outweigh the social costs of setting them too high.

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<sup>9</sup> See section 4.4 for a discussion of the Commission's proposed approach to leverage.

<sup>10</sup> Allowed revenues may be accelerated by, for example, 'tilting' the firm's CPI-X schedule over time, or by front-loading depreciation in the regulated cash flows (e.g. Jenkinson, 2006). The key is that the NPV of the firm's expected cash flows is equated to zero in all cases.

<sup>11</sup> In instances where the Commission has adopted a real WACC approach, the revenue streams that would apply under a nominal WACC, un-indexed asset base approach in the short-term might be adopted as an upper limit on the magnitude of any proposed depreciation adjustment.

## 3 The Cost of Capital Defined

60. A widely adopted definition of the cost of capital (as spelled out in Kolbe, Read and Hall, 1984), is the minimum rate of return necessary to attract capital to an investment. It can be defined more precisely as “the expected rate of return prevailing in capital markets on alternative investments of equivalent risk”. The cost of capital has four important characteristics:
- It is *forward-looking*. Investment returns are uncertain; outturn returns may differ from expected returns. The cost of capital is an expected rate of return.<sup>12</sup>
  - It reflects the *opportunity cost* of investment. Investors face a variety of investment opportunities, so the expected rate of return on any investment must be sufficient to compensate for foregone (or the next best) investments. This is why the cost of capital is sometimes referred to as the ‘required rate of return’.
  - It is *market-determined*. In other words, it is determined by the balance between supply and demand for capital, so it is an equilibrium rate of return, and should therefore have reasonable regard to prevailing market circumstances.
  - It reflects the *risk* of the investment. In particular, it is the expected rate of return that applies on investments with a similar risk profile (assuming markets are efficient and no arbitrage opportunities exist). The cost of capital reflects the risk of the project, not the risk of the firm that holds the rights to those projects. Finally, it is assumed that investors are rational and well-diversified<sup>13</sup>, so the cost of capital does not compensate for firm specific risk, only for systematic risk (Kolbe, Tye and Myers, 1993, pp.129–132 and Appendix A).

### 3.1 The Cost of Capital in Commercial vs. Regulatory Use

61. In the regulatory context, the cost of capital is a tool designed to effectively balance the interests of the infrastructure owner, access seekers (where an access regime applies), and consumers. Since the cost of capital is the minimum rate required to attract capital to the investment (i.e., it covers all relevant opportunity costs), it is considered to be a *fair* rate of return that can be used as the allowed rate of return for regulatory purposes, which in turn determines regulated firms’ prices. If the

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<sup>12</sup> The word ‘expected’ is used here and elsewhere in these Revised Draft Guidelines in the statistical sense (i.e. the probability-weighted rate of return). It does not refer to a ‘hoped for’ or ‘most likely’ rate of return (Kolbe, Tye and Myers, 1993, pp.68–69).

<sup>13</sup> In practise, it is not necessarily the case that holding the market portfolio (as determined by the classical CAPM) results in a well diversified investor. One such example would be Finland, where Nokia would represent a large fraction of the market portfolio.

allowed rate of return is set too high, then consumers will end up paying too much. If the allowed rate of return is set too low, the firm will be unable to attract sufficient capital to undertake efficient investment. The aim of balancing interests in this way is to maximise welfare to society through gains in economic efficiency.

62. Commercially, however, the cost of capital is employed by firms for a slightly different purpose — namely to assist in selecting which of a number of possible investments should be undertaken. It represents a so-called hurdle rate, the minimum rate of return that an investment must achieve in order for it to proceed. Unlike the regulatory cost of capital, there is no direct link between a competitive firm's cost of capital and the prices it can charge in the market. As such, once the investment has been made, actual returns may differ quite markedly from the project's cost of capital. If actual returns exceed (fall below) the cost of capital, the project will have earned a supernormal (subnormal) profit. If actual returns exactly match the cost of capital, it will have earned a normal economic return, i.e. just enough to equal the return on an investment of similar risk, but no more.
63. Whilst a regulator sets prices to recover the cost of capital, ex-ante regulation itself can never guarantee the returns of a firm. Thus, when the Commission sets the allowed rate of return of a firm equal to its cost of capital, it recognises that in some years actual returns may exceed the cost of capital, and in other years actual returns may fall short but that, on average, over a long enough period of time, the firm will have earned its cost of capital.
64. For regulated firms, there is a direct relationship between the cost of capital and regulated prices via the allowed rate of return. (There is no such direct link for unregulated firms.) As a result, the cost of capital can have a significant bearing on the earnings of regulated businesses. For example, Grout (1995, p.386) estimated that if shareholders in regulated utility companies in the UK were permitted to earn just an additional 1% on equity, the combined profit to those firms would increase by around £562 million. Hence, the economic implications of errors in cost of capital can be substantial.
65. While recognising the significant impact the cost of capital can have on regulated companies, the Commission notes that it is only one of many regulatory inputs. The cost of capital may be reasonably set to balance investors' and consumers' interests but if, for instance, the regulatory asset base (RAB) is measured inappropriately, or the business' expected cash flows are miscalculated, unintended regulatory outcomes may still result. In the interests of achieving internal consistency, the Commission keeps in mind the interlinkages and possibility of spillover effects between the cost of capital and its elements, and other regulatory parameters.

### **3.2 The Components of the Cost of Capital**

66. In the context of these Revised Draft Guidelines, 'capital' refers to the financial resources that must be committed to a firm or a project with a delayed payback. Firms are typically financed through two main forms of capital:

- **Debt capital:** Firms may borrow, for example, from lending institutions or by issuing corporate bonds. Depending on the nature of the form of debt, firms will promise to make repayments during the borrowing period, or upon maturity.
  - **Equity capital:** Firms issue shares, representing a claim on the value of the firm after any existing debt has been repaid. Shareholders receive returns both through dividends and through any capital gains on their investment.
67. In order to attract funds from lenders and equity investors, firms must expect to pay these capital providers an appropriate rate of return to compensate them for the risks they bear. The overall cost of capital of a firm whose capital base is made up of equity and debt is typically measured by the weighted average of the cost of equity and the cost of debt capital, otherwise referred to as the Weighted Average Cost of Capital (WACC).
68. The simplest (i.e. tax-free, or ‘vanilla’) specification of the WACC is

$$WACC = r_d L + r_e (1 - L), \quad (1)$$

where  $r_d$  is the cost of debt capital,  $r_e$  is the cost of equity capital, and  $L$  is the financial leverage ratio.

69. The specific meaning of the cost of capital depends on the context. In some cases a firm may be financed entirely through equity, in which case the cost of capital would be the cost of equity (the weighting given to debt,  $L$ , would be zero)<sup>14</sup>.
70. The cost of debt and the cost of equity are now discussed in further detail.

### 3.3 Cost of Debt

71. The cost of debt measures the overall cost to the firm of borrowing. It may be expressed in two ways: a *promised* yield, or an *expected* yield.
72. The promised yield on debt is the interest rate the firm promises to pay when it borrows. For firms with relatively risk-free debt (i.e. companies with low levels of gearing and highly-rated debt), it is reasonable to assume the cost of debt equals the promised yield.
73. The expected yield on debt is the rate lenders can expect to earn, taking into account the probability of credit default. In the special case where the probability of default is zero, the firm’s expected yield on debt will equal its promised yield on debt. For firms with very risky (subprime) debt, the expected yield is a more appropriate measure of the cost of debt than the promised yield.
74. In practice, the Commission’s proposed approach to setting the debt premium and appropriate leverage assumption (as outlined below), means that it is unlikely to set

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<sup>14</sup> See, for example, the Commission’s setting of the discount rate for Fonterra pursuant to regulation 9(2) of the Raw Milk Regulations (Decision 501, 12 June 2003).

a cost of capital on the basis of risky (subprime) debt. As such, it is likely that it would set a cost of debt based on the promised yield.

75. Debt comes in many varieties. For example, firms may borrow on a long-term basis or a short-term basis; they may borrow at fixed or floating rates; debt may be senior or subordinated, traded or non-traded; hybrid instruments may give the lender the option to convert debt for equity in the firm. The rate at which firms can borrow will depend, in part, on the features of the debt instrument.
76. Since most firms tend to hold a range of debt instruments, it is generally not possible to observe a *single* yield (either expected or promised) that reflects the cost of borrowing from credit markets. Moreover, many of the businesses the Commission regulates are not standalone enterprises, whose borrowing costs can be discretely measured. Most are divisions of integrated multipart firms, and it may not necessarily be true that the debt costs of the regulated division equal the debt costs of the overall firm. Further, in some instances, the regulated business (or the wider group) 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, in which case allowing actual debt costs would seem inappropriate. In such cases, providing for a cost of debt that incentivises a more prudent level of borrowing would appear reasonable. Finally, when setting allowed rates of return for a particular regulatory period, the Commission is interested in estimating the business's cost of debt *over that period*. However, in most cases the firm's actual term of borrowing will not exactly match the regulatory cycle.
77. For these various reasons, in practice, the Commission has tended to estimate the cost of debt, using an approach that involves adding an estimated debt premium to the riskless borrowing,

$$r_d = r_f + p \quad (2)$$

The Commission's proposed approach for setting the risk-free rate and the debt premium are discussed in further detail later in Sections 4.1 and 4.5, respectively.

78. It is often argued before the Commission that debt issuance costs should be included as a margin on the cost of debt. The Commission agrees that the costs associated with prudent refinancing are legitimate expenses that ought to be compensated. However, the Commission considers that, rather than imputing these into the cost of debt, debt issuance costs are more naturally viewed as expenses to be amortized over the regulatory period (which, as explained later, is taken to be the *notional* term of borrowing for regulatory purposes) and included in the allowed cash flows. In line with the adoption of such a time period, the Commission would expect any allowance for refinancing costs to be consistent with the overall financial structure implied within its cost of capital assessment.

### 3.4 Cost of Equity

79. The cost of equity is the expected rate of return required by investors on equity that compensates them for the risk they bear, and the opportunities they forgo by committing funds to the firm.
80. The cost of equity cannot be observed directly; it must be estimated. One of the most common economic models used to estimate the cost of equity is the Capital Asset Pricing Model (CAPM), which was originally developed by Sharpe (1964), Lintner (1965) and Mossin (1966).
81. The CAPM is a single factor model that postulates a positive linear relationship between the expected return on an asset and the systematic risk associated with holding that asset (measured by its *beta*).<sup>15</sup> When applied to equity capital, the classical (tax-free) version of the CAPM has the form

$$r_e = r_f + (r_m - r_f)\beta_e, \quad (3)$$

where  $r_m$  is the expected return on the market portfolio (an unobservable portfolio comprising all available assets in the market<sup>16</sup>),  $r_m - r_f$  is the market risk premium (MRP), and  $\beta_e$  is the equity beta. The CAPM says that the expected risk premium on an individual stock varies in direct proportion to that stock's exposure to systematic risk. In other words, suppose a given security's beta were 0.5; the expected premium from holding that stock would be half the expected risk premium on the market (Brealey and Myers, 2003, p.195).

82. A key message of the CAPM is that, provided capital markets are competitive and efficient, equity investors will, in expectations, only be compensated for bearing systematic risk. Rational investors could and would diversify away firm-specific risk, so such risk should not be priced by the market. The implication for regulators is that, when setting allowed rates of return, compensation should only be awarded to investors for bearing systematic risk.

#### 3.4.1 Alternative Asset Pricing Models

83. The CAPM is appealing because it identifies a single measure of risk, it is well-understood by analysts and commentators, and its implications are intuitive. The CAPM has received support from many regulators and academics (e.g. Myers, 1972a,b) as a reasonable model for estimating the regulated cost of capital.
84. However, 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 (Fama and French, 2004). A number of other economic factors have been shown to explain historical average returns much better than the CAPM beta

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<sup>15</sup> *Systematic risk* refers to market risk, which cannot be eliminated through diversification.

<sup>16</sup> The implications of not "correctly" identifying the market portfolio are discussed in the seminal paper Roll (1977).

(Grinblatt and Titman, 2002, Section 5.10).<sup>17</sup> Myers (1972b) 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.

85. Overseas regulators (e.g. IRG, 2007, pp.11–12) and academics (e.g. Franks et al, 2008) have considered two alternative asset pricing models—the Fama-French three-factor model, and the discounted cash flow (DCF) model—as useful cross-checks on the CAPM.
86. The Fama-French (1993) three-factor model adds two new factors to the CAPM's market factor (the MRP). These factors are a firm size factor (the return on small-firm stocks minus the return on large-firm stocks) and a book-to-market factor (the return on high book-to-market ratio stocks minus the return on low book-to-market ratio stocks). Each factor represents a risk premium that contributes towards the overall risk premium of the asset. Under the Fama-French model, the expected risk premium on a stock denoted by  $r_i$  is given by the following formula:

$$r_i - r_f = b_m.r_m + b_s.r_s + b_b.r_b \quad (4)$$

where  $r_m$ ,  $r_s$  and  $r_b$  respectively represent the return on the market, the size factor and the book-to-market factor, and  $b_m$ ,  $b_s$  and  $b_b$  represent the stocks sensitivities to the respective factors.

87. The Fama-French model is one of many alternative multifactor models that exist. Fama and French (1996) assert that their simple three-factor model explains most of the risk premiums of stocks (so-called anomalies of the CAPM) identified by these competing models. However, the theoretical foundations of the Fama-French factors are less well-developed than that of the CAPM, and authors such as MacKinlay (1995) and Campbell (2001) have criticised Fama and French for 'data-mining' — inferring the existence of relationships in the data that appear purely through chance. Wright, Mason, Miles (2003, pp.72–76) observe that the statistical significance of the factors themselves is dubious; there is little evidence that the historical risk premiums associated with these factors are significantly different from zero. Furthermore, the reliability of the model may vary between countries; the model has typically been applied to US or UK data. Finally, the availability of reliable size and book-to-market data may constrain the model's applicability to some New Zealand industries. Hence, the Fama-French three-factor model suffers from its own limitations.
88. There are several versions of the DCF model. The simplest of these is Gordon's (1962) constant dividend growth model, which says that the long-run rate of return on a security  $i$ , denoted by  $r_i$ , is the discount rate that equates the current stock

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<sup>17</sup> Campbell,Lo,and MacKinlay (1997, p.211–217), and Jagannathan and Meier (2002), provide good surveys of the empirical evidence on the CAPM.



price,  $P_{i,t}$ , to the present value of the future stream of expected dividends,  $D_{i,t}$ , which are expected to grow in perpetuity at a constant rate,  $g_i$ :

$$P_{i,t} = \frac{1 + g_i}{r_i - g_i} D_{i,t}, \quad (5a)$$

which implies that

$$r_i = \frac{E_t[D_{i,t+1}]}{P_{i,t}} + g_i. \quad (5b)$$

89. DCF is routinely applied by US regulators, such as the FERC, as the primary model for estimating firms' allowed return on equity (Gordon and Makholm, 2008).
90. Apart from being used to estimate firms' cost of capital, the DCF model can also be used to estimate the MRP for application in the CAPM, as discussed in Section 4.2.
91. There are a number of obvious limitations with the DCF model. First, the informational requirements mean the standard model is only feasible for listed firms that pay dividends. Second, the constant growth assumption is only reasonable for stable, mature firms. Third, good forecasts of dividend growth are essential. In practice, forecasts of firms' earnings are used as a surrogate for the growth in dividends, so it is necessary to assume that earnings and dividends grow roughly in balance. It is also necessary to assume that forecasts do not systematically underestimate or overestimate earnings, and that growth forecasts are based on the same information that the market uses to value firms' stocks (Grinblatt and Titman, 2002, pp.388–390). Presently, forecasts of earnings for some, but not many, New Zealand firms are available through the Institutional Brokers' Estimate System (IBES). Fourth, dividend growth forecasts, which are generally only available for the short-run, often exceed the long-run rate of economic growth. Cornell (1999) observes that, as a consequence of this empirical fact, and the constant growth model's assumption that the forecast growth rate applies in perpetuity, gives rise to the implausible result that the company will eventually engulf the entire economy. Multistage models described in Franks et al (2008) and Cornell (1999, Chapter 3), seek to overcome this problem. Finally, the model relies on the assumption that financial markets are efficient and correctly value investments (IRG, 2007, p.19). The empirical evidence on that question has been mixed, at best.
92. There are many other asset pricing models apart from the three discussed here. Wright et al (2003, Chapter 4) survey several of these, including nonlinear, conditional, multifactor and intertemporal models. They conclude that each suffers from its own shortcomings, and in their view, "there is no one clear successor to the CAPM for practical cost of capital estimation".
93. The CAPM remains the most widely applied asset pricing model. In a study covering 392 US Chief Financial Officers (CFOs), Graham and Harvey (2001) found that the CAPM was by far the most frequently used model to estimate the

cost of equity capital, with almost 74% of CFOs always or almost always using it. Bruner, Eades, Harris and Higgins (1998) found that 85% of their 27 best-practice firms use the CAPM or a modified CAPM. Keck, Levengood and Longfield (1998) surveyed 2,700 Chicago University graduate business school alumni and found that of the 131 respondents, 86% use the CAPM or some other single-factor model (although, the authors also found indications that, when estimating the cost of capital, a large number of CAPM-users also take into account factors such as sovereign risk and political risk, presumably in an ad hoc fashion). Brounen, de Jong, Koedijk (2004) surveyed 313 European CFOs and found that, of those that explicitly compute a cost of capital, approximately 43% use the CAPM. Myers (1972b, p.627) argues that “[the] fact that the model may not be exactly true does not mean that it should be thrown away. A good case can be made for the use of [the CAPM’s]  $\beta$  as part of the evidence in regulatory proceedings”. Consistent with this view, many overseas regulators employ the CAPM or versions of it.

