



Evidence in support of setting allowed rates of return above the midpoint of the WACC range

A REPORT PREPARED FOR TRANSPower NEW ZEALAND LTD

March 2014

Evidence in support of setting allowed rates of return above the midpoint of the WACC range

Executive summary	iii
1 Introduction	1
1.1 Background	1
1.2 Structure of this report	1
2 Role of WACC in economic regulation and investment decisions	3
3 Conceptual basis for setting an allowed rate of return above the midpoint of the estimated WACC range	7
3.1 Distorted prices and consumption	8
3.2 Distorted investment	10
4 Evidence from academic studies using simulation modelling	19
4.1 General methodology and key model assumptions	20
4.2 Main results	21
4.3 Key conclusion for the Commission	23
5 Regulatory practice overseas	25
6 MEUG's two-tier WACC proposal	32
6.1 The Helm split cost of capital idea has been rejected widely by regulators overseas	32
6.2 MEUG's two-tier WACC approach would likely distort investment incentives	35
6.3 Recommendations for considering the two-tier WACC approach	36
Appendix – Views of regulators in Great Britain on Helm's split cost of capital proposal	37

Evidence in support of setting allowed rates of return above the midpoint of the WACC range

Figures

Figure 1: Efficient prices and economic welfare in a stylised competitive market	9
Figure 2: Deadweight loss from high allowed return and prices	10
Figure 3: Load duration curve	13
Figure 4: Marginal utility of transmission capacity	15
Figure 5: Declining marginal transmission utilisation and value	16
Figure 6: Optimal transmission capacity	17
Figure 7: Key modelling results from Dobbs (2011)	23

Tables

Table 1: Choice of WACC point estimates in recent determinations by the UK's Competition Commission	iv
---	----

Executive summary

The Commerce Commission (the Commission) is currently seeking views on whether it should review or amend the input methodologies (IMs) for the cost of capital that apply to electricity lines services, gas pipeline services and specified airport services regulated under Part 4 of the *Commerce Act*.

This consultation follows a recent judgment by the High Court (the Court), which raised questions about the Commission's practice of setting the allowed rate of return for these suppliers by reference to the 75th percentile of the estimated range for the weighted average cost of capital (WACC).

We have been asked by Transpower to evaluate the evidence for the Commission's practice of adopting the 75th percentile. Our main findings are the following:

- There is strong **conceptual** support, from standard economic theory and the characteristics of electricity networks, for the Commission's current approach and rationale.
- The main source of **empirical** evidence on this issue is from studies that use simulation modelling to evaluate the optimal allowed rate for return, given the welfare consequence trade-offs articulated by the Commission. The Court and other parties have referred to this as the 'loss function approach'. The most comprehensive and germane of these studies we know of is strongly supportive of the Commission's approach of setting allowed rates of return well above the midpoint of the WACC range.
- Despite the limited evidence adduced before the Court, there is strong evidence of a broad **acceptance by regulators and policymakers overseas** (e.g. in Great Britain and Australia) that the social harm of setting the allowed rate of return too low likely outweighs the social harm from setting it too high. The Commission's approach of adopting the 75th percentile of the WACC range is very much in line with accepted regulatory practice.
- The consensus amongst regulators overseas is summed up by UK's Competition Commission in its 2007 determination on regulated charges for Heathrow and Gatwick Airports:¹

150. Given the uncertainties in cost of capital estimates, we considered the cost of setting an allowed WACC that was too high or too low. If the WACC is set too high then the airports' shareholders will be over-rewarded and customers will pay more than they should. However, we consider it a necessary cost to airport users of ensuring that there are sufficient incentives for BAA to invest, because if the WACC

¹ Competition Commission (2007), BAA Ltd (Heathrow Airport Ltd and Gatwick Airport Ltd), 28 September, Appendix F.

is set too low, there may be underinvestment from BAA or potentially costly financial distress. Annex 5 illustrates how the weight to be put on these costs will flow into the decision-making process.

151. Given the significance to customers of timely investment at Heathrow and Gatwick, we have given particular weight to the cost of setting the allowed WACC too low. Most importantly, we note that it is difficult for a regulator to reduce the risks of underinvestment within a regulatory period.

152. Taking these factors into account, we concluded that the allowed WACC should be set close to the top of our range.

The Competition Commission has consistently set allowed returns well above the midpoint of its estimated WACC range, as shown in the Table below:

Table 1: Choice of WACC point estimates in recent determinations by the UK's Competition Commission

Determination	Point estimate adopted
Bristol Water (2010)	100 th percentile
Stansted Airport (2008)	81 st percentile
Heathrow Airport (2007)	88 th percentile
Gatwick Airport (2007)	85 th percentile

Source: Various Competition Commission determinations

We have also been asked by Transpower to comment briefly on the split cost of capital approach proposed by Professor Dieter Helm in the UK, and MEUG's proposed two-tier WACC approach, which share similar features and were referred to by the Commission in its consultation document. We find that:

- The Helm split cost of capital proposal has been considered and rejected widely by regulators overseas.
- The practical and conceptual problems associated with the Helm split cost of capital approach also apply to MEUG's proposed two-tier WACC approach.
- There is a strong likelihood that MEUG's two-tier WACC approach would distort incentives to make new investments because investors and firms are forward-looking.
- The Commission should defer consideration of the two-tier approach until such time as it conducts a wider review on the WACC IMs, since it is important that the Commission analyse fully the implications of adopting such an approach.

1 Introduction

We have prepared this report for Transpower in response to a consultation paper issued by the Commerce Commission (the Commission) seeking views on whether the Commission should review or amend the input methodologies (IMs) for the cost of capital that apply to electricity lines services, gas pipeline services and specified airport services regulated under Part 4 of the Commerce Act.