94. For these reasons, the Commission proposes to retain the CAPM as its primary tool for estimating the cost of capital. However, it also considers that other models may be helpful to inform whether or not the CAPM estimates are likely to fall within a sensible range. Where appropriate (e.g. where reliable data are available, and where the models seem amenable to particular industries), the Commission may use evidence based on the Fama-French and DCF models as cross-checks on the CAPM.
95. The weight applied to any cross-check models is a matter of judgement for the Commission. The Commission does not consider it appropriate, for example, to estimate the cost of equity using the three alternative methods discussed above, assign some fixed weights to each estimate, and then calculate an overall weighted average. Such an approach would imply a false sense of precision and confidence in the weights. Moreover, as discussed earlier, the cross-check models may perform better in some industries than others, and there may be *a priori* reasons why one or both should not be employed in certain situations.

### 3.4.2 The Form of the CAPM

96. There are a number of alternative versions of the CAPM that, in principle, could be employed. These include, among others, the classical CAPM and the international CAPM.
97. The classical CAPM effectively assumes that personal taxes do not differ across forms of income, and as a result, these tax rates drop out of the model. It therefore does not adjust for the effect of any imputation credits attached to dividends, or reflect differences in tax rates in capital gains relative to dividends. It could therefore be inconsistent with the New Zealand tax regime that permits the use of imputation credits to offset investor tax obligations, in order to avoid double-taxation (i.e. on company earnings, and then again on personal earnings), and imposes no capital gains tax.
98. Building on the work of Brennan (1970) and Cliffe and Marsden (1992), Lally (1992) developed a version of the CAPM (the ‘Brennan-Lally model’) that

explicitly takes account of investor tax rates on interest income differing across investors..

99. However, none of these models can be considered completely correct. First, the classical and simplified Brennan-Lally models assume national capital markets are closed, whereas the international CAPM assumes they are perfectly integrated. In practice, New Zealand capital markets are partially integrated. Second, regulated firms in New Zealand display diverse ownership structures, ranging from large international investors and local authority owned businesses that do not enjoy the (full) benefits that New Zealand's dividend imputation system confers to local investors that can avail themselves of imputation tax credits.<sup>18</sup> Consequently, using the classical CAPM in those cases would generate distorted estimates of the cost of capital.
100. In light of these factors, the Commission considered whether it ought to adapt the version of the CAPM applied, to reflect the investors' utilisation rate of imputation credits. In other words, if a large majority of shareholders in the firm cannot access imputation credits, the classical CAPM would be used; if the reverse were true, the simplified Brennan-Lally model would be employed. However, the Commission considers that adopting different cost of capital assumptions based solely on ownership (particularly where the difference reflects public or private ownership) could potentially create perverse investment incentives. As a result, it considers that it should adopt a single form of the CAPM. Such an approach is also consistent with the Commission's proposal to adopt a single industry-wide cost of capital assumption.
101. Keeping in view the current New Zealand tax system, the Commission proposes to use in all cases a simplified version of the Brennan-Lally model, when estimating the cost of equity. The simplified Brennan-Lally model assumes that: dividends are fully imputed and investors have the ability to fully utilise them; the average investor faces the average marginal tax rate on ordinary income across all investors in the market,  $t_i$ , which the Commission assumes is 30%; that capital gains are not taxed; and that national capital markets are perfectly segmented. The simplified Brennan-Lally model, applied to equity capital, has the form<sup>19</sup>

$$r_e = r_f(1 - t_i) + (r_m - r_f(1 - t_i))\beta_e \quad (6)$$

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<sup>18</sup> Under a dividend imputation system shareholders pay personal tax on the gross dividends and imputation tax (company tax) credits, and obtain credit for the company tax paid. It essentially results in equity returns being tax free whilst interest income is not.

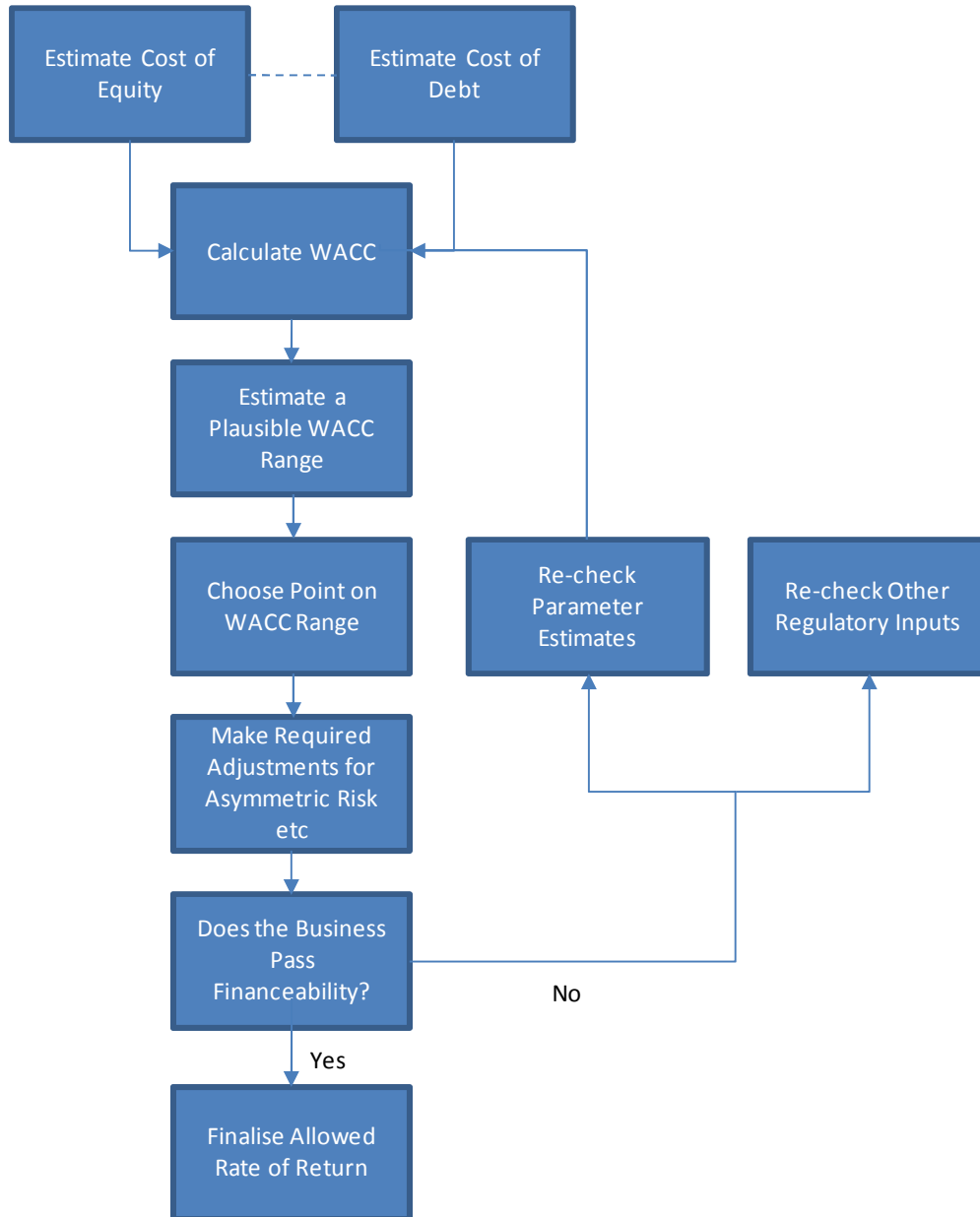
<sup>19</sup> A similar model has in the past been advocated for use by UK regulators. See Grout (1995), p.399.

## 4 The Cost of Capital in Detail

102. The remainder of this document explores the various components of the WACC and describes the Commission's approach to estimating each. Figure 1 below schematically illustrates the Commission's procedure for setting allowed rates of return. As outlined in Sections 3.3 and 3.4 respectively, the first step is to estimate the cost of debt and the cost of equity. A number of models exist to estimate the cost of equity, and some of these models can be useful cross-checks. The primary model is the (simplified Brennan-Lally) CAPM.
103. To implement this model, the Commission needs a proxy, of suitable maturity, for two generic, market-wide parameters: the risk-free rate (as describe in Section 4.1), and the MRP (Section 4.2). These figures are then combined with an equity beta (Section 4.3), and appropriate adjustments to reflect taxation (Section 4.6). The estimation of the equity beta is a complex task with a number of steps. In line with the Commission's intention to adopt a single, industry-wide cost of capital, the objective is to estimate a single industry beta. The estimate for the industry equity beta should be based on a five step process, as follows:
- indentify relevant sample of comparators;
  - estimate equity beta for each comparator;
  - de-lever each equity beta estimate to get an asset beta for each firm;
  - calculate an average asset beta for the sample; and
  - re-lever the asset beta to an equity beta estimate consistent with the Commission's assumed notional leverage.
104. The cost of debt is estimated by adding to the risk-free rate proxy an estimated debt premium (Section 4.5).
105. The second step is to calculate the WACC by combining the capital structures weights for the business (which depend on a notional level of leverage; Section 4.4), the estimated cost of equity, and the estimated cost of debt.
106. Step three involves deriving a plausible range for the WACC (Section 4.7), taking into account the (model and parameter) uncertainty attached to each of the individually-estimated components of the WACC.
107. Once a range has been estimated, the next step is to choose an appropriate point along that range (Section 4.8). This gives a point estimate for the WACC.
108. Next, the Commission considers whether adjustments to the WACC — for asymmetric risks (Section 5.1), financial distress costs (Section 5.2), and resource constraints (Section 5.3) — are required. (In some cases, allowances for these issues may be dealt with outside the cost of capital rate.)
109. Having made any necessary adjustments, the Commission would then consider any financeability analysis submitted by interested parties (as outlined in Section 2.4). If the business passes the financeability test, as outlined in Section 2.4.2, then the

cost of capital calculated in the previous step is finalised as the allowed rate of return. If the business fails the financeability test, the Commission would: consider whether another regulatory input should be adjusted; consider whether the time profile of the business's allowed cash flows should be modified (in a NPV-neutral way); and, as a last resort, consider whether any of the individually-estimated parameters underlying the WACC should be adjusted. If the allowed rate of return is modified, then each of the steps above would need to be repeated.

**Figure 1: Process for Setting Allowed Rates of Return**



110. The remainder of Chapter 4 provides a detailed discussion of the Commission's proposed approach for deriving an appropriate WACC range.

## 4.1 The Risk-Free Rate

111. The risk-free rate is the interest rate that an investor would expect to earn by holding a riskless asset. The Commission uses the risk-free rate when estimating both the cost of debt and the cost of equity.
112. In practice, the risk-free rate cannot be observed; it is usually proxied by the return on a very safe asset. When selecting the risk-free rate, the first step is to identify a suitable proxy. A related second issue involves choosing how to deal with the statistical properties — mean reversion and interest rate volatility — of certain proxies. Depending on the proxy chosen, the third step is to decide whether spot rates or yields to maturity should be used. The final step is to determine the appropriate maturity of the rate. Each of these issues are discussed in detail below.

### 4.1.1 Suitable Proxies

113. The Commission, and most other regulators have traditionally employed government bonds as the relevant proxy for the risk-free rate. However, it has recently been argued before the Commission and some overseas regulators that a more appropriate benchmark is the yield on interest rate swaps.<sup>20</sup> This was motivated by a recent widening of spreads between treasury and swap yields, across maturities, which has been driven by a rise in demand for, and a fall in supply of, New Zealand government bonds (RBNZ, 2007, 2008).<sup>21</sup>
114. The Commission considers that a good risk-free proxy should be (i) virtually free of risk, (ii) liquid, (iii) free of restrictions on trade, and (iv) not have characteristics other than its returns distribution that attracts or repels investors.
115. The governments of most industrialised countries have historically been viewed as the most creditworthy borrowers, so the securities issued by these governments have been considered essentially riskless. As at January 2009, New Zealand government bonds held AAA ratings from Standard & Poor's — the highest possible rating with this agency. In addition, there may be a flight-to-quality explanation for the recent high demand for New Zealand government bonds as they become viewed as “safe haven” investments.<sup>22</sup> Finally, until fairly recently the New Zealand government has run large fiscal surpluses, which may potentially have a positive impact on the creditworthiness of government securities.

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<sup>20</sup> An *interest rate swap* is an agreement between two parties to exchange one stream of interest payments for another. The most common type of interest rate swap exchanges fixed interest rate payments for floating interest rate payments for a given principal amount and period of time. The floating rate in such contracts is often based on interbank offer rates (e.g. LIBOR). Swap rates are quoted in terms of the fixed rate that must be paid in order to convert to floating (Fleming, 2000).

<sup>21</sup> An undersupply of government securities can occur when, for example, large fiscal surpluses prompt governments to retire existing debt and issue new debt more slowly.

<sup>22</sup> A *flight-to-quality* involves the flow of funds from riskier to safer investments, which sometimes occurs during times of high market volatility. At times of extreme market turbulence this can lead to supra national movements in capital, as well as simply movements between different categories of investment.