By necessity, this report was prepared within a short timeframe so the views expressed reflect our preliminary views.

1.1 Background

The High Court (the Court) in *Wellington International Airport & Ors v Commerce Commission* [2013] NZHC 3289 rejected the appeal by the Major Electricity Users' Group (MEUG) in respect of the Commission's use of the 75th percentile of the estimated weighted average cost of capital (WACC) range when setting allowed rates of return, for the price-quality path regulation under Part 4 of the Commerce Act.

The Court referred to the Commission's arguments in favour of adopting a 75th percentile WACC, specifically, the asymmetric costs of setting the allowed rate of return too low compared to setting it too high. However, the Court commented that neither the Commission nor its advisers had provided evidence required to justify its practice of setting the allowed rate of return by reference to the 75th percentile of the WACC range. The court noted that in 2007 the Australian Competition Tribunal (ACT) had refused an adjustment to the allowed WACC for Telstra to recognise the asymmetric costs of error.

The Court questioned how using a 75th percentile WACC estimate could be consistent with sub-section 52A(1)(d) of the Commerce Act and suggested a 75th percentile WACC estimate was "unlikely to be necessary to promote incentives to invest and innovate" (para [1479]). However, the court concluded that in the absence of evidence from MEUG demonstrating that a midpoint (50th percentile) WACC estimate was materially better, it was not satisfied that the IM ought to be amended (para [1483]). On these grounds, MEUG's appeal on this matter was not upheld.

1.2 Structure of this report

This report considers the evidence for the Commission's approach of setting allowed rates of return well above the midpoint of its estimated WACC range. In particular, we investigate the evidence for the position embodied in the existing IMs that, given uncertainty about regulated suppliers' 'true' WACC, the

Commission should opt in favour of setting allowed rates of return that are higher than the 50th percentile of the estimated WACC range.

This report is structured as follows:

- Section 2 reviews the role of the WACC in economic regulation and sets into context the Commission's IM approach to choosing a WACC point estimate.
- Section 3 discusses the conceptual basis for setting the allowed rate of return above the midpoint of the WACC range.
- Section 4 presents evidence from academic simulation modelling, which supports the Commission's approach to choosing the WACC point estimate.
- Section 5 surveys the regulatory practice from abroad and shows that the Commission's approach of adopting the 75th percentile of the WACC range is consistent with established regulatory practice.
- Section 6 discusses briefly the Helm split cost of capital approach, and MEUG's two-tier WACC approach, referred to in the Commission's consultation document.

2 Role of WACC in economic regulation and investment decisions

The cost of capital is an important input into the determination of the revenues regulated suppliers may earn. The ‘building blocks’ model used by the Commission, and many other regulators, to calculate maximum allowable revenues involves adding up all the costs the supplier is expected to incur in supplying the relevant service. One of these costs is the cost of raising capital to fund the activities of the supplier, including the investments necessary to deliver regulated services.

Regulators seek to ensure regulated suppliers can expect to earn a reasonable rate of return on their assets, sufficient to pay investors the return they require in order to commit scarce funds to the suppliers. In global and increasingly integrated capital markets, investors have available to them a very large set of investment opportunities. In order to attract the capital necessary to make the investments the regulated supplier must make, this allowed rate of return needs to be at least high enough to compensate investors for the risks they face and other investment opportunities foregone, when investing in the supplier.² If investors do not expect to earn at least this level of return, they will simply allocate their funds elsewhere, and the supplier may not be able to raise the funds necessary to invest. Regulated suppliers are competing for capital.

When considering whether or not to undertake a particular investment, any commercial business goes through much the same decision process as an external investor would when deciding where to allocate funds. The business will have in mind a *hurdle rate* — a minimum rate of return that the prospective investment should satisfy in order for it to be worthwhile. The hurdle rate should, in principle, be just sufficient to compensate the supplier for the risks and opportunity cost of the investment. If the expected return on the investment equals or exceeds the hurdle rate, the investment should proceed; if the expected return is lower than the hurdle rate, the investment should not proceed.

The hurdle rate for the investment is also known as the cost of capital:³

The cost of capital is the minimum acceptable rate of return on capital investment. It is an *opportunity* cost of capital, because it equals the expected rate of return on investment opportunities open to investors in financial markets. (Original emphasis)

² Note, by ‘allowed rate of return’ we do not mean a guaranteed rate of return. Under an incentive regulation scheme, as administered by the Commission, the supplier’s actual return on capital may exceed or fall short of the allowed rate of return.

³ Brealey, R., A., Myers, S. C., Allen, F. (2014), *Principles of corporate finance*, 11th edition, McGraw-Hill: New York, p.725.

Regulators are generally concerned with ensuring that the profits made by regulated suppliers are consistent with normal (and not excessive) economic returns. Since the cost of capital is the **minimum** rate of return that the supplier must offer investors in order to attract funding, it represents the rate of profit that is most consistent with the concept of a normal economic return. The cost of capital is therefore viewed by most regulators as the appropriate rate to use when determining the allowed return on capital (i.e. the allowed rate of return \times regulatory asset base).

In practice, regulators typically assume that the cost of capital is equivalent to the weighted average cost of capital (WACC).^{4,5}

In respect of the particular issue the Commission is currently consulting on, it is worth emphasising several points:

- Firstly, the Commission does not set the WACC of a regulated supplier; financial markets set the WACC,⁶ while the Commission sets the allowed rate of return.⁷
- Secondly, the supplier's true WACC cannot be observed; it can only be estimated.
- Thirdly, the Commission strives to set the allowed rate of return equal to the supplier's true WACC. Broadly, it does this by developing its best estimate of the true WACC and then setting allowed returns equal to that estimate. However, due to the scope for estimation error, the allowed rate of return may not match the true WACC.⁸ In practice, given the significant uncertainties involved when estimating the WACC, it is very difficult to avoid estimation errors. Both the Court's judgment (para [1082]) and the Commission's cost of capital IMs acknowledge this fact.
- Fourthly, there is no reason to presume that the Commission's best estimate of the true WACC (which the Commission refers to as the WACC "point

⁴ However, it is a well accepted concept in financial economics that, under certain circumstances (e.g. when accounting properly for valuable delay options), the cost of capital of the investment can exceed the standard WACC.