116. While swaps may be low risk, they are probably not risk-free. Many have argued that interest rate swaps may be subject to counterparty default risk (e.g. Cooper and Mello, 1991; Duffie and Huang, 1996; Duffie and Singleton, 1997; Blanco, Brennan and Marsh, 2005); although, Fleming (2000) suggests that dealers can mitigate such risk by executing swaps out of credit-enhanced subsidiaries, or by structuring swap contracts so that they automatically unwind if the counterparty's AAA debt rating is lost, and Feldhütter and Lando (forthcoming) suggest that counterparty risk could be eliminated through collateralisation. Fleming (2000) and Blanco et al (2005) also observe that the floating leg of swaps is typically indexed to LIBOR, which itself contains a premium for credit risk.
117. Generally, both treasuries and swaps are viewed as very liquid instruments. However, since the 1990s swap markets (particularly in Europe and North America) have emerged as among the most deeply traded in the world. For example, Remolona and Wooldridge (2003) estimated that in June 2002 the notional stock of euro-denominated and US dollar-denominated interest rate swaps and forwards totalled in the order of €52.5 trillion — the largest and most liquid financial market in the world (see also McCauley, 2002). There is evidence that New Zealand treasuries have experienced a fall in liquidity, while the liquidity in swaps has risen, in recent times (RBNZ, 2008).
118. Some have speculated that investors demand government bonds, in part, because these can be used as collateral to obtain cheap, short-term funding in the repo market,<sup>23</sup> and because government securities are a desirable hedging instrument against interest rate risk (e.g. Duffie, 1996; Grinblatt, 2001; Feldhütter and Lando, forthcoming). As a result, government securities attract a so-called liquidity convenience yield, which drives a wedge between their returns and the true riskless rate. If this is correct, it would suggest that government securities have features other than their returns distributions that attract or repel investors, which weakens their appeal as riskless proxies.
119. Feldhütter and Lando provide the most recent empirical work on the question of risk-free benchmarks. Their study decomposes swap spreads of varying maturities into three components: (a) a convenience yield to holding government securities, (b) a credit risk element of the underlying LIBOR rate and, (c) an idiosyncratic swap factor. They conclude from their modelling that
- “...the riskless rate is better proxied by the Treasury rate for long maturities whereas the swap rate is a better proxy for the riskless rate in the short end.”

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<sup>23</sup> “Repo” is short for repurchase agreement. A repo is effectively a short-term interest-bearing loan against collateral, which involves contracts for the sale and future repurchase of a financial asset, most often Treasury securities. On the termination date of these assets, the seller repurchases the asset at the same price at which it was sold, and pays interest for the use of the funds.

120. Apart from all the arguments and evidence presented above, a number of other considerations seem relevant to the issue of appropriate benchmarks:
- The notion that swap rates should replace government bond yields as the risk-free proxy has not yet achieved widespread consensus in academia.
  - Swap rates appear to be widely used by practitioners as benchmarks. For instance, it is common in New Zealand to see corporate bond and capital notes issues, where yields are calculated as a premium over prevailing swap rates.<sup>24</sup>
  - The Commission is not aware of any regulator that has employed swap rates in place of yields on government securities as a surrogate for the zero-risk rate.
121. The issue of suitable risk-free proxies is complex with mixed evidence on the suitability of government bond yields. However, given recent market volatility, and growing concerns over default risk within the credit default swaps market, to the extent that government bond yields continue to be treated as effectively risk-free, the Commission proposes to retain its current practice of benchmarking the risk-free rate against government bond yields. The Commission will keep its position under review as further evidence on the issue becomes available, and the Commission leaves it open to parties to submit evidence that may usefully inform the matter.

#### **4.1.2 Mean Reversion and Interest Rate Volatility**

122. When choosing a risk-free rate, many UK regulators have allowed an element of ‘headroom’ above observed yields on UK government bonds. Several factors have motivated UK regulators to act in this way. First, many financial commentators have observed that UK government bond yields are well below historical levels. Second, it has been argued that government bond yields are mean reverting, so current low yields are unlikely to be sustained in the future. Third, government bond rates (both real and nominal) have been very volatile in recent times. Fourth, as in New Zealand, spreads between government bond yields and swap rates (and AAA-rated corporate bond yields) have widened recently, apparently as a consequence of what some have described as a “flight to liquidity”.
123. These factors have caused regulators to worry that risk-free rates could rise dramatically toward long-run levels during a regulatory cycle (relative to the rate initially allowed), thereby raising the cost of finance to firms and deterring efficient investment. Such an outcome would ultimately harm consumers. (Another possibility is that interest rates fall very low, creating distorted incentives to overinvest.)
124. However, allowing headroom in the cost of capital may introduce windfall gains to firms at the expense of consumers. Hence, the Commission does not favour the approach of granting arbitrary margins over market-determined interest rates.

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<sup>24</sup> Reinhart and Sack (2000) suggest that government securities remain the riskless benchmark because market participants believe that most other traders also view them as the benchmark. Hence, should some agents come to believe that others will not use government bonds as the riskless rate, then neither will they. Once a critical mass in switching has been achieved, there could be a self-reinforcing tip away from government securities in favour of swaps.



125. One proposed solution is to ‘index’ the risk-free rate over the regulatory period, which would involve updating the allowed rate in line with current rates either at regular preset intervals within the regulatory cycle, or whenever actual interest rates breach preset upper or lower tolerance thresholds (i.e. whenever actual rates become ‘too high’ or ‘too low’; see CEPA, 2007).
126. However, indexation has a number of drawbacks. For example, in principle, any tolerance thresholds should be set in such a way that the expected payoff to the firm (in present value terms) of an upper threshold breach just offsets the expected payoff of a lower threshold breach. Failure to ensure this might introduce some implicit arbitrage to the scheme. If interest rates are in fact mean-reverting, the Commission would need to appeal to very complex option-pricing models in order to calculate thresholds that eliminate these problems.
127. Further, even if the Commission could correctly identify appropriate tolerance thresholds, it is unlikely that  $NPV=0$  would be satisfied. Whenever the Commission resets the risk-free rate part way through the regulatory cycle, the maturity of the risk-free rate will not match the horizon over which those rates will apply (namely, the remaining duration of the regulatory cycle), thus violating the  $NPV = 0$  principle (see Section 4.1.4).
128. For these reasons, the Commission does not favour indexation as a means to deal with volatility and mean reversion in interest rates.

#### **4.1.3 Yields to Maturity vs. Spot Rates**

129. The Commission typically uses yields to maturity as the risk-free rate in the CAPM. However, the theoretically correct approach would be to use spot rates on government bonds instead.
130. A *spot rate* is the interest rate on a bond that delivers a single payoff at maturity. A bond’s *yield to maturity*, also known as its internal rate of return, is the discount rate that sets the price of the bond equal to the discounted value of the promised future payments on the bond.
131. A fundamental principle in finance theory is that expected future cash flows should be discounted at a rate that reflects the risk and maturity of those cash flows. For example, a cash flow expected in one year ought to be discounted at the one year spot rate; a cash flow expected three years from now ought to be discounted at the three year spot rate, etc.
132. The same principle holds for regulatory price setting. If yields to maturity are used in place of spot rates, pricing errors will generally arise. Such errors are likely to be greatest for low-risk enterprises because the NPV of such investments are more sensitive to changes in the risk-free rate than for risky projects, which will have a larger risk premium.
133. However, yields to maturity are more readily obtainable than spot rates (most practitioners rely on financial institutions to estimate these), and using a single interest rate in the price setting process simplifies the necessary calculations.

134. For these pragmatic reasons, the Commission proposes to continue using yields to maturity when setting allowed rates of return. However, in the event that the firm's overall cost of capital is very sensitive to the risk-free rate, the Commission may cross-check the use of yields to maturity by also applying spot rates.

#### 4.1.4 The Appropriate Term of the Risk-Free Rate

135. In New Zealand, yields on government bonds ranging from one and ten year maturities are available. Given a choice of maturities, the Commission must select an appropriate one for the purposes of cost of capital estimation.
136. As discussed in Section 3.4, the primary model used by the Commission to estimate the cost of equity is the CAPM. In theory, the CAPM is derived as a single-period model, where the length of the period is unspecified. However, in practice the length of the period is almost always interpreted as relatively short, at most one year (Franks et al, 2008). If investors are rational and investing according to the CAPM, they will rebalance their portfolios frequently, and the investment horizon implicit in the model should be interpreted as the interval between two points of rebalancing. Furthermore, CAPM equity betas are estimated using high-frequency returns data.
137. However, the Commission must typically apply the CAPM to long-lived assets, whose economic lives span several regulatory periods. Suppose that a cost of capital is needed for a term of N years, longer than the horizon of CAPM investors. Assume this horizon is one year. Taking N as given, there are two approaches the Commission could take to obtain an N-period cost of capital:
- (i) Use the N-period interest rate as the intercept in the CAPM. Define the MRP as the difference between expected returns on the stock market and expected returns on N-period bonds. The historical measure of this MRP would average annual returns on the market vs. N-period bonds;<sup>25</sup> or
  - (ii) Estimate the MRP as the difference between returns on the stock market and returns on one-year bonds.<sup>26</sup> Then use an N-period forecast of average future one-period interest rates as the intercept in the CAPM.
138. Although superficially it appears otherwise, in each case there is only one risk-free rate in the CAPM equation: an N-period rate in (i); and a one-period rate in (ii). The MRP could differ between approaches because it is estimated against N-year interest rates in (i) and one-year rates in (ii). The MRP in (ii) is independent of N.

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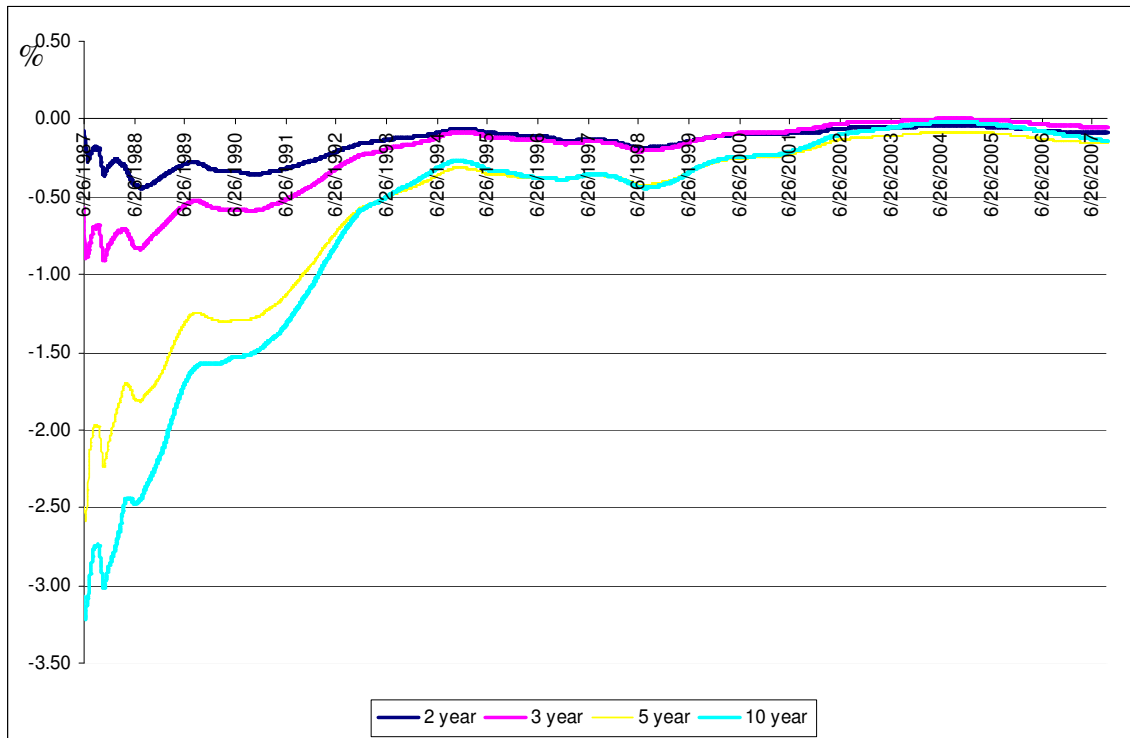
<sup>25</sup> The procedure for calculating the historical average is as follows. For each past year in the historical sample, record the difference between the return on the market and the return on a portfolio of N-period bonds in that year. Generate a series of annual risk premiums, then average. As discussed in Section 4.2, the Commission may also wish to consider forward-looking estimates of the MRP, here defined as a spread over expected N-period bond returns.

<sup>26</sup> The historical measure would average annual returns on the market versus one-period interest rates at the start of each year. Forward-looking MRPs could also be estimated, in this case as a spread over one-period interest rates.

However, (ii) requires an N-period forecast of one year rates for the CAPM intercept.

139. One way to forecast average future one-period interest rates over the next N years is to take the current N-period interest rate and subtract an N-period term premium. The term premium is the expected difference between returns on N-period versus one-year bonds and can be estimated using historical returns on bonds of different maturities. The historical measure averages the differences in annual returns from investing long in N-period bonds versus investing in one-year bonds over a long period of time.
140. The term premium, which in large part compensates investors for inflation risk, has historically been positive, i.e. investors have on average earned higher rates of return from holding long bonds. This is supported by recent empirical evidence (e.g. Buraschi and Jiltsov, 2005), which suggests that the inflation risk premium is upward sloping and time-varying, and analysis in Dimson, Marsh and Staunton (2009), which indicates that the historic term premium is around 0.9 per cent.<sup>27</sup>

**Figure 2: The Average Term Premium on 2, 3, 5 and 10 Year Government Bonds**



141. Whilst many regulators adopt approach (i) above as a pragmatic solution, the Commission considers that approach (ii) is conceptually better, in principle, because it recognises that the CAPM is a short-term model, and it therefore obtains a longer-term cost of capital using short rates. However, the Commission will be

<sup>27</sup> Dimson et al (2009) estimate the arithmetic mean return for “bonds vs. bills” for the period 1900-2008 based on UK data. Treasury bills are used to measure the short-term riskless rate of interest, and the bonds are represented by long-term government bonds.

setting the risk-free rate using evidence on New Zealand Government bonds. Due to currency controls, historic term premiums in New Zealand can only be assessed back to the mid 1980s. Figure 2 above shows the average term premium on 2, 3, 5 and 10 year government bonds. This analysis suggests that the term premium in New Zealand is very close to zero on average.

142. Under the assumption that the average term premium remains close to zero, options (i) and (ii) can be expected to produce the same outcomes in practice. As a result, the Commission considers that it would be appropriate to adopt the more straightforward approach under option (i) outlined in paragraph 137.
143. The second issue is to choose N. One option is for the Commission to match N to the longest maturity available in New Zealand, which is ten years, in recognition that regulated assets are typically long-lived. However, this approach will generally provide windfall gains or losses to the firm, depending on the term structure of interest rates.
144. As noted earlier, a fundamental concept in finance is that the interest rate applied to a set of cash flows should reflect the risk, and the term, of those cash flows. To illustrate, consider the pricing of a zero-coupon five year bond. The only discount rate that will correctly price this bond is the five year spot rate. Applying an interest rate with a term other than five years would generate either windfall gains or losses to the holder of the bond by mispricing it. The precise outcome will depend on the slope of the term structure of interest rates.
145. In the regulatory context, the Commission will typically be setting firms' prices or evaluating returns over a given horizon — the regulatory period. The term of the interest rate used to set prices or assess returns should match the length of this horizon otherwise the present value to the firm will, in general, be positive or negative.<sup>28,29</sup> In other words, NPV = 0 would be violated, and the firm would, in expectations, earn supernormal profits or losses.
146. For this reason, the Commission intends to match N to the length of the regulatory period, which could vary across industries and regulated instruments, rather than standardising it to ten years or any other length of time.
147. The risk-free rate is also a component of the cost of debt. The Commission considers that the same risk-free rate used to estimate the cost of equity should be

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<sup>28</sup> To be absolutely correct, the risk-free rate selected by the Commission should have a *duration*, rather than a *term*, equal to that of the regulatory cash flows. (For a flat term structure, 'duration' is the weighted average number of years before receipt of an asset's cash flows, where the weights are the discounted values of the cash flows. Duration is shorter than the term of a bond, which refers to its time to maturity. For example, a ten-year coupon bond has a term of ten years (because the principal is repaid in year ten), but a duration of less than ten years, because cash flows from coupons are received from years one through ten.) However, the Commission considers that the matching of terms provides a reasonable approximation to the matching of durations.

<sup>29</sup> Specifically, whenever the yield curve is downward sloping (as it has been in New Zealand for some time), and the term of the risk-free rate used to set prices exceeds the length of the regulatory period, the firm will be undercompensated (i.e. the NPV of the firm's regulated cash flows will be negative), all other things being equal.

used to estimate the cost of debt. This approach is desirable for two reasons. First, it ensures an internally consistent approach to measuring the overall cost of capital. Second, it is consistent with the Commission's objective of estimating firms' financing costs *over the regulatory period*. Specifically, when the Commission sets regulated prices or makes assessments of returns, it does so only for the regulatory period. In doing so, the Commission evaluates the firm's allowed costs for the period, and the cost of capital is just one of these. It would not be consistent to restrict allowances for certain cost categories (e.g. operating or capital expenditure) to the regulatory period, and then provide allowances for others (e.g. the cost of debt) for some longer period.

148. Regulated firms may borrow for periods longer or shorter than the regulatory cycle if they wish. Any interest rate risk associated with doing so could be offset in the interest rate swap market.

## 4.2 Market Risk Premium

149. The MRP measures the additional expected return over and above the risk-free rate required to compensate investors for holding the market portfolio. It represents, therefore, the premium investors can expect to earn for bearing only systematic (market) risk. As such, the MRP is not a firm-specific parameter, but rather is common to all assets in the economy.
150. In practice, it is not possible to take a direct measurement of the appropriate MRP for two key reasons. First, the MRP is a forward-looking concept and, as a result, reflects investors' expectations. Second, the market portfolio itself cannot be observed as market values for many assets are not known, leading to the use of a proxy (e.g. a listed equity). In light of these factors, considerable debate remains over which of the various approaches that has been identified for estimating the MRP is most appropriate in a regulatory setting. These approaches are discussed in the section below,

### 4.2.1 Techniques for MRP Estimation

151. The various approaches that can be used to estimate the MRP can be classified into two broad categories: *ex post* (backward-looking) methods; and *ex ante* (forward-looking) methods.
152. The most common *ex post* approach is to average the historical spread between market returns (i.e. the returns on a market index used to proxy the market portfolio) and risk-free rates (e.g. Dimson, Marsh and Staunton, 2002).
153. Another *ex post* method, developed by Merton (1980), calculates the excess returns on the market as the *market price of risk* — the product of an estimated reward-to-risk ratio and the estimated volatility of market returns. Boyle (2005) prefers this formulation over the conventional application of the CAPM, which takes the MRP as an exogenous free parameter to be estimated using data. He argues that the MRP is in fact an endogenous parameter in the CAPM equilibrium so applications that

take it as given ignore an important aspect of the model.<sup>30</sup> Boyle also argues that there are empirical advantages to Merton's approach because the volatility of market returns can typically be accurately estimated using short time series of high-frequency returns data, whereas to obtain similarly good estimate of the MRP using historical averages, one requires a very long time series (see also Campbell et al, 1997).

154. Unfortunately, Boyle finds that the variance of (New Zealand) market returns is itself very volatile over time, which translates into very volatile cost of equity estimates. This leads Boyle to conclude that the CAPM is deficient in its description of the relationship between market risk and expected returns.
155. Among the *ex ante* approaches is the DCF model (e.g. Cornell, 1999; Claus and Thomas, 2001; Fama and French, 2002) and survey evidence of academics and practitioners (e.g. Graham and Harvey, 2001; Welch, 2000, 2001).<sup>31</sup>
156. An advantage of *ex post* evidence is that it is relatively objective and easy to interpret. However, historical premiums may be poor predictors of future premiums for a number of reasons. First, Dimson et al (2002) argue that global equity returns have exceeded expectations in the past century, and that this growth is unlikely to be repeated. Thus, prospective MRP estimates based on unadjusted historical averages are probably biased upwards (Dimson, Marsh and Staunton, 2003). Second, it is possible that investors' risk preferences have changed over time, which would alter required rates of return. Shifts in investors' tolerance of risk may be reflected in changes in stock-price-to-earnings or stock-price-to-dividend ratios.<sup>32,33</sup> Dimson, Marsh and Staunton (2008) find a long-term upward trend in price-to-dividend ratios for a number of markets, and argue that such trends cannot persist in the long-run. Removing the contribution of these trends from historical MRP averages causes their MRP estimates to fall.<sup>34</sup> (The Commission considers that such adjustments are appropriate and useful.) Third, as financial markets deepen and become more globally integrated, the opportunities for investors to diversify their portfolio increase. This will tend to reduce the level of systematic risk faced

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<sup>30</sup> Boyle shows that treating the MRP as an exogenous parameter is consistent with assuming that equilibrium prevails only in the market for risky assets. However, this approach is conceptually unappealing because it expresses the CAPM as only a partial equilibrium model. When an equilibrium condition is imposed on risky assets *and* riskless assets, the MRP becomes endogenous to the model.

<sup>31</sup> Although described here as forward-looking, the *ex ante* approaches mentioned here do, strictly speaking, draw on historical data. Specifically, analysts' earnings and growth forecasts used in the DCF model, and survey respondents' future expectations, would typically be informed by past experience.

<sup>32</sup> In particular, price-to-earnings and price-to-dividend ratios would be expected to decline as investors become more risk-tolerant.

<sup>33</sup> It is true that movements in price-to-dividend ratios may be explained by factors other than investors' changing risk preferences. For example, firms may have switched a greater proportion of payouts from dividends to other channels, such as share repurchases. Firms may have retained and reinvested a greater share of earnings, thus reducing payouts across all channels. Increases in expected corporate profitability could also cause price-to-earnings and price-to-dividend ratios to increase. See Myers (2008).

<sup>34</sup> A similar adjustment could be made for long-term trends in price-to-earnings ratios. See Morningstar (2008) p.98.

by investors, and therefore, the premium they require for bearing such risk (Dimson et al, 2002).

157. In addition, the efficiency of estimates based on historical averages relies on the quality and availability of the underlying data. As noted earlier, if only relatively short time series are available, the resulting MRP estimates are likely to be statistically imprecise. However, adopting too long a series (in an attempt to improve the precision of the MRP estimates), increases the possibility of including data from periods in which the underlying risk of that period relates less to the current period.<sup>35</sup>
158. The *ex ante* approaches have their own drawbacks. The DCF model suffers from the limitations discussed in Section 3.4, and survey evidence can be subjective and difficult to interpret.
159. The Commission's view is that the most helpful starting point for MRP estimation is the *ex post* techniques, and in particular, the Dimson et al (2008) estimates adjusted for long-term trends in price-dividend ratios. The next step is to consider the *ex ante* estimates as cross-checks on the *ex post* estimates. The overall MRP estimate will be a matter of judgment for the Commission, taking into account all the available evidence.
160. This approach is consistent with that taken by some other regulators. For example, Ofcom (2005b) stated that

“The amount of weight that Ofcom has placed on *ex ante* implied ERPs [equity risk premiums] and survey results is significantly less than it has placed on estimates based on historic data, and on regulatory benchmarking.” (p.33)

Ofcom has indicated that it would continue with this policy, going forward.

#### 4.2.2 Overseas Data

161. As alluded to earlier, data limitations can frustrate accurate MRP estimation. In New Zealand, interest rate controls and regulation of financial institutions prevailed until 1985. This meant that interest rates prior to this period were not market-determined. Also, New Zealand equity markets were closed to foreign investors until liberalisation occurred in 1985. Deregulation was followed by a large inflow of capital from foreign investors, which likely had a significant impact on domestic stock returns and risk premiums. Therefore, the removal of controls would likely have produced a significant structural shift, limiting the usability of data prior to 1985. Furthermore, New Zealand equity markets are relatively young and small compared to those of many other countries. Trading is characteristically thin, and stock indices represent weakly diversified investment portfolios, given the small

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<sup>35</sup> For example, MRP estimates are available for the US using data from as far back as the 1800s. These estimates may have low standard errors due to the large sample they draw on, but because financial markets have changed so significantly since the early years of that sample the results are likely to be biased estimates of future premiums.

number of represented firms. In comparison, US equity markets are significantly more established, well-diversified, and deeply traded.

162. Damodaran (1999) argues that historical data on thinly traded equity markets (such as New Zealand's) yields unreliable estimates of the MRP, since such markets represent a small proportion of the overall economy, tend to be dominated by a few large firms, and are generally poorly diversified across industries. They also typically provide only relatively short time series, so the resulting estimates would generally be quite imprecise.
163. For this reason, when estimating the MRP the Commission intends to draw on recent estimates from other developed economies. Such estimates are presented by sources such as Dimson et al (2008). As the MRP is a generic parameter, the Commission would expect to apply the same estimate within all its analysis until such a time as it publishes a revised estimate.
164. For the MRP the Commission adopts a figure of 7 per cent. The Commission's preliminary view is that it should continue to use the estimate of 7 per cent for the market risk premium. The Commission will fully consider any submissions that provide robust analysis as to the sustained (rather than transitory) effects of the recent financial market turmoil.

## 4.3 Beta

165. Beta measures the sensitivity of an investment's return to movements of the market portfolio. In other words, it is a measure of market risk.<sup>36</sup>
166. The total risk of an asset or business comprises of both systematic and unsystematic risk. Unsystematic risk is specific to the investment and may be eliminated through diversification. Systematic risk is market risk, which is not unique to a particular firm. Such risk cannot be eliminated by diversification because it affects all assets in the economy. Beta captures a particular asset's sensitivity to systematic risk.
167. The risk-return trade-off means that firms with greater exposure to systematic risk must pay their investors higher rates of return in order to attract capital.
168. As discussed earlier, only systematic risk is relevant in determining firms' cost of capital within a CAPM framework. According to the CAPM, investors should not be compensated for bearing diversifiable risk.

### 4.3.1 The Equity Beta

169. The equity beta measures a security's sensitivity to market risk. For firms with traded stocks, the equity beta can be estimated directly by applying the CAPM to the historical returns on those stocks. However, in many cases direct estimation may not be feasible because no traded returns are available. For example, the firm may be unlisted, or the Commission may be interested in estimating the beta of only a single division within a multipart company. Moreover, even when traded returns

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<sup>36</sup> 'Risk' refers to the dispersion of possible outcomes around an expected outcome.



are available, firm-specific beta estimates are often very statistically imprecise. To overcome these problems, the Commission intends to estimate an industry-wide equity beta, as a starting point (see section 2.2), using a *portfolio* of comparable businesses.

170. The first step is to identify a collection of comparable firms for inclusion in the portfolio. Here, ‘comparable’ means firms that, *à priori*, have very similar exposure to market risk. In practice, in several New Zealand industries, it is difficult to find a sufficient number of comparable businesses to implement such an approach based solely on domestic data. Indeed, in some cases (e.g. electricity transmission), the entire industry consists of a single natural monopoly firm. As a result, it is likely that the collection of comparable firms will include similar firms from overseas jurisdictions. This may include firms from the industry in question, or other sectors with comparable risk profiles.
171. The portfolio of comparator firms are identified by examining their similarity across several fundamental drivers of market risk:<sup>37</sup>
- **Aggregate demand shocks.** Because unexpected changes in aggregate demand affect all firms in the economy, the risk associated with these shocks cannot be diversified away.<sup>38</sup> Firms’ exposure to such shocks will depend on a number of things, including:
    - the sensitivity of costs or revenues to the state of the economy, e.g. firms such as construction companies will face high market risk.<sup>39</sup>
    - the presence of long-term fixed-price supply contracts, which can be expected to have lower sensitivity to market risk since profits will be smoother than fluctuations in real output.
    - high *operating leverage* — the ratio of fixed to total costs — which will tend to increase sensitivity to aggregate demand shocks because such

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<sup>37</sup> The factors listed here are commonly identified in the corporate finance literature as important in explaining firms’ *asset* betas. For further discussion on the economic determinants of systematic risk see, for example, Robichek and Cohn (1974), Fewings (1975), Thompson (1976), Myers (1977), Turnbull (1977), Mandelker and Rhee (1984), Chen, Roll and, Ross (1986), Callahan and Mohr (1989), Binder and Norton (1999), Bernardo, Chowdhry and Goyall (2007).

<sup>38</sup> This assumes national capital markets are segmented, which is consistent with the assumptions of classical CAPM and the simplified Brennan-Lally CAPM.

<sup>39</sup> By contrast, firms facing income inelastic demand (e.g. those supplying staple foods) should have lower sensitivity to unexpected changes in real GDP than firms facing very income elastic demand (e.g. those producing luxuries).

Companies within the same industry, who employ similar technology and organise production in a comparable way, will likely face similar exposures to aggregate demand shocks. However, this may not apply universally. Consider two distinct geographic regions: in one there are many competing firms, each with little market power; in the other, there is a single monopolist. All these firms supply a homogenous product. Under certain conditions the monopolist may be able to exploit positive economy-wide shocks, and at least partially insulate itself from negative macroeconomic shocks, by virtue of its market power. By contrast, its contemporaries in the other region may be unable to exploit or mitigate exogenous shocks in the same way due the forces of competition. This is an example of how firms within the same industry may face different exposures to market risk.

firms must pay a large proportion of their total costs regardless of the output they sell.

- high *financial leverage* — the ratio of debt to total capital — which scales up the volatility of returns to its shareholders, and therefore, the equity beta. Because obligated payments on debt do not vary with the level of revenues, and debt holders have a priority call on cash flows, financial leverage magnifies the systematic risk of the cash flows distributable to equity holders.
- the presence of growth opportunities, which tend to increase exposure to systematic risk because: (i) expansion often adds leverage (operating and/or financial), which increases the firm's sensitivity to market risk; and (ii) since companies with more growth opportunities have cash flows with longer duration, their values tend to be more responsive to changes in macroeconomic factors such as interest rates.<sup>40</sup> By contrast, businesses that own the option to contract operations (e.g. abandonment or suspension options) should be less sensitive to unexpected changes in macroeconomic conditions, and their betas should be commensurately lower.
- the nature of the regulatory regime they face. For example, firms' profits under pure rate-of-return regulation will tend to be quite insensitive to market risk because companies are guaranteed a rate of return and prices are adjusted in such a way as to ensure this rate is earned. In contrast, price-cap regulation can have varying implications on a firm's risk profile depending on the length of the control period, the treatment of assets and expenditure, and the nature of any cost pass-through provisions. Hence, the specifics of the regulatory regime matter.<sup>41</sup>
- **Inflation.** Both anticipated and unanticipated inflation can alter the costs faced by the economic agents that firms interact with. These agents include customers, suppliers, lenders and the government. Such economy-wide cost adjustments will affect the variability of firms' profits and, therefore, the systematic risk they face.
- **Real interest rates.** Unexpected changes in real interest rates, and in the term structure of interest rates (i.e. the spread between real yields on short-dated and long-dated bonds), will affect the discount rates at which projects are valued. Firms with long-lived (e.g. infrastructure) assets in particular will be exposed to interest rate risk. Some interest rate risk may be eliminated in interest rate swap markets, but the residual risk will be market risk.

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<sup>40</sup> In general, those businesses whose growth prospects are closely correlated with the health of the economy will tend to be high-beta businesses (Grinblatt and Titman, 2002, pp.392-393).

<sup>41</sup> See Alexander, Mayer and Weeds (1996), who based on empirical analysis across countries and sectors, estimate the asset beta risk associated with rate-of-regulated firms was lower than that associated with price-cap regulation.