⁵ WACC has two basic components: the cost of equity capital; and the cost of debt capital. The cost of equity is the expected rate of return required by investors in equity that compensates them for the risk they bear, and the opportunities they forgo by committing funds to the supplier. The cost of debt measures the expected cost of borrowing to the business. The WACC calculation weights these two components according to the proportion of debt and equity capital within the business's financing structure, i.e. its gearing.

⁶ The cost of capital is determined by the balance of demand for, and supply of, capital in financial markets, and is therefore the market-clearing price for capital.

⁷ However, to the extent that the Commission can influence the risk of the business by the way it regulates, its actions can influence its cost of capital.

⁸ The possible consequences of misestimating the true WACC are explored in section 3.

estimate”) must necessarily correspond to the 50th percentile of the WACC range.

- Finally, given that the true WACC is unknown, deviation from the midpoint is justifiable on the grounds that it may lower the chances of estimation error. The relevant question for the Commission is which direction it ought to deviate.

The Commission’s position in the IMs was to err on the side of caution when selecting a point estimate from the WACC range, because it considered that the cost of setting the allowed rate of return to low (i.e. below the true WACC) outweighs the cost of setting it too high (i.e. above the true WACC):

H11.61 Given the imprecision of the cost of capital estimation process, the Commission considers it may be preferable, in the context of non-exempt EDBs, GPBs and Transpower that will be subject to default/customised or individual price-quality regulation, to err on the side of caution. That is, if a point estimate is required to set the price/quality path for this service, a figure above the mid-point of the range may be used.

H11.62 The reason for the Commission adopting under Part 4 a cost of capital estimate that is above the mid-point is that it considers the costs from the point of view of consumers associated with underestimation of the cost of capital in the Part 4 regulatory setting, are likely to outweigh the short-term costs of overestimation. That is, the Commission acknowledges that where there is potentially a trade-off between dynamic efficiency (i.e. incentives to invest) and static allocative efficiency (i.e. higher short-term pricing), the Commission, under Part 4, generally favours outcomes that promote dynamic efficiency. Accordingly, this consideration has been given greater weight for price-quality regulation than minimising the costs to consumers of regulated suppliers earning excess profits through higher prices in the short-term. The Commission has also been explicit that the 75th percentile is applied to address asymmetric cost:⁹

the rationale behind applying a 75th percentile estimate is to address the asymmetric risk of regulatory error, which cannot be reduced through other means, and could affect incentives for future investments.

Essentially, the question raised by the Court, and considered in the Commission’s consultation paper, is the following: *what evidence is there to support the notion that the costs of setting allowed returns below the true WACC outweigh the costs of setting allowed returns above the true WACC?*

The relevant evidence could, in principle, be of three types:

- **Conceptual.** Does economic theory support the Commission’s proposition?

⁹ Commerce Commission (2012), Revised Draft Reset of the 2010-15 Default Price-Quality Paths, 21 August.

- **Empirical.** Is there empirical evidence that the costs of setting allowed returns too low outweigh the cost of setting allowed returns too high?
- **Regulatory precedent.** Is there support from regulators and policymakers in other jurisdictions for the proposition?

In this report we consider the body of evidence available and find that it is supportive of the Commission's practice of choosing a point estimate well above the midpoint of the estimated WACC range.

3 Conceptual basis for setting an allowed rate of return above the midpoint of the estimated WACC range

As noted in section 2, the IMs reflect the view that given uncertainty about the *actual* or true WACC faced by a regulated supplier, the Commission should opt in favour of setting an allowed rate of return that is higher than the midpoint of the WACC range.

The Court notes in its judgment that:

[1460] The Commission's approach of using the 75th percentile in the manner set out in the cost of capital IMs involves the likelihood that suppliers will earn excess returns. (This is true even having regard to the fact that the calculation of the 75th percentile involves some generally acknowledged imprecision, and false precision.)

It is important to recognise that, given the uncertainty associated with the true value of the WACC faced by regulated suppliers, applying a point estimate equal to the 75th percentile of the estimated range does not necessarily imply that suppliers will earn supranormal returns. It is true that supranormal returns might arise under the Commission's approach, but it is also possible that the true WACC corresponds to the 75th percentile of the range, or that it even lies above the 75th percentile. The point of adopting the 75th percentile is to reduce the likelihood that the allowed rate of return will be lower than the true, unobservable cost of capital.

Given the uncertainty over the true WACC, the key questions that should determine the Commission's policy for selecting its WACC point estimate are the following:

- What are the consequences of setting an allowed rate of return that is either higher or lower than the true WACC?
- Are these consequences symmetric (i.e. is the harm caused by setting the allowed rate of return too high as severe as the harm caused by setting it too low)?

If the consequences are not symmetric, then an approach that involves the likelihood of the regulated supplier earning supranormal returns may be justified.

Two broad sets of consequences flow from adopting a WACC estimate that is above or below the true WACC:

- **Distorted prices.** Prices to consumers will be inefficiently low if the allowed WACC is below the true WACC and inefficiently high if the allowed WACC is above the true WACC. This will tend to distort consumers' decisions regarding use of the relevant service, and would result in a 'deadweight loss' (i.e. a loss in total welfare to society).

Conceptual basis for setting an allowed rate of return above the midpoint of the estimated WACC range

- **Distorted investment.** A WACC that is above or below the true WACC can lead to over- and under-investment, respectively.

The conceptual basis for setting an allowed rate of return above the 50th percentile of the estimated WACC range is derived from the combined negative effect on overall economic welfare of consumption and investment distortions from a ‘too high’ allowed rate of return being less than the combined negative effects from a ‘too low’ allowed rate of return.

We consider below, analytically, the effects of each type of distortion identified above.

3.1 Distorted prices and consumption

In a stylised competitive market, prices tend towards the level that equates the marginal consumer’s willingness to pay with the marginal cost of supply. Such a price (P^*) is associated with a quantity exchanged (Q^*) that maximises overall economic welfare, which is equal to the area ABO in Figure 1. Overall economic welfare comprises the sum of:

- ‘Consumer surplus’, being the difference between the value consumers receive from the service and the price they are required to pay (the area ABP*).
- ‘Producer surplus’, being the difference between the price suppliers receive and the cost of supplying the service (the area P*BO).

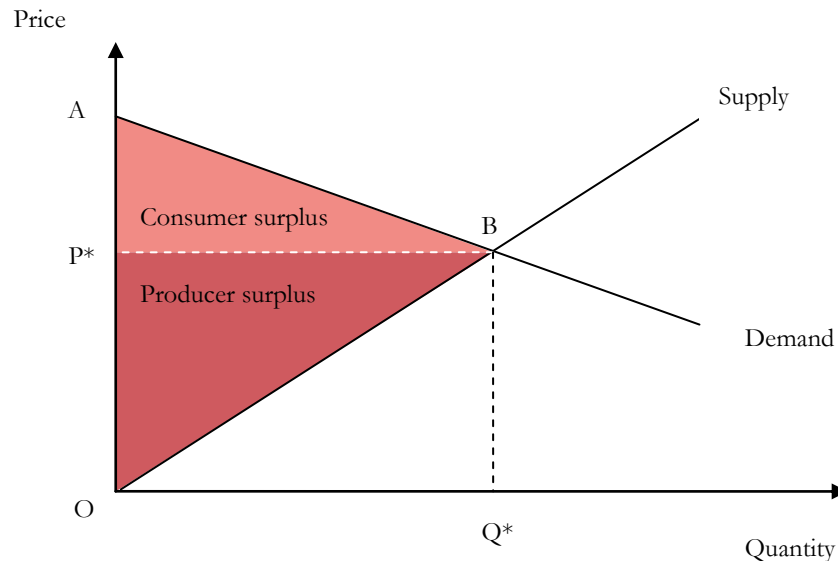
A price of P^* maximises overall economic welfare, because:

- A lower price would discourage provision of the service such that demand from consumers would be left unmet, even though some consumers would be willing to pay a higher price for additional service than the cost of that additional supply.
- A higher price would discourage consumption of the service such that supply from businesses would not be consumed, even though suppliers were willing to provide additional service for a lower price than the value consumers placed on additional supply.

At P^* the supplier is earning a normal economic profit. This means the supplier is just covering its costs, including opportunity costs. At this point, the returns earned by the supplier would be just equal to its WACC and no more/less.

Conceptual basis for setting an allowed rate of return above the midpoint of the estimated WACC range

Figure 1: Efficient prices and economic welfare in a stylised competitive market



Source: Frontier Economics

Notes: Total welfare = Consumer surplus + Producer surplus

In the context of electricity network services, if prices for regulated services are higher than P^* because the supplier is allowed a rate of return that is set higher than its true WACC, consumption would be reduced below efficient levels. This would lead to a 'deadweight loss' ('DWL' – see Figure 2 below). The size of the deadweight loss depends on:

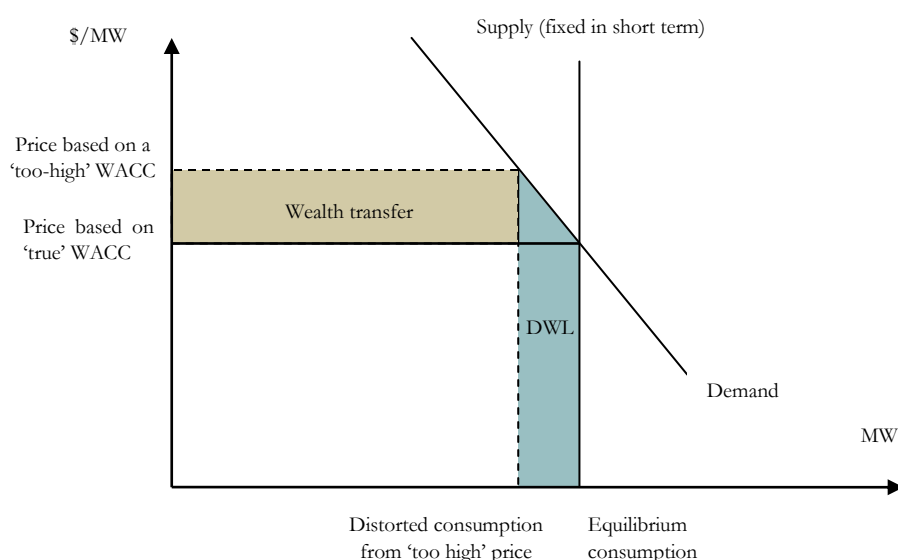
- The extent of the over-pricing – the higher the price charged above P^* , the greater the DWL;
- The structure of prices imposed on customers – if network tariffs are structured efficiently, the distortionary effect of higher prices on consumption may be limited; and
- The price elasticity of demand for the service – the more elastic or responsive is demand to price, the larger would be the DWL from an allowed rate of return that is too high.