- **Market weight.** Increasing a company’s weight in the market proxy against which its beta is defined will draw its beta towards a value of one. Even if the business is not significantly represented in the market index, the composition of the rest of the index may affect the beta for *all* industries (i.e. the technology stock bubble in recent years, which temporarily lowered the betas of firms in other industries).
172. The second step in the estimation process is to econometrically estimate the equity beta of each firm in the sample by regressing historical spreads on individual returns (equity returns minus the risk-free rate) on historical spreads on the market<sup>42</sup> (returns on the market minus the risk-free rate). Each of these ordinary least squares estimators will be an unbiased estimator of the true beta of that stock, and the standard error of the estimate — a measure of its statistical precision — is readily obtained from the regression output.
173. Estimated betas can be volatile over time. Large economic shocks and bubble or bust events that have only temporary effects on financial markets, and significant but transitory changes to firm-specific leverage, can distort beta estimates if not accounted for properly.<sup>43</sup> To identify and exclude such anomalies, where sufficient data is available, the Commission proposes to check betas estimated with monthly data over long periods using a plot of rolling five-year betas.
174. The third step is to remove any effect of financial leverage by converting the estimated equity betas to asset betas. This is done by applying the general degearing formula<sup>44</sup>

$$\beta_a = \beta_d \left( \frac{D}{D + E} \right) + \beta_e \left( \frac{E}{D + E} \right) \quad (7)$$

Where,  $\beta_a$  is the asset beta,  $\beta_d$  is the debt beta,  $\beta_e$  is the equity beta,  $D$  is the value of debt,  $E$  is the value of equity, and  $D/(D + E)$  is the financial leverage ratio denoted in earlier equations by the term  $L$ .<sup>45</sup>

175. Fourth, estimate an ‘industry’ beta by taking a weighted average across the individual beta estimates of the comparator companies.<sup>46</sup> For simplicity, as a starting point, each estimate would be equally weighted in most cases. However, the Commission may apply unequal weights when there are compelling reasons to do so. In practice, adjustments of this nature may be required either to reflect large

<sup>42</sup> The returns of each firm in the sample should be regressed against the market returns from the jurisdiction within which it is listed.

<sup>43</sup> Examples of large anomalous events that affected global markets include the 1987 Stock Market Crash, the Asian and Russian financial crises, the dot.com bubble and subsequent bust and, potentially, the recent subprime financial crisis.

<sup>44</sup> See Brealey and Myers (2003), Chapter 9.

<sup>45</sup> Debt betas are discussed below.

<sup>46</sup> An alternative approach would be to construct a portfolio comprising the sample firms, calculate a time series of returns for the portfolio, estimate the beta of that portfolio, and then take that as an estimate of the industry beta. However, the Commission does not favour this approach due to the likelihood that the portfolio of firms will often need to be drawn from a number of different jurisdictions.

differences across the sample in the fundamentals discussed above, or to reflect differences between markets in various jurisdictions.<sup>47</sup> Such adjustments cannot be made mechanically. Rather, the Commission intends to evaluate the appropriate weighting scheme on a case-by-case basis, using its experience and judgment.

176. The final step is to convert the estimated ‘industry’ asset beta to an equity beta that can be applied in the CAPM. The standard formula for making this adjustment is:

$$\hat{\beta}_e = \hat{\beta}_a + (\hat{\beta}_a - \hat{\beta}_d) \frac{D}{E} \quad (8)$$

Where,  $\hat{\beta}_a$  is the estimated asset beta,  $\hat{\beta}_e$  is the estimated equity beta,  $\hat{\beta}_d$  is the estimated debt beta.

177. As noted in section 2.2, there may cases where there are real idiosyncratic differences between companies in the same industry. It is open to firms to submit evidence to the Commission to support any proposal for a firm specific cost of capital. To the extent that any such proposal is based on a regression of market data, the Commission would expect the submission to have regard to the statistical precision of such estimates.
178. In principle, if all the firms within the ‘industry’ sample are very comparable (on the dimensions outlined above), then the estimated ‘industry’ beta could be employed as an unbiased estimator for any of the firms in the portfolio. (In other words, any cross-sectional variation between individually-estimated betas for firms within the sample, and any variation between firm-specific estimates and the industry estimate, could be assumed to be simply noise.)
179. However, in practice it is very difficult to obtain comparators that are sufficiently similar in all the fundamentals discussed above to adopt such an approach. In most cases, the error associated with equating the industry estimate with the estimate for a specific firm will be part statistical error (i.e. a divergence between estimated and true betas, measured by the estimate’s standard error) *and* part intrinsic variation (i.e. cross-sectional variation in true betas). The confidence bands around the final beta estimate should account for both these sources of error.

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<sup>47</sup> Estimates from some jurisdictions may be more precise than others due to, for example, the availability of better data. In addition, any fundamental differences between markets could produce large differences in estimated costs of capital between countries and make international comparisons difficult. For example, McCauley and Zimmer (1989) suggest that cross-country differences in the cost of capital for a range of investment projects could be explained by some of the following factors: (i) differences in personal and corporate taxation; (ii) differences in the required rates of return on household savings (consumer thrift); (iii) differences in the availability of credit and government sponsored guarantee of borrowings; (iv) differences in macroeconomic stability; and (v) differences in ties between corporations, suppliers of credit and governments. Hail and Leuz (2006), who surveyed 40 different economies, found that the effectiveness of a country’s legal institutions and securities regulation is statistically related to cross-country differences in the cost of equity capital. Cross-country differences in the scale and scope of financial markets could mean differences in opportunities for diversification and the elimination of risk. There might be other idiosyncratic differences between economies in the fundamental drivers of systematic risk. For instance, different countries may enjoy different rates and levels of technological progress, and the growth opportunities of firms may vary across nations accordingly.

180. Large statistical imprecision in individual-company beta estimates would drive the Commission towards the industry estimate. However, significant intrinsic cross-sectional variation across true betas would push the Commission towards firm-specific estimates. Therefore, any proposal for a firm specific equity beta must trade-off these two types of error when choosing a final beta estimate. One possible solution would be to take some combination of the individual firm's estimated beta and the portfolio's estimated beta.<sup>48</sup>

### 4.3.2 Multi-Divisional Betas

181. A company's overall beta can be viewed as a weighted average of the betas of its component business units. The risk attached to a company's different divisions may vary considerably, and the weighted average gives the overall risk of the firm. Where multi-division firms are used in the Commission's analysis, it may be necessary to extract an estimate of beta for a specific type of regulated service from the overall group beta.
182. Consider a multi-division firm; only one of this company's many divisions is comparable to the regulated service in question. Suppose also that the regulated division is very risky in comparison to the other units. If the Commission chooses to use the group beta of the firm as a proxy for the regulated business, the lower risk of other divisions and the process of averaging would understate the risk of the regulated unit. As a result, the allowed rate of return could potentially be set too low. Conversely, if the regulated division faces little risk compared to the rest of the firm, using the company beta could result in an overstated rate of return, and end users of the regulated services would be overcharged. (Ofcom (2005a,b) identify precisely this problem.) Hence, ideally, the beta of the division of interest should be estimated for regulatory purposes.
183. The task of estimating divisional betas is complicated by the fact that there are no traded returns for individual business units. Nevertheless, a number of approaches have been developed to try to tackle this task. The applicability and performance of these techniques will depend on the data available, so no one approach can be recommended in all instances. The Commission therefore intends to take a case-by-case approach on this issue.

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<sup>48</sup> One approach to combining the estimates — developed by Vasicek (1973) — is to adjust the industry estimate (the 'prior') towards the firm-specific estimate (the 'sampling information'). Vasicek showed that, provided the prior and the sampling information are uncorrelated, the optimal weight to give to each estimate when making this adjustment is proportional to the variance of that estimate. Vasicek helpfully also derives the standard error of the adjusted beta estimate. This is a function of the variance of the individual estimate and the variance of the prior. Vasicek recommends that an appropriate estimate of the latter is the cross-sectional variance of the individually-estimated betas in the sample.

184. Numerous techniques for estimating divisional betas have been proposed in the finance literature.<sup>49</sup> However, the Commission has narrowed the set of feasible choices to three possibilities:
- (i) the pure play approach;
  - (ii) the full information approach; and
  - (iii) econometric prediction based on risk-drivers.
185. An outline of these techniques, together with a discussion of some of the challenges of applying to each in practice, is contained in Appendix A: Techniques for estimating multi-divisional betas.
186. In cases where the Commission finds none of the techniques described in Appendix A to be reliably usable, the Commission will need to employ its regulatory discretion in identifying a suitable assumption from all the evidence available to it. In some cases, where such evidence is particularly limited, the Commission may — as a pragmatic measure — employ the estimated beta for the whole firm when setting prices or performing a regulatory assessment.

### 4.3.3 The Debt Beta

187. The debt beta measures a firm's systematic risk associated with borrowing, and is measured by the sensitivity of the returns on corporate debt to movements in returns on the market portfolio of debt assets.
188. Debt betas can affect cost of capital estimates in three ways: first, when converting estimated asset betas to equity betas; second, when converting estimated equity betas of comparators into asset betas; and, third, when estimating the firm's cost of debt (in particular, the debt premium).
189. Whereas considerable attention has been given to investigating the riskiness of common stocks, surprisingly, little empirical work has been done to measure the systematic risk of debt. Many practitioners and regulators (including the Commission in past determinations) assume that debt betas are zero.<sup>50</sup> Some early studies on the systematic risk of corporate debt found evidence that debt betas have been positive and significant during some periods (e.g. Reilly and Joehnk, 1976; Weinstein, 1981). During such times, the impact of ignoring debt betas on allowed rates of return can be large (e.g. Ofcom, 2004, p.129). Therefore, the Commission considers that it is appropriate to have regard to debt betas when setting allowed rates of return.
190. One approach to estimating debt betas is to form a portfolio of traded corporate bonds aggregated by rating class and by maturity, and apply the CAPM to the

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<sup>49</sup> See, for example, Fuller and Kerr, 1981; Ehrhardt and Bhagwat, 1991; Wood, Mcinish, and Lawrence , 1992; Kaplan and Peterson, 1998; Grinblatt and Titman, 2002, pp.390-391; Brealey and Myers, 2003, pp.237-238.

<sup>50</sup> Hamada's (1972) famous relationship between leverage and systematic risk was derived effectively assuming riskless debt, and many users of the CAPM still apply Hamada's original gearing formula. For instance, Ross, Westerfield and Jaffe (1999, p.303) state that: "The beta of debt is very low in practice"..

returns on that portfolio. The coefficient on the market factor would be the estimated beta for that risk and maturity class of bonds.

191. However, even the portfolio approach, which pools together information from several traded debt instruments, can be difficult to implement for small, thinly-traded markets such as New Zealand; paucity of data can be a major hindrance to obtaining reasonably precise debt beta estimates.
192. Furthermore, an appropriate market index must be selected in order for the CAPM results to be internally consistent. As discussed earlier, when estimating equity betas it is common to use a stock index as the market proxy. Since such indices exclude traded debt, it is conceptually inappropriate to use these to proxy 'the market' when estimating debt betas.<sup>51</sup> A partial solution may be to use a value-weighted average between a stock index (e.g. the NZX 50) and debt market indices (e.g. the NZX Corporate Bond, Government Bond, Bank Bill, NZD Swap and NZ Kauri Bond indices) as the market proxy (e.g. Weinstein, 1981). However, New Zealand debt market indices suffer from selection bias because they typically include only investment-grade rated securities. Finally, any estimates obtained by applying the CAPM to traded returns may not necessarily extend to measuring the systematic risk of firms' untraded debt.<sup>52</sup> Any such errors would be particularly problematic when untraded debt represents a substantial portion of the firm's capital structure.
193. A number of recent empirical studies have found credit risk to explain only a very small proportion of spreads on corporate debt.<sup>53</sup> These studies agree that the relationship is weak across all rating classes, although credit risk is found to explain a greater fraction of the yield spread for junk-rated debt.<sup>54,55</sup>
194. It is unlikely that debt betas remain stable over time. For example, it is possible that periods of significant and persistent market turbulence (such as the recent credit crisis) may cause debt betas to increase across all risk classes. For this to occur, yield spreads must become more sensitive to changes in the market premium. Without a sufficiently long history of traded returns on corporate debt that incorporates all relevant periods, it is difficult to identify and measure the magnitude of any such shifts.

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<sup>51</sup> In principle, the market portfolio should encompass all assets in the economy, including debt and equity securities, as well as those assets that are traded and untraded.

<sup>52</sup> One would have to assume that traded and untraded debt has the same systematic risk, which may not be an appropriate assumption to make.

<sup>53</sup> Many of these studies measure 'credit risk' as the sensitivity of credit spreads to equity premiums for the issuing firm. See, for example, Collin-Dufresne, Goldstein and Martin (2001), Huang and Huang (2003), Naik, Trinh and Balakrishnan (2003), Schaefer and Strebulaev (2008).

<sup>54</sup> The measure of credit risk estimated in a number of these studies (e.g. Schaefer and Strebulaev (2008)) is the elasticity of the yield spread to the equity premium. In order to obtain an estimate of the conventional CAPM-based debt beta (which measures the sensitivity of bond returns to market movements), the estimated elasticity must be transformed by multiplying by the issuing firm's estimated equity beta.

<sup>55</sup> The two major credit rating services rate bonds as to their credit worthiness. Bonds that are rated at or above "Baa3" by Moody's or "BBB-" by Standard & Poor's are said to be investment grade bonds. Bonds rated lower than these ratings are said to be high yield or "junk" bonds.

195. When setting allowed rates of return, the Commission intends to estimate debt betas wherever feasible using the CAPM. If, for the reasons outlined above, reliable estimation proves infeasible, the Commission intends to draw on recent published evidence (which usually relate to overseas markets such as the US) to inform its view on the magnitude of (New Zealand) debt betas.

#### 4.4 Leverage

196. Leverage is the ratio of debt to total capital (i.e. debt plus equity). Leverage is used in WACC estimation in two places: first, when transforming asset betas to equity betas (and vice versa); and, second, when calculating the capital structure weights in the WACC formula.
197. The choice of leverage ratio, for the purposes of setting allowed rates of return, will depend on the nature of the industry. In some industries (e.g. electricity transmission) only one firm exists. In such industries, it would be natural to use the firm's actual leverage ratio, provided the capital structure is consistent with a reasonable investment grade corporate credit rating.<sup>56</sup> In the case of unrated firms, the Commission would want to be satisfied that the business is financed conservatively enough that future efficient investments can be financed on reasonable terms (i.e. those consistent with a reasonable investment grade credit rating).
198. On the other hand, some industries may comprise several firms, and the capital structures of these businesses can vary considerably for business specific reasons that are difficult to identify precisely.<sup>57</sup> For such industries, a pragmatic approach would be to apply a 'notional' leverage to all firms involved.<sup>58</sup> One way to determine the appropriate notional capital structure would be to take an average of the gearing ratios in the industry, checking that this average is consistent with that

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<sup>56</sup> Rating agencies, (e.g. Standard & Poor's 2006, p.43), publish approximate leverage bands that might be consistent with a particular corporate rating. These ranges are useful guides toward understanding which gearing policies may be consistent with an investment grade rating. However, these bands should not be applied mechanically or in isolation. Firstly, rating agencies review these bands periodically. Secondly, considering the leverage bands in isolation may provide a misleading picture. Rating agencies typically evaluate a wide range of qualitative and quantitative indicators — of which, leverage is only one — when determining an overall corporate rating. Some indicators may push a company's rating up and others may push it down; all the relevant evidence must be viewed in the round to arrive at a final rating. Hence, published leverage bands are indicative at best.