If prices are too low due to an allowed rate of return set below the true WACC, consumption would be inefficiently high or, if supply is fixed, some form of non-price rationing (such as queuing) would be required to prevent congestion. It would only be coincidental if such rationing resulted in potential welfare from the service being maximised.

Conceptual basis for setting an allowed rate of return above the midpoint of the estimated WACC range

In either case, the relatively inelastic demand for electricity and, by extension, transmission services, suggests that the welfare losses from setting transmission network prices too high or too low are likely to be relatively small.

Figure 2: Deadweight loss from high allowed return and prices



Source: Frontier Economics

If the Commission were to focus on consumer surplus, rather than total surplus, when assessing the appropriateness of electricity network regulatory parameters, the measured loss from setting the allowed rate of return too high would be larger than represented in Figure 2 because they incorporate a wealth transfer from networks to consumers. We consider that the maximisation of total welfare offers a more compelling interpretation of the Commission's objective under Part 4 of the Commerce Act than the maximisation of consumer surplus alone. This is because consumer surplus can almost always be improved by lowering prices; what is important is the sustainability of those low prices and that depends on the adequacy of returns to suppliers. Nevertheless, even if the Commission were to focus exclusively on consumer welfare, the costs of setting allowed returns and prices too high are outweighed by the costs of setting them too low. This asymmetry arises from the effect that differing regulated rates of return can have on suppliers' incentives to invest. This issue is explored further, below.

3.2 Distorted investment

Prices for regulated services that are above or below what the price would be if the allowed rate of return for a supplier were set equal to the supplier's true WACC can also distort suppliers' investment decisions. The extent to which

Conceptual basis for setting an allowed rate of return above the midpoint of the estimated WACC range

these investment distortions arise may be limited by other aspects of the regulatory arrangements.

This section considers the implications of regulatory errors in determining the allowed rate of return on investment and overall welfare under two alternative scenarios:

- Scenario 1: The regulatory arrangements impose no explicit constraint (such as an investment test or another form of cost-benefit test) on excessive or inappropriate investment (section 3.2.1); and
- Scenario 2: The regulatory arrangements can effectively constrain excessive or inappropriate investment (section 3.2.2).

3.2.1 Scenario 1: No explicit constraints on inefficient investment

If the allowed rate of return is below the true WACC, a rational supplier would, at the margin, not invest.¹⁰ As described in section 2, the true WACC represents the hurdle rate for investment (i.e. the minimum rate of return that investors require in order to cover their risks and opportunity costs). If the return that the supplier is permitted to earn does not at least equal this hurdle rate, it would be unable to pay investors the minimum return they require and, therefore, it would not be economically rational for the investment to proceed.

If the allowed WACC is above the true WACC, the supplier would, again at the margin, invest.

The Commission's price-quality path system of regulation incorporates a range of incentives on suppliers to undertake efficient capital and operating expenditures. If these other elements of the regulatory regime are set appropriately so as to encourage efficient levels of investment, then it should be expected that:

- An allowed rate of return set above the true WACC would represent a supernormal profit margin to the supplier. This would encourage inefficient over-investment because, under the existing framework for setting maximum allowed revenues, this profit margin may be applied to every dollar of investment in the regulatory asset base (RAB). This problem of 'gold-plating' network investment has been described in the economics literature as the "Averch-Johnson effect".¹¹

¹⁰ It is conceivable that non-commercial factors would cause investment to proceed, even if the expected return on investment were to fall below the investment's hurdle rate. For instance, the business might be compelled to invest, even at a lower expected return, e.g. to satisfy reliability and/or safety standards.

¹¹ "If the fair rate of return is greater than the cost of capital, a firm will have an incentive to invest as much as it can consistent with its production possibilities, because the difference between the

**Conceptual basis for setting an allowed rate of return above the
midpoint of the estimated WACC range**

- An allowed rate of return set below the true WACC would result in inefficient under-investment. Under-investment is inefficient/socially sub-optimal because all the consumer surplus and producer surplus that would otherwise be gained by serving demand (i.e. the entire area under the demand curve in Figure 2) would be unrealised.

The relative costs of over- versus under-investment will depend on a number of key technical and economic features of the industry in question. However, some studies show that the welfare costs of delaying socially beneficial investments, arising from unmet demand, can be extremely large. For instance, Hausman (1997) estimates that a 7-10 year delay in the introduction of cellular telephony in the United States, due to regulatory indecision about spectrum licensing procedures, cost consumers \$31–50 billion each year (in 1994 dollars) through unmet demand.^{12,13}

More specifically, one of the key characteristics of the electricity industry is the high cost of unserved energy and the large losses that can be incurred from under-investment in the grid or in generation capacity leaving consumers without supply. Especially in developing countries, electricity consumption can be a strong indicator of economic and social well-being and progress.¹⁴ Even in developed countries, estimates of the value of unserved energy are typically much higher than the cost of providing that power.¹⁵ This and other features of the electricity industry are discussed further below.

Key stylised facts about the electricity industry

There are good reasons for thinking that the costs of under-investment relative to over-investment in electricity networks are relatively high. This is because of the:

- Variable demand for electricity;
- High (and declining) costs of unserved energy; and
- Probability of plant and network contingencies.

allowed rate and its actual cost of capital is pure profit.” See Averch, H. A. (1998), *The New Palgrave, A Dictionary of Economics*, Macmillan, p.160.

¹² Hausman, J. A. (1997), ‘Valuing the effect of regulation on new services in telecommunications’, *Brookings Papers on Economic Activity*, 1–38.

¹³ Hausman’s estimates of the loss in economic welfare are conservative in the sense that his analysis focuses only on unrealised consumer surplus, i.e. it does not reflect the loss of producer surplus from delay in the introduction of mobile telephony (Hausman, 1997, p.40).