<sup>57</sup> It has been suggested in the corporate finance literature that capital structure may reflect, among other things, (i) a desire to take advantage of tax benefits (Graham, 1996), (ii) a desire to mitigate free cash flow agency problems (Jensen, 1986), (iii) imperfect or incomplete capital markets (Rose, 1959; Modigliani and Miller, 1963), (iv) the prospective costs of financial distress or bankruptcy (Myers, 1984), (v) the availability of internal finance (Myers and Majluf, 1984), (vi) the nature of strategic interactions between competitors, suppliers and customers (Harris and Raviv, 1991), (vii) whether or not the firm is in the market for corporate control (Harris and Raviv, 1988; Stulz, 1988), and (viii) the firm's growth prospects (Graham, 2000). As yet, there is no completely unified theory on the determinants of optimal capital structure (for regulated or unregulated firms).

<sup>58</sup> Most regulators in the UK and in Australia apply notional capital structures when setting allowed rates of return.



of an investment grade corporate. If the average industry leverage appeared too high by rating standards, it would be adjusted down to a more appropriate level for the purposes of setting allowed rates of return.

199. In practice, it is often argued that the value of the firm is only sensitive to leverage at extreme levels. Indeed the impact on the cost of capital is likely to be even more muted with the simplified Brennan-Lally CAPM, where marginal tax rates for corporations and investors are assumed equal, because any net tax advantage from borrowing is eliminated (Franks et al, 2008). Therefore, provided firms' actual gearing levels lie within reasonable bounds (i.e. consistent with a reasonable investment grade), any errors arising from applying a uniform leverage ratio to all firms within an industry will be slight.
200. Since the cost of capital should be an equilibrium rate (i.e. it should be market-determined), the market value of leverage should ideally be used for estimation purposes. However, in the case of unlisted firms, and firms with a large quantity of untraded debt, market values will be unavailable. In practice, most firms gearing covenants (with funders) will be based on book, not market values, even when they are listed. In such cases, the Commission therefore intends to use the (accounting) book value of leverage. In a regulatory setting, this is likely to be a reasonable proxy for the market value of leverage as price control regulation will tend to push the market value of the firm toward its (regulatory) book value.
201. Where the Commission has regard to actual leverage levels of firms within a given industry, it will be mindful of examples where the regulated service represents only a subset of the activities undertaken by the company. To the extent that the risk profile of the regulated service is likely to be materially different to that of the firm as a whole, the Commission may need to apply judgement in determining whether the actual leverage of the firm represents an appropriate benchmark.

#### **4.4.1 High Leverage**

202. The Commission may apply a notional level of gearing when setting allowed rates of return, but regulated firms are free to adopt an alternative capital structure. The Commission recognises that firms borrow for a variety of reasons (as discussed in footnote 57), and therefore considers that businesses should be allowed appropriate flexibility over their borrowing policies, provided such policies are within reasonable bounds.
203. At the same time, 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.<sup>59</sup>

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<sup>59</sup> In the case of unrated corporations, the Commission could examine a number of financial indicators (which are used by rating agencies) to evaluate the creditworthiness of the firm. See for example Standard & Poor's (2006).

Moreover, very risky gearing policies raise the likelihood of the firm becoming financially distressed and seeking regulatory concessions.

204. A number of UK regulators have addressed such concerns by requiring — through license provisions — regulated businesses to maintain an investment grade credit rating.<sup>60</sup> Failure to meet this condition may result in penalties set out in the firms' licenses, which are issued by the regulators.
205. 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. There are, however, other schemes the Commission could pursue to incentivise firms to adopt prudent debt policies. The common goal of such schemes is to balance the interests of consumers and firms.
206. One option would be to allow regulated firms full flexibility to adopt any financial structure, but impose a penalty on those firms that take on excessive quantities of debt that leads to a deterioration of creditworthiness below investment grade. For example, if the firm fails to maintain its rating at investment grade over the current regulatory period, the Commission could impose a deduction to the allowed rate of return in the next regulatory period. Such a direct punitive measure would provide strong incentives for forward-looking regulated businesses to adopt prudent financing decisions.
207. However, the Commission does not favour this approach for several reasons. First, the size of the penalty rate would be quite arbitrary. Second, such penalties would introduce intergenerational inequities between cohorts of consumers since, all else equal, customers today would pay more than consumers tomorrow. Third, a commitment problem arises when future regulatory periods are uncertain.
208. 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.<sup>61</sup> (The details are discussed below in Section 4.5) Again, firms would have the flexibility to choose their gearing policy. 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.<sup>62</sup> 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.

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<sup>60</sup> Such measures are related to the financial ring-fencing provisions discussed below.

<sup>61</sup> To provide a buffer against small movements in ratings that could push the business into junk territory, the Commission could benchmark against a rating that is comfortably investment grade, e.g. A–, rather than a rating that is barely investment grade, i.e. BBB–.

<sup>62</sup> All else equal, a higher level of leverage will increase the risk faced by both equity and debt holders, causing them to demand a higher rate of return in exchange for supplying capital.

#### 4.4.2 Financial Ring-fencing

209. The likelihood of financial distress increases when firms make risky investments or operate at high debt ratios. Where a regulated service is provided by a stand-alone entity, the regulator can seek to design an incentive framework that deters companies from adopting such a position. However, where the regulated service is provided by a subsidiary of a larger group, any such incentive framework can be undermined during periods of financial distress as a parent could draw on its subsidiaries' reserve earnings by increasing dividend requirements (which may force the subsidiary to defer efficient investments or necessary maintenance) or selling key assets. Thus, in times of hardship, the resources of a subsidiary could be drained away to help its parent recover.
210. The option to call on the resources of its subsidiaries mitigates the risk borne by the parent, but as a consequence, risk is shifted onto the customers of the subsidiaries. For example, customers may have to endure degraded service quality if maintenance is deferred, or may have to forego the benefits of welfare-enhancing upgrades if investments are delayed. Unregulated subsidiaries may seek to raise prices to fund the recovery of distressed owners. Regulated subsidiaries may pressure the regulator to relax controls, which would essentially have the same effect.
211. Financial ring-fencing seeks to prevent the assets of regulated companies being called by its parent, even during times of financial distress, without the approval of the regulator.<sup>63</sup> The motivation for this measure is twofold. First, it prevents the parent from diverting scarce resources and essential assets away from its regulated subsidiary. Second, it removes the need for regulated businesses to appeal to the regulator for price increases, citing the financial distress of its parent as a reason why the regulator should accede. The aim is to insulate customers of regulated firms from unduly bearing costs (both direct and indirect) that may be associated with any financial distress arising from the risky activities of regulated firms' owners.
212. A number of UK regulators, including Ofwat and Ofgem, have ring-fenced regulated businesses.<sup>64</sup> UK regulators are able to implement financial ring-fencing through the conditions of the operational licenses issued to regulated firms, which

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<sup>63</sup> Whereas 'financial ring-fencing' in this context involves insulating a firm potentially supplying both regulated and non-regulated services from the financial distress of a parent, in the past, 'ring-fencing' has been used in New Zealand to describe the notional accounting or operational separation of a set of regulated services from non-regulated services (or possibly other regulated services), all of which are supplied by the same firm. The latter would apply to the operations of the whole firm, including both regulated and non-regulated services and is relatively straightforward to implement because the firm (as opposed to a set of regulated services) is a legal entity in its own right. In contrast, it is difficult to insulate the regulated services of a diversified, multipart company from the wider activities of the firm.

<sup>64</sup> One example is the case of Wessex Water Services Ltd in the UK, which was owned by the Enron Corporation. When Enron became distressed the assets of Wessex were secure thanks to the ring-fencing measures the regulator had put in place; when Enron eventually failed, there was no disruption to customers while Wessex was sold.

are essentially contracts between the regulator and the regulated businesses.<sup>65</sup> Without these licenses, the firms cannot operate.

213. Clauses within the UK licenses establish the regulated company as a separate legal entity that must be managed independently of its parent. In addition, the businesses are prohibited from transacting in certain ways (e.g. the transfer or sale of assets) with their parent, without the approval of the regulator. The companies face penalties (such as revocation of licenses) if these conditions are not satisfied.
214. Another provision is the potential for a lock-up on dividends paid by the subsidiary to its parent in the event that the subsidiary's credit rating falls below investment grade. This provides the parent with strong incentives to ensure its subsidiary is managed prudently, and that it has sufficient means to finance efficient investments and maintain service quality.
215. Clearly, financial ring-fencing is an appealing tool. However, under New Zealand legislation the Commission is not provided with express powers to implement financial ring-fencing, and there is no license regime similar to that in the UK. In addition, regulatory instruments in New Zealand focus on the regulation of *goods and services*, not entire *companies*.<sup>66</sup> It is generally easier to ring-fence entire firms because the legal boundaries of the entity are in most cases clearly defined. In contrast, the ring-fencing of goods and services is not straightforward.
216. For these reasons, financial ring-fencing measures of the type employed by UK regulators appear unfeasible at the present time.

## 4.5 The Debt Premium

217. The debt premium is the margin between the corporate rate of borrowing (usually, the rate of return on traded bonds) and the riskless rate of interest. The Commission estimates debt premiums as an intermediate step toward estimating the cost of debt.
218. There is still considerable debate over exactly what this spread reflects. Most empirical investigations have found that at least a small proportion of the debt premium reflects credit risk, a component of which will be systematic. Firms in or near financial distress are more than likely to face high debt premiums; firms with rapidly increasing leverage could also expect to see credit spreads rising. The credit rating of an individual debt issue provides an indication of the credit risk associated with that issue.<sup>67</sup>
219. Another apparently important determinant of credit spreads is maturity. Suppliers of credit will generally demand a premium to cover the opportunity cost of funds

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<sup>65</sup> See for example Ofgem (2004) and Ofwat and Ofgem (2006).

<sup>66</sup> See, for example, Part 4 of the Commerce Amendment Act 2008, or Part 2 of the Telecommunications Act 2001.

<sup>67</sup> In instances of an unrated issuance, the Commission could take the overall rating for the corporation as a proxy for the rating of the issue. As discussed earlier, it is possible to use guidelines published by rating agencies such as Moody's and Standard & Poor's to *infer* a rating for unrated firms.

foregone, and this premium could be expected to increase with maturity (i.e. long-term borrowing rates should attract a larger premium than short-term debt).<sup>68</sup>

220. When estimating debt premiums, the Commission finds it is useful to have regard to these two factors. Specifically, the Commission proposes to benchmark allowed debt premiums against the premiums paid by firms who have recently (over the past two years) issued plain vanilla debt that is: (i) of similar maturity, and; (ii) of a reasonable investment grade, e.g. using Standard & Poor's/Moody's ratings A-/A3 or BBB+/Baa1. The choice of appropriate credit rating can though never be entirely scientific. The Commission's objective is to provide, through the allowed debt premium, incentives for firms to maintain a reasonable rating that is at least investment grade, i.e. BBB-/Baa3.
221. In benchmarking the allowed cost of debt, the Commission may draw upon evidence of the actual debt costs of the regulated businesses, provided that debt satisfies the two conditions outlined in paragraph 220. Particular weight may be placed on this evidence in circumstances where there is a single firm in the industry and actual leverage has been adopted (see section 4.4)<sup>69</sup>.
222. Note that the firms used to benchmark the allowed debt premium need not be drawn from the same industry. It is not necessarily true that firms within the same industry pay similar debt premiums; nor is it always the case that firms from disparate industries pay dissimilar debt premiums.
223. Furthermore, for conceptual consistency, the following conditions should be satisfied when estimating debt premiums:
- (i) the risk-free rate and the corporate bond yield used to measure the debt premium should be of the same maturity; and
  - (ii) the risk-free rate used to measure the debt premium should be the same risk-free rate used to estimate the cost of equity in the CAPM formula.
224. In summary, if the regulatory period is five years the Commission proposes to use a five-year risk-free rate (forecasted using data on the 1 year government bond rate) to estimate the cost of equity (see Section 4.1) and the cost of debt. This will ensure as much as possible that the overall allowed rate of return reflects a five-year cost of capital. In such circumstances, the allowed debt premium would therefore be

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<sup>68</sup> A number of studies have also found several other non-credit-risk factors that could explain the variation in corporate spreads. These include: illiquidity, interest rate movements, the slope of the yield curve, the implied volatility of equity markets and changes in the business climate, and some unidentified systematic factor (Collin-Dufresne et al, 2001); the call and conversion features of some corporate bonds, any asymmetric tax treatments of corporate and government bonds (Huang and Huang, 2003); the Fama-French firm-size (small-minus-big) and book-to-market ratio (high-minus-low) factors (Schaefer and Strebulaev, 2008). This list is by no means exhaustive. There is a large and growing literature examining the possible drivers of observed corporate spreads. The presence of liquidity and non-credit risk premiums explain why credit spreads can be positive even when debt betas are zero.

<sup>69</sup> There may be cases in which a regulated business (operating within a wider group) issues debt directly (e.g. Chorus bonds). In such circumstances, the Commission would have regard to the actual cost of debt of the regulated business.

measured as the average spread paid by firms issuing plain-vanilla corporate debt with a maturity of five years and a rating of A– or BBB+.

## 4.6 Tax Rates

225. In setting price controls, or analysing company returns, a regulator needs to make a suitable allowance for the tax liabilities that the firm will incur in carrying out its activities.
226. From a presentational point of view, this allowance can either be included within the cost of capital, or as an operating cost through a separate cash flow allowance. In practice, there are therefore a number of ways to present the cost of capital, depending on the treatment of tax. These are outlined below:

- (i) A pre-tax WACC, in which the cost of equity is adjusted upwards by a tax wedge to provide the company with remuneration for its tax liabilities through the cost of capital. Under this approach the cost of capital is calculated as:

$$\begin{aligned} \text{Pre - tax WACC} &= \frac{\text{Post - tax WACC}}{(1 - t_c)} \\ &= r_d L \frac{(1 - t_c)}{(1 - t_{eff})} + r_e \frac{(1 - L)}{(1 - t_{eff})} \end{aligned} \quad (9a)$$

where,  $r_d$  denotes the cost of debt capital,  $r_e$  is the cost of equity capital,  $L$  is the financial leverage ratio,  $t_c$  is the corporate tax rate, and  $t_{eff}$  is the effective tax rate calculated on the basis of the regulatory tax figure and the regulated profits.

The Commission notes that in the above equation, where the effective tax rate is equal to the corporate tax rate, the Pre-Tax WACC will simplify to,

$$\text{Pre - tax WACC} = r_d L + r_e \frac{(1 - L)}{(1 - t_c)}$$

- (ii) A vanilla WACC, in which no adjustments for tax are made to the underlying inputs into the WACC, and the company is remunerated for its levered tax liabilities through a cash flow allowance. Under this approach the cost of capital is calculated as:

$$\text{Vanilla WACC} = r_d L + r_e (1 - L) \quad (9b)$$

- (iii) A post-tax WACC, in which the cost of debt is adjusted down by an interest tax deduction, and the company is remunerated for its (unlevered) tax liabilities through a cash flow allowance. Under this approach the cost of capital is calculated as:

$$\text{Post-tax WACC} = r_d (1 - t_c) L + r_e (1 - L) \quad (9c)$$

227. In principle, in a regulatory price setting context, providing that the same tax rate is applied consistently across each approach, the overall revenue requirement should be equivalent regardless of whether the tax allowance appears in the cost of capital

(through a pre-tax WACC), or through a cash flow allowance under a vanilla or post-tax WACC approach. As such, the method through which the tax allowance is included in the revenue requirement can be considered a second order issue.

228. The key issue in practice is whether the tax allowance is based on the statutory tax rate (the tax expense approach), or the effective tax rate (the tax payable approach). The Commission will assess the appropriate approach on taxation as part of its analysis of the regulatory framework that applies on a case-by-case basis.
229. In circumstances where the Commission considers that tax allowances should be based on an estimate of each firm's effective tax rate across the period, the Commission notes that this is likely to result in tax rates that vary both between firms within an industry, and annually for an individual firm in each year of any regulated control period. As a result, the Commission considers that where possible, it would be preferable and simpler from a presentational point of view, to include remuneration for tax liabilities as a separate cash flow item. Where the Commission can and needs to account for tax liabilities in the cash flows, the Commission would expect to adopt a vanilla WACC.
230. The Commission, however, recognises that a post-tax return may represent the most readily comparable figure to published company results. As such, it may choose to present the WACC on both a vanilla and post-tax basis where it considers it appropriate to do so.<sup>70</sup>
231. A second tax rate that can enter into the calculation of WACC is  $t_i$ , the average personal tax rate across all investors in the economy, which appears in the simplified Brennan-Lally version of the CAPM used by the Commission to estimate the cost of equity capital. In practice, it is very difficult to determine what this average tax rate is. For simplicity, the Commission has to date assumed that this rate is equivalent to the corporate tax rate (previously 33%; currently 30%). The effect of a small difference in the rate is likely to be immaterial to the final allowed rate of return.
232. Taking a pragmatic view, the Commission intends to maintain its assumption that the average investor tax rate is very close to the corporate tax rate, and hence proposes to adopt the figure of 30% as the average personal tax rate across all investors in the economy.

## 4.7 Estimating the WACC Range

233. Typically, the Commission is faced with model and parameter uncertainty when it estimates the key variables in the WACC formula discussed above. These uncertainties include such things as the statistical error surrounding individual parameter estimates; the choice of model (e.g. CAPM versions, Fama-French, DCF, etc.); the suitability of various proxies (e.g. the market index for the market portfolio, or government bond yields for the risk-free rate); the MRP and the term

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<sup>70</sup> This recognises that any post-tax WACC presentation can be complicated if the firm is expected to incur a tax loss at any stage during the duration of the regulatory period.

premiums imbedded in these; the way in which various MRP estimation techniques are blended together; the way in which comparators are selected for MRP; and beta estimation.

234. The Commission has often dealt with these uncertainties by deriving a plausible range for the WACC (rather than a single point estimate) that reflects the possible spread between estimated and true parameter values underlying the WACC, and then selecting an appropriate point along that range.
235. Details of the Commission's procedure for estimating the WACC range are set out in, for example, Lally (2008, Appendix6; pp.92–93). Broadly, the approach involves the following steps:

**First**, estimate each of the individual WACC parameters and their associated standard errors using the procedures discussed above. 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.<sup>71</sup>

**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.

236. Although this approach uses statistical concepts to inform the range, the range itself should not be interpreted as an exact statistical distribution. Rather, the range should be viewed as a plausible band within which the true WACC is likely to lie, recognising the many uncertainties (quantifiable or otherwise) surrounding the WACC's individual component parts.
237. It has previously been suggested that the Commission use Monte Carlo methods to simulate a WACC distribution, in place of the approach described above (e.g. Boyle, Evans, Guthrie et al, 2006).<sup>72</sup> The parties argued that Monte Carlo techniques permit joint variation in parameters, and therefore provide a useful means of testing the effect of combinations of variable settings that underlie the WACC.

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<sup>71</sup> 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.

<sup>72</sup> *Monte Carlo simulation* is a technique used to estimate the probability distribution of a random variable. Monte Carlo simulates the results of a model or process by accumulating average results of thousands of random draws from the probability distributions of input variables.



238. However, 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.

#### **4.8 Selecting a Point along the WACC Range**

239. Once the WACC range has been estimated, the next step in setting the allowed rate of return is to select an appropriate point along that range. Section 2.5 explained that the Commission accepts the general proposition that the social costs of setting allowed rates of return too low probably outweigh the costs of setting allowed rates too high. Reflecting this view, the Commission often selects a WACC estimate above the midpoint of the estimated range when setting allowed rates of return.
240. The extent to which the Commission departs from the midpoint is a matter of judgment and must be assessed on a case-by-case basis. The factors that determine the exact movement along the range will depend on the degree of uncertainty reflected in the range, and whether the final value selected seems reasonable given the characteristics of the industry and prevailing economic conditions.
241. Recently, LECG proposed that the Commission employ a ‘loss function’ approach to selecting an appropriate point along the range. This suggestion initially requires a loss function to be specified that depends on the ratio of harm from underestimating the WACC relative to overestimating it, and on the corresponding ‘percentile’ of the WACC range. The loss function is then optimised (i.e. a point is chosen along the WACC range) so as to minimise the expected loss.
242. Although conceptually interesting, the Commission does not favour this approach because there is no empirical data on the loss ratio. In other words, there is no way to know the true form of the function, and there is no way to reliably calibrate it. Instead, the Commission would have to make large theoretical assumptions, which could have a significant impact on the final cost of capital. In the Commission’s view, LECG’s recommended approach is too mechanical and suggests a misplaced sense of precision and mathematical rigour. For this reason, the Commission does not propose to pursue the approach further.

## 5 Possible Adjustments to the WACC

243. The next step in setting the allowed rate of return is to consider whether adjustments to the WACC — for issues such as asymmetric risks, real options, market frictions and resource constraints — are necessary. The answer depends on the specific circumstances of the regulated business. This chapter sets out the Commission’s views on the treatment of these issues, beginning with the most substantial of these topics: asymmetric risks and real options.

### 5.1 Asymmetric Risks

244. A firm faces *asymmetric risk* when its distribution of returns is truncated at one extreme without an offsetting truncation at the other. In other words, the firm’s payoffs are ‘asymmetric’. For example, in competitive markets existing firms are exposed to the risk of new entry that would erode upside returns when the market is profitable; however, when the market is unprofitable entrants never arrive so incumbent firms are left to entirely bear any losses. Similarly, in monopolised markets regulation can cap profits without providing commensurate insulation from downside risk. All firms may also be exposed to stranding risk (e.g. through technical obsolescence, unfavourable demand shocks), and large catastrophic events such as natural disasters.
245. For clarity, it is useful to distinguish two categories of asymmetric risk:
- Type I risks** are risks that are generally unrelated to the day-to-day operations of the firm, and arise through infrequent events that could produce large losses. Examples include natural disasters; pandemics; terrorist threats; or large, unexpected policy shifts that could force the shutdown of operating plant before the end of its economic life, such as the introduction of a stiff carbon tax.
- Type II risks** are risks that derive from such events as the threat of competitive entry or expansion. That is, there tends to be a cap on any significant upside to the firm, but typically not the significant downside risk that it faces. On the downside, assets can become stranded through technical innovations that unexpectedly lower operational costs or through negative demand shocks.
246. The treatment for each of these types of risk differs, and so the discussion below deals with each separately.

#### 5.1.1 Type I Asymmetric Risk

247. The events that give rise to Type I risk are events that firms would naturally wish to insure against. However, insurance markets typically provide no cover for catastrophic risks, so firms — even those operating in competitive markets — are often left to self-insure (Froot, 1999, p.3).
248. The lumpy and extreme nature of events that give rise to Type I risk means it is often unfeasible for firms in competitive or contestable markets to recover the cost

of catastrophic events after the fact. (The exception is an industry-wide adverse event that raises costs to all rivals.) Often, the only option available to firms is to self-insure in advance. Since one aim of regulation is to mimic outcomes that are consistent with those of competitive or contestable markets, any scheme designed to deal with Type I risk should ideally allow some *ex ante* recovery. On the other hand, regulators are in the unique position of being able to make *ex post* adjustments with the benefit of hindsight. Therefore, a scheme that permits some flexibility in this regard is desirable.

249. It has been put to the Commission that an allowance for asymmetric risks could be included within the cost of capital by adopting a point estimate at the upper end of the estimated plausible range. However, such an adjustment would be difficult to quantify and would risk becoming conflated with the unrelated issue of recognising the potential asymmetries arising from estimation uncertainty (as discussed in sections 2.5 and 4.8). In addition, whilst allowing an uplift to the cost of capital might provide firms with the necessary revenues to undertake self insurance, without any form of “ring fencing” arrangements in place, it is unlikely to provide consumers with any guarantee that the additional funds would be employed for that purpose.
250. With these issues in mind, Franks et al (2008) have proposed a hybrid scheme that mixes *ex ante* and *ex post* allowances. In particular, they recommend that the Commission handle Type I risks by allowing regulated firms to charge an ‘insurance premium’ that is invested in a reserve fund, which would pay out in the event of a Type I occurrence (effectively, a form of self-insurance that simulates what might otherwise occur, absent regulation). *Ex post* adjustments could be made if the fund proves inadequate or too generous.
251. The Commission considers that such a scheme has potential benefits in securing continuity of services, and reducing the need for firms to demand significant price increases in the event that such a risk were to crystallise. However, the Commission acknowledges that there would be a number of practical challenges in implementing such a scheme, not least the requirement to calculate an appropriate annual premium. In addition, it will need to explore further the practicalities of creating such a fund under existing legislation. An alternative approach might be to require the firm to set-up its own self-insurance fund, with payments into the fund allowed to borne as an operational expense subject to pre-determined conditions on the management and operation of the fund.
252. In principle, such schemes, if they were to be adopted, would apply most readily to a price control situation. Clearly, a reserve fund would not be established for the purposes of assessing excess returns, although the Commission might make allowances for the firm under scrutiny to self-insure against Type I risk, in which case assessments of a reasonable self-insurance premium could be obtained from an actuarial service.

### 5.1.2 Type II Asymmetric Risk and Real Options

253. Type II asymmetric risks may exist in industries characterized by long-lived, irreversible (large sunk cost) investments, and substantial uncertainty (e.g. over future demand, costs, or technology shifts that would change the operating costs of later facilities in a way that leaves existing investments obsolete and stranded).
254. Dixit and Pindyck (1994) explain that the orthodox neoclassical theory of investment provides a simple decision rule. First, calculate the expected present value of future revenues. Then, calculate the expected present value of expenditures associated with the investment. Finally, determine whether the difference—the NPV—is greater than or equal to zero; and if it is, then invest. A firm following this rule will invest when its WACC just equals the expected rate of return.
255. Dixit and Pindyck argue that conventional theory ignores the role of sunk (irreversible) investment, and the flexibility that firms undertaking such investments sometimes have to respond to uncertainty and the arrival of new information. A body of literature — the so-called ‘theory of real options’ — has emerged showing that when these factors are important, the optimal investment rule can differ from the neoclassical one. The reason is, in the presence of significant uncertainty about the future, and when investments are largely irreversible once made, there can be substantial value in waiting to see what the future holds.
256. Real options theory predicts that firms facing investment decisions that are largely irreversible and subject to significant uncertainty will not invest when the (conventionally calculated) NPV of doing so is zero. This is because when a firm makes such an investment or exercises its option to invest, it extinguishes the opportunity to wait for new information that may influence the desirability of the investment. As a firm undertaking an irreversible investment cannot disinvest if market conditions change unfavourably, the ability to defer an investment or wait has value, and if such a firm were to follow the neoclassical NPV rule it would invest too early. Taking the option to invest into account, the firm using real option theory will therefore only invest at a time when the NPV was greater than or equal to the value of the option to invest.
257. The implication of this is that a firm undertaking an irreversible investment that is subject to uncertainty will require a rate of return that exceeds the conventional cost of capital by a margin that compensates it for the value of delay. That is, it will only invest if it expects to be compensated, over and above its traditional cost of capital, for the loss of this option to defer (Dixit and Pindyck, 1994, Chapter 1).
258. The major sources of uncertainty faced by firms are uncertainty over costs (including those imposed by large shifts in government policy), demand, and technology. Adverse shocks to any of these can leave assets stranded before the end of their economic lives.<sup>73</sup>

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<sup>73</sup> Long-lived, durable assets, which are typical in infrastructure industries, can be particularly vulnerable to stranding risk.

259. Dixit and Pindyck outline that in competitive markets with irreversible investments, firms need to contend with the uncertainty associated with the threat of new entry, or expansion by existing competitors. Whilst the irreversible nature of the investment may create a potential barrier to entry, if favourable market conditions prevail, it could allow new rivals to enter and existing rivals to expand until supernormal profits are competed away. After entry occurs in markets with a high proportion of sunk assets, the irreversible nature of the investment creates a barrier to exit. It is therefore contended that the relative ease of entry as opposed to exit creates an asymmetry in the distribution of returns.<sup>74</sup>
260. Similarly, it has been suggested that regulated monopolies can be subject to a cap on excess profits, without any offsetting limitation on losses if market conditions deteriorate. Hence, it is argued that like competitive markets, regulated monopolies potentially face asymmetric payoffs, which gives rise to so-called Type II asymmetric risk.
261. On the face of it, the preceding discussion suggests that when regulated businesses face asymmetric returns (because of large, sunk investment costs) and significant uncertainty, the allowed rate of return should be set greater than the WACC, to reflect the behaviour of a firm investing optimally. However, the existence of, and extent to which a regulated firm is exposed to Type II asymmetric risks will be heavily dependent on other aspects of the regulatory framework (which may act to shield the firm from risks associated with stranded assets), the extent to which future demand is uncertain (i.e. whether or not there is likely to be sufficient market power to enable the firm to charge up to any regulatory cap), and the irreversibility of the investment being considered.
262. In addition to the implications of the regulatory framework, there are further important factors that need to be considered before reaching any firm conclusions about the need for regulatory allowances. These are now discussed.

### 5.1.3 Compound Options

263. The value of a potential investment can be viewed as a bundle of real options (a so-called compound option).<sup>75</sup> One element of the enterprise value is the value of waiting to invest. The action of investing extinguishes this option, so investors require some compensation in order to undertake it, as discussed earlier. However,

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<sup>74</sup> Leahy (1993) shows that while the competitive firm requires the same price threshold above costs as a monopoly investor in order to undertake irreversible investment under uncertainty, the value of the real option to wait for the competitive firm will be competed way to zero. Similarly, see Dixit and Pindyck, Chapter 8.

<sup>75</sup> Trigeorgis (1999) provides a summary of the various types of real options a firm may have at its disposal, including the option to defer investment; the option to abandon during construction (time-to-build option); the option to expand; the option to contract; the option to shutdown and restart operations; the option to abandon; the option to switch production inputs to alternative uses; and corporate growth options.

investment potentially also *creates* valuable options, which may have an offsetting effect on sacrificed delay options (see Abel, Dixit, Eberly and Pindyck, 1996).<sup>76</sup>

264. Depending on the interaction between these various options, the optimal investment rule moves closer to the neoclassical NPV rule. For example, when the firm invests, it may also acquire the ability to suspend or contract operations, or scrap the project altogether if conditions turn unfavourable (Dixit and Pindyck, 1994, Chapter 7). Such options can be valuable because they allow the firm to avoid large ongoing losses — i.e. they restore (some) symmetry to the firm's payoffs by allowing the lower tail of the returns distribution to be (at least partly) avoided.<sup>77</sup> Whether such options prove to be valuable will depend on how large and reversible the initial investment and restart costs are; if these are significant and sunk, then suspension, contraction or scrapping options may be worth very little.
265. Firms often make investments not because of immediate earning prospects, but because of the large potential for growth that the initial investment facilitates (Kulatilaka and Perotti, 1998). These growth options will tend to be worth more in emerging markets with rapid technological progress.
266. One strategy firms employ to mitigate uncertainty is to invest sequentially (e.g. Majd and Pindyck, 1987; Pindyck, 1993; Berk, Green and Naik 2004). For example, a firm may roll out a narrow product range to test customer demand before sinking significant further funds into R&D (i.e. research and development); when construction costs are very uncertain, a firm may build gradually to avoid budget blowouts, even though the payback from investment may not commence until construction is completed; and when technology is moving very rapidly, and the threat of obsolescence is high, a firm may roll out new technology cautiously to avoid stranding. In such cases, the required compensation for extinguished deferral options may be small since the firm can take steps to mitigate the uncertainty that makes delay valuable.
267. However, firms must sometimes trade-off the flexibility of building slowly against the benefits of scale. When scale economies are important to the feasibility of the business, the firm may be forced to forgo flexibility by building large upfront. In

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<sup>76</sup> Hubbard and Lehr (2000) apply the Abel et al (1996) model to telecommunications and note that the impact of real options on the cost of capital is ambiguous. They note that under a real options approach, taking into account such things as xDSL technologies (i.e. all variants of Digital Subscriber Line technology), which have provided additional growth opportunities for the existing telecommunications copper access network investments, might lead to the allowed rate of return needing to be set below the WACC.