¹⁴ See Chi Seng Leung and Peter Meisen, *How electricity consumption affects social and economic development by comparing low, medium and high human development countries*, July 2005.

¹⁵ de Nooij, M., C. Koopmans and C. Bijvoet, “The value of supply security, The cost of power interruptions: Economic input for damage reduction and investment in networks”, *Energy Economics* Volume 29 (2007) pp.277-295, p.289.

Conceptual basis for setting an allowed rate of return above the midpoint of the estimated WACC range

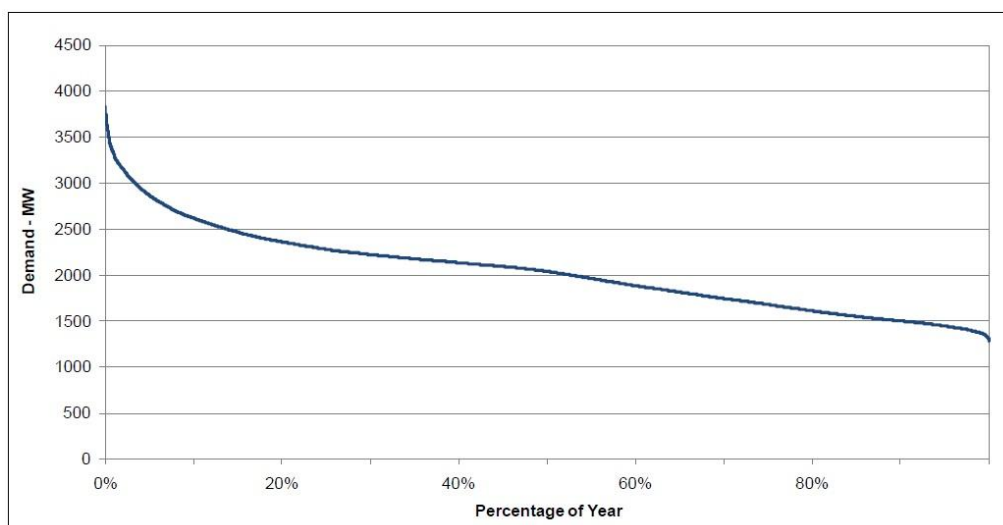
There is plentiful evidence to support these stylised facts.

Variable demand

Demand for electricity distribution and transmission services is a derived demand because demand for these services depends on demand for an underlying good, electricity. Electricity demand varies over the course of each day, by day of the week, and by season. It also differs between normal working weekdays and school and public holidays.

A load duration curve represents the proportion of a year in which demand exceeds a certain level. If there is any variability of demand, the load duration curve will be downward-sloping (see, for example, Figure 3). While different electricity markets exhibit different levels of demand variability, all have load duration curves that are downward-sloping to some extent, if only because of the difference in electricity demand between day-time and night-time. Other things being equal, markets in which demand is highly seasonal exhibit steeper load duration curves.

Figure 3: Load duration curve



Source: Independent Market Operator of Western Australia, *Electricity Statement of Opportunities*, June 2013, Figure 5, p.23, available at: http://www.imowa.com.au/docs/default-source/Reserve-Capacity/soo_2013_rev1.pdf?sfvrsn=2

High costs of unserved energy

The costs of unserved energy are very high. The current Electricity Industry Participation Code contains a default value of NZ\$20,000/MWh.¹⁶ This value was initially suggested to the Electricity Commission by Frontier Economics in 2004 based on research available at that time. More recent Australian estimates of

¹⁶ Electricity Industry Participation Code 2010, Schedule 12.2, clause 4.

Conceptual basis for setting an allowed rate of return above the midpoint of the estimated WACC range

the value of unserved energy are in the range of A\$40,000-100,000/MWh.¹⁷ The Electricity Authority's recent Value of Lost Load (VoLL) technical report found that the value of unserved energy tends to vary by duration of outage, location and type of customer.¹⁸ The Technical Report referred to a 2010 VoLL survey which found that the value (in \$/MWh) of unserved energy fell dramatically as outage duration increased from 10 minutes to 8 hours.¹⁹

Consistent with the Electricity Authority's research, international studies show that the customer damage function (CDF) declines sharply as outage duration lengthens. For example, the Australian Productivity Commission reported that a US meta-analysis found that the costs of an electricity supply interruption fell from US\$173/kWh (\$173,000/MWh) for a momentary interruption to US\$39/kWh for a 30-minute interruption, US\$25/kWh for a one-hour interruption, and just US\$14/kWh for an eight-hour interruption.²⁰ This suggests that, other things being equal, there are increasing returns from investing in transmission capacity to the extent that additional increments of capacity avoid progressively shorter and shorter periods of unserved energy. Therefore, the marginal utility of transmission capacity could rise, rather than fall as for most goods and services.

For example, consider the stylised load duration curve represented in Figure 4 below. This shows that the first block of transmission capacity (Q_1) is sufficient to meet demand for approximately 50% of the year, say, night-time. This means that supply must be rationed during the daytime and implies that the average duration of outages will be fairly long. Because the CDF declines, the average value of unserved energy avoided (in \$/MWh) during these long outages will be relatively low.

If transmission capacity is increased to Q_2 , it may be sufficient to meet consumer demand at all times other than during summer weekday afternoons and winter weekday evenings, the times of peak cooling and heating load, respectively. This means that the periods during which supply needs to be rationed are shorter than before and hence the average value of unserved energy (in \$/MWh) avoided during these times will be higher than the average value of unserved energy avoided by the first block of transmission capacity, Q_1 .

¹⁷ See, for example, Australian Energy Market Operator, *Value of Customer Reliability Issues Paper*, March 2013.

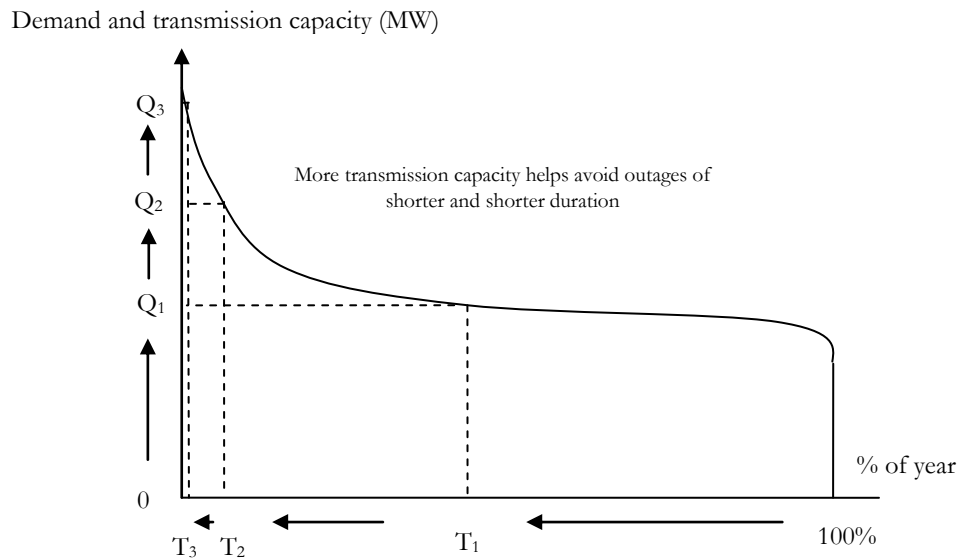
¹⁸ Electricity Authority, *Investigation into the Value of Lost Load in New Zealand, Report on methodology and key findings*, 23 July 2013 (Technical report).

¹⁹ Technical report, Tables 11 and 12, pp.37-38.

²⁰ Productivity Commission, *Electricity Network Regulatory Frameworks, Inquiry Report, Volume 2*, No.62, 9 April 2013, Table 14.1, p.539.

If transmission capacity is increased to Q_3 , it may be sufficient to meet consumer demand at all times other than afternoons on extremely hot days and evenings or extremely cold winter weekday evenings. This means that the periods during which supply needs to be rationed are even shorter than before and hence the average value of unserved energy avoided during these times will be higher than the average value of unserved energy avoided by the second block of transmission capacity, Q_2 .

Figure 4: Marginal utility of transmission capacity



Source: Frontier Economics

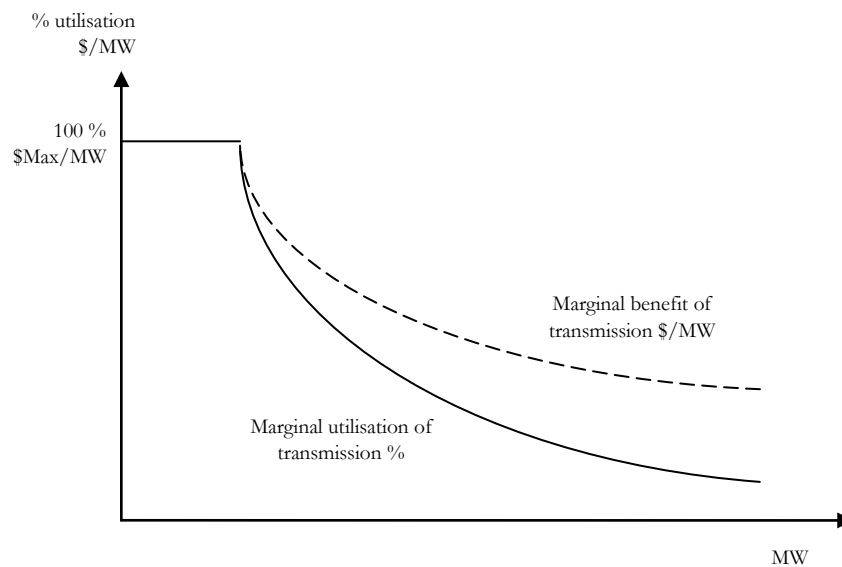
All of this suggests that the marginal benefits of transmission in \$/MW will decline more slowly than the rate at which the utilisation of incremental transmission capacity declines – see Figure 5 below.²¹

Contingencies

The possibility of network or generating plant contingencies means that even transmission capacity well in excess of peak demand may provide some value to consumers because if and when contingencies arise, this capacity may be heavily utilised in avoiding the costs of unserved energy to consumers.

²¹ Expressed mathematically, the second derivative of the benefits of transmission will be greater than the second derivative of the utilisation of transmission.

Figure 5: Declining marginal transmission utilisation and value



Source: Frontier Economics

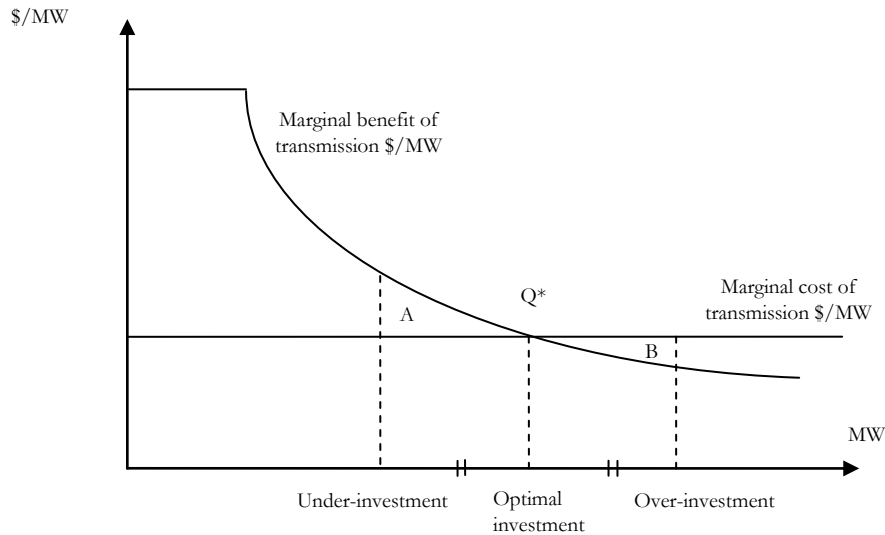
Comparing the incremental benefits and costs of transmission capacity