<sup>77</sup> However, when uncertainty is industry-wide; disinvestment can be very difficult. For example, a steel plant cannot be employed outside the steel industry. If one steel plant faces an idiosyncratic negative shock, it can sell plant to another firm in the same industry and get a fairly good value for the assets. But, if the whole industry suffers a negative shock, then the resale value of plant will be small, irreversibility will be large, and abandonment will be very difficult (Dixit and Pindyck, 1994, p.249). Even when capital is non-specific (e.g. automobiles, computers, office equipment), resale value can be very low due to the adverse selection ("lemons") problem. Finally, even if installed capital can be resold, environmental regulations may impose large clean-up/shut-down costs on some industries, which would raise the cost of exit.

other cases, staged rollouts are simply not viable because investment (entry) is an all-or-nothing affair (e.g. a firm that needs to establish basic infrastructure before bidding for a contract to supply).

268. If extinguished delay options warrant an allowance to regulated firms, then the creation of growth, abandonment, contraction and suspension options through investment might also warrant a countervailing reduction in that allowance. Focusing exclusively on delay options can provide quite a misleading picture. Certainly in some situations investment delay may be optimal, but when all the options generated by investment are accounted, it may be that the value of waiting is significantly diminished or offset altogether.

#### 5.1.4 Symmetric Risk

269. The Commission considers however, that it would be inappropriate to provide compensation for extinguished delay options when the regulated business faces *symmetric risk*. This situation can occur when the firm has some form of market power (i.e. something that releases, or at least partially insulates, the firm from the threat of competitive entry or expansion by rivals).<sup>78</sup> In other words, the firm's downside risks are offset by possible upside outcomes.
270. Symmetric risks can also arise when — because of very few or small sunk costs — the firm can easily restore symmetry to its returns distribution by abandoning, scaling back, or temporarily halting operations in response to large negative shocks (this possibility was discussed in the previous section).

#### 5.1.5 The Regulatory Treatment of Type II Asymmetric Risk

271. The Commission acknowledges that in certain circumstances Type II asymmetric risks are real (in both competitive and monopolised markets) and can have an impact on firms. The Commission considers that in those instances it is reasonable to provide regulatory allowances for Type II asymmetric risks.
272. In principle, in circumstances where it is appropriate to take into account a Type II asymmetric risk, the appropriate allowance would be: the option value of waiting (to invest) just long enough to cover the business's cost of capital and its Type II risk, net of all options created through investment, and then amortised over the expected economic lifetime of the assets. The resulting annuity could then be included as an expense in the business's regulated cash flows. Alternatively, this option value could be expressed as an annualised rate of return — calculated as the rate of return on the initial investment that the net option value represents — which could be added as a margin on the WACC.
273. In the past 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

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<sup>78</sup> A firm's market power may derive from, among other things, its: franchise or patent rights (intellectual property); large economies of scale or scope that may deter new entry; specialised assets; ownership of land or natural resources; unique managerial talent or labour pool; reputation; first-mover position, etc.

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

274. At this stage the Commission notes that there is still little regulatory precedent for taking Type II asymmetric risks into account, and no regulator appears to have taken real options into account to adjust the allowed rate of return. Regulators have highlighted difficulties associated with adopting a real options approach. In particular, the techniques for calculating option values are complex, there is still no best practice developed for taking such options into account,<sup>79</sup> and the appropriate modelling approach often depends on the specific circumstances of the firm, as no one model can uniformly be applied to all businesses.<sup>80</sup>
275. The Commission's view is that in the event that it did compensate for Type II asymmetric risks (including its effect on investment timing), it would automatically be compensating firms for any relevant extinguished timing options, and no further treatment for timing options would be required.
276. In circumstances where parties wish to submit to the Commission that they consider a Type II asymmetric risk is material, the submissions, as an initial step, should clearly address, and provide substantive evidence on, the following sorts of questions:
- (i) What is the value of the investment, and what proportion of this is irreversible or sunk?
  - (ii) Are the firm's payoffs asymmetric?
  - (iii) What are the key sources of uncertainty related to the investment (e.g. demand uncertainty, cost uncertainty, technology risk)?
  - (iv) Does the investment create a large first-mover advantage? Is the threat, and value, of pre-emption significant?
  - (v) Does the investment provide large opportunities for growth and expansion (into existing and/or new markets)?
  - (vi) Is abandonment, suspension or contraction of operations feasible? What would trigger such events; what are the associated costs; and are these costs sunk?
  - (vii) Is slow or sequential build feasible?

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<sup>79</sup> The Independent Regulators Group (IRG) stated that: "As a future development, it may be of interest to analyse new approaches in methodologies for calculating the cost of capital, such as the Real Option Theory, that is so far a still debated issue for which best practice is not yet developed." (IRG, 2007, p.3)

<sup>80</sup> For example, Ofcom (2005b, p.103) acknowledged that while asymmetric risks and real options could be an important consideration for future regulation of next generation networks, it was still a controversial area, and there was no consensus regarding the appropriate mechanism for taking the value of real options into account.



277. The list of questions above is not necessarily exhaustive. Interested parties may wish to include additional evidence in support of their submission on the severity of the Type II risks faced by the regulated business.<sup>81</sup>

## 5.2 The Costs of Financial Distress

278. Regulated firms have argued before the Commission that firms that face losses on a particular project may find it costly or even impossible to raise further funds from capital markets. Yet without such funds, firms may be forced to forgo future valuable projects in other areas, or shut down existing ones. The argument often advanced to the Commission is that the potential loss of value on forgone investments imposes additional costs on investors, for which they should be compensated.
279. The Commission is of the view that businesses should not be awarded compensation for imprudent or reckless borrowing or investments that significantly raise the prospects of financial distress. Rewarding such behaviour would contribute to a moral hazard problem in the sense that firms would face diminished incentives to avoid risky activity, and the effect would be to transfer risk onto customers.
280. The Commission acknowledges that financial distress can constrain investment activity. It is precisely for this reason that the Commission intends to set debt premiums in such a way as to incentivise firms to avoid very risky gearing that would raise the likelihood of distress (Section 4.4.1). Furthermore, as discussed in Section 2.4), the Commission would consider sanity checks on the allowed rate of return to test if firms would likely be in a position to raise finance on reasonable terms in future. The Commission further notes that the use of promised rather than expected yields on debt within the WACC implicitly represents some recognition of financial distress costs.
281. The Commission recognises that sometimes even conservatively financed regulated companies are forced into financial distress by extraneous and unforeseen circumstances; preservation of a minimum debt rating and/or a benchmark leverage level can never fully protect against the possibility of financial distress. Whilst such situations are generally rare in stable market conditions, during times of extreme market turbulence they can be much more prevalent, with even very prudent businesses finding it difficult to raise funds. The Commission considers that such scenarios are best dealt with on a case-by-case basis. Interested parties are welcome to provide submissions where they consider this is a significant issue. Any submission should clearly set out the concerns and supporting evidence for the Commission to consider.

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<sup>81</sup> A similar list to that described above was outlined by Ofcom (2005a, p.43) when assessing if a real options approach could be incorporated into access regulation of telecommunications networks. Ofcom also provides (2005b, pp. 96-103) a discussion on the principles for the application of real options to regulation.

### 5.3 Resource Constraints

282. It has been argued before the Commission that some firms are unable to undertake all desirable projects due to resource constraints, such as credit rationing and limited managerial talent. Thus, undertaking one project sacrifices other desirable projects, and this raises the opportunity cost of the current project. It has been suggested that if the Commission's objective is to set a fair rate of return, this additional opportunity cost should be compensated because investors implicitly recognise these costs when assessing their investment hurdle rates.
283. When considering this issue, it is useful to distinguish between capital and non-capital constraints. Capital constraints (credit rationing) occur when firms with genuine prospects cannot raise finance. The source of the problem may be a market failure arising from asymmetric information between borrowers and lenders, which cannot easily be resolved. Greenwald, Stiglitz, and Weiss (1984), Myers and Majluf (1984) and Hart and Moore (1994) show that when such imperfections exist firms can face financing constraints, and if insufficient internal funds are available, profitable projects may need to be forgone. In principle, credit rationing should not occur in efficient capital markets.
284. Some firms may impose credit rationing on themselves, for example, as a means to address internal agency costs, or because they are reluctant to issue external finance (Mukherjee and Hingorani, 1999).<sup>82</sup> A firm may also be exposed to lost investment opportunities if, through imprudent borrowing and debt management, the regulated business has failed to maintain a good credit history and thereby jeopardised future financing. The Commission does not consider that either of these issues should warrant any compensation over and above what it assesses to be a 'fair' rate of return.
285. Suppose instead that the regulated business faces resource constraints unrelated to capital markets, e.g. a pool of very scarce skilled labour that must be shared between regulated and unregulated activities. In that case, devoting these resources to the regulated business to the exclusion of other divisions may generate a real opportunity cost for the firm.
286. However, in such cases, the market price of such resources could be expected to adjust to (at least partially) eliminate the constraint, and these additional expenses on the operational side to the firm may then be passed through into the regulated

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<sup>82</sup> The *pecking-order hypothesis* says that firms will finance their investments using the easiest and cheapest means possible. This means, firms will tend to prefer internal financing first, next they will raise debt, and only as a last resort will they issue equity. The further up the pecking order, the greater are the costs of financial distress. Hence, rational investors, who recognise that they are at an informational disadvantage to business insiders, will infer that firms that issue equity have the most pessimistic outlooks (Myers, 1984). As a result, firms with genuinely optimistic outlooks will prefer not to raise equity because they worry about being mistaken for pessimists (and the associated problem of the stock issue being undervalued by investors).

prices by the Commission.<sup>83</sup> The Commission does not believe that it would be appropriate to allow any further additional compensation through the cost of capital allowance, as this would effectively reward the firm for a risk that it is not bearing in practice. Whilst in some cases it might be argued that the firm is constrained in its decision making by regulatory requirements, to allow an adjustment for such a perceived cost could create undesirable incentives for regulatory firms to actively seek entry into high-risk, non-regulated sectors.

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<sup>83</sup> This would particularly be the case where regulation adopted a “building blocks” approach to setting the regulated price.

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## Appendix A: Techniques for estimating multi-divisional betas

- A.1. In section 4.3.2, the Commission identified three possible approaches for estimating multi-divisional betas. These were:
- the pure play approach;
  - the full information approach; and
  - econometric prediction based on risk-drivers.
- A.2. This appendix provides further detail on how each technique might be used in practice, and identifies some potential drawbacks with each approach.
- A.3. Under the *pure play* approach, the Commission would identify traded standalone firms that are very similar across the fundamental risk drivers discussed above, and benchmark the division's beta to, say, the average beta of a sample comprising these standalones. The procedure essentially follows the steps described in the previous section.<sup>84</sup>
- A.4. There are a number of drawbacks to the pure-play approach. First, it may often be difficult to identify a sufficient number of comparable firms to reliably implement the procedure. In addition, Wood et al (1992) point out that the pure-play method assumes that diversified multi-division firms do not enjoy operating synergies in reducing risk, which seems unlikely to be true for most integrated businesses.
- A.5. The *full-information* approach (e.g. Ehrhardt and Bhagwat, 1991; Wood et al, 1992; Kaplan and Peterson, 1998), exploits the idea that a multi-product firm is simply a portfolio of projects, and so its overall beta is a weighted average of the unobservable betas of its individual business units.
- A.6. The approach is implemented by econometrically fitting the following model for all firms within the same industry segment:

$$\beta_i = \sum w_{i,j} \beta_{i,j} + \varepsilon_i, \quad \sum w_{i,j} = 1,$$

where  $\beta_i$  is the overall unlevered beta for firm  $i$ ,  $\beta_{i,j}$  is the beta of the  $j$ th division of firm  $i$ ,  $\varepsilon_i$  is a firm-specific error term that is assumed to be independent of the divisional weights, and  $w_{i,j}$  — the value weight attributed to the firm  $i$ 's  $j$ th division — are calculated as

$$w_{i,j} = \frac{S_{i,j}}{S_i},$$

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<sup>84</sup> For an application of the pure-play approach, see Cox and Griepentrog (1988), who estimate divisional betas for insurance firms.

where  $S_{i,j}$  is the value of sales of the  $j$ th division of firm  $i$ , and  $S_i = \sum_j S_{i,j}$  is the total value of sales for firm  $i$ .<sup>85</sup>

A.7. Ehrhardt and Bhagwat (1991) argue that the main advantage of this approach is that it incorporates useful information from multi-product firms that would otherwise be ignored by the pure-play method. The biggest limitation with this approach is that it requires good data (i.e. of sufficient frequency, and over a long enough period) in order to generate plausible estimates. Such data can be difficult to obtain.<sup>86</sup> Another major drawback is that the market values used to construct the divisional weights usually cannot be observed; in practice they are proxied by accounting measures. This could produce biased estimators.

A.8. The third technique — the econometric investigation of *risk-drivers* — involves estimating a beta equation, specified as a function of potential drivers of asset betas,

$$\beta_{a,t} = a_{0,t} + \sum_{n=1}^N a_{n,t} X_{n,t} + u_t,$$

for a large sample of firms.

A.9. The factors  $\mathbf{X} = \{ X_1, X_2, \dots, X_N \}$  may include the level of operating leverage, financial leverage, dummy variables for various regulatory regimes, the sensitivity of revenues to changes in aggregate output, control variables for public or private sector participation, the average duration of supply contracts, instrumental variables to proxy growth opportunities (e.g. the total annual spend on R&D), the proportion of total assets (expressed in present values) that are sunk (since firms with low sunk costs tend to have more flexibility, which may provide greater insulation against market risk), among many others.

A.10. The resulting estimates of  $\mathbf{a} = \{ a_0, a_1, \dots, a_N \}$ , along with observed values of  $\mathbf{X}$  for the division of interest,  $j$ , can be substituted into the expression

$$\hat{\beta}_{a,j} = \hat{a}_0 + \sum_{n=1}^N \hat{a}_n X_{n,j}$$

to obtain a prediction of the division's asset beta. The final step is to lever  $\hat{\beta}_{a,j}$  to obtain an equity beta estimate.

A.11. Although attractive in principle, this approach is very data-intensive and therefore difficult to reliably implement (Franks et al, 2008).

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<sup>85</sup> The ratio of divisional sales and total company sales is used to proxy the proportional *market* value of divisional assets, which cannot be directly observed in most cases. Another possible surrogate for percentage of market value is the ratio of segment net revenue to total net revenue for the company.

<sup>86</sup> The full information approach is often implemented using data from sources such as Standard & Poor's Compustat database. Such data services typically offer only limited coverage of New Zealand firms.