Given the shape of the load duration curve and the constant (or declining) value of unserved energy avoided, the incremental benefits of transmission capacity can be represented by a flat line coupled with a convex function (see Figure 6 below). If the incremental cost of transmission capacity is flat (in \$/MW), the optimum amount of transmission capacity is Q^* .

In Figure 6, a given amount of over-investment in transmission leads to a welfare loss of area B, reflecting the extent to which the benefits of the over-investment fall short of the costs. Conversely, the same amount of under-investment in transmission leads to a welfare loss of area A, reflecting the extent to which the costs of the under-investment (in terms of higher unserved energy) exceed the benefits (in terms of avoided network capacity costs).

Conceptual basis for setting an allowed rate of return above the midpoint of the estimated WACC range

Figure 6: Optimal transmission capacity



Source: Frontier Economics

Due to convexity of the incremental benefits curve, area A will always be larger than area B. In our view it is reasonable to make, and rely on, this assumption without necessarily quantifying the difference in size of A and B. Therefore, other things being equal, it is less inefficient to over-invest in transmission capacity than to under-invest.

3.2.2 Scenario 2: Regulation limiting over-investment

In practice, major transmission network investments are typically subject to an *ex ante* efficiency test. Allowing for effective checks on over-investment increases the case for erring further still in favour of a higher allowed rate of return.

Clause 3.3.2 of the Transpower Capital Expenditure IM (31 January 2012) states that a 'major capex' project (>\$5 million for RCP1 and >\$20 million thereafter) must be approved by the Commission in order that Transpower can recover the capital expenditure relating to that major capex project under an individual price-quality path (IPP). Schedule C provides that the Commission may not approve a major capex investment if it is not satisfied that the investment satisfies the Investment Test. For major capex investments to increase service level (capacity, voltage support), Transpower is required to apply the Investment Test set out in Schedule D of the IM. If Transpower overspends its allowance on a major capex project, it may seek approval from the Commission to amend the allowance to recover through regulated revenues the cost of the overspend. If such approvals are not granted, any overspend is effectively disallowed (i.e. the present value of

Conceptual basis for setting an allowed rate of return above the midpoint of the estimated WACC range

all such expenditure and expected on those investments, is deducted from future allowed revenues). This provides a very strong incentive on Transpower to avoid over-investment.

Under these conditions, the likelihood and hence costs of over-investment are likely to be curtailed significantly, even if the allowed rate of return is set above Transpower's true WACC. This means that the only economic welfare loss from setting the allowed rate of return above the true WACC would be the deadweight loss arising from regulated prices being above efficient levels. The costs of under-investment would be no different to what they would be in the world without checks on over-investment. Therefore, regulatory checks on over-investment further strengthen the case for erring on the side of an allowed rate of return towards the top of the WACC range.

The next section considers the potential practical implications for economic welfare of adopting different WACCs under conditions where the regulatory arrangements work effectively to prevent over-investment.

Conceptual basis for setting an allowed rate of return above the midpoint of the estimated WACC range

4 Evidence from academic studies using simulation modelling

The Court (e.g. paras [1471], [1486]), and to some extent the Commission, has emphasised the need for empirical evidence in support of the rationale for setting allowed returns above the midpoint of the estimated WACC range. When discussing the lack of empirical evidence before it, the Court referred to a loss function approach raised by submitters as part of the consultation process on the IMs (para [1465]):

The notable feature of the Cost of Capital Workshop discussion, and of related submissions, is the absence of supporting material. There was widespread agreement that the loss function approach was appropriate, but no flesh was put on the idea.

As the Court noted (para [1464]):

The rationale for the Commission's approach comes closest to having a clear basis,..., in terms of the loss function that was discussed at the Cost of Capital Workshop.

Therefore, an evaluation of the evidence for the Commission's approach should take account of the extant analysis using this technique.

The most comprehensive analysis of the question whether errors in setting the allowed rate of return are asymmetric that we are aware of is provided by Dobbs (2011).^{22,23} The Commission cites this study in its consultation paper, but does not provide an assessment of the key findings from the study.

Dobbs studied the overall welfare outcomes from setting the allowed rate of return at different levels within an estimated WACC range, i.e. given uncertainty about the regulated supplier's 'true' WACC. He found that the optimal allowed rate of return for a regulated supplier was generally well above the mean value (50th percentile) of the WACC distribution. The driver for the upward skew in the distribution of optimal allowed rates of return was the asymmetric effects of:

- An allowed rate of return *in excess of* the 'true' WACC – the negative effects of a 'too high' return were limited to a small reduction in demand and hence a small reduction in economic welfare;

²² Dobbs, I.M. (2011), 'Modeling welfare loss asymmetries arising from uncertainty in the regulatory cost of finance', *Journal of Regulatory Economics* 39, pp.1-28.

²³ We are aware of another, older study by the same author. See Dobbs, I. M. (2008), 'Setting the allowed rate of return using simulation and loss functions – the case for standardising procedures', *Competition and Regulation in Network Industries* 9(3), pp. 229-247. However, the analysis in that paper is more preliminary in nature than is contained in Dobbs (2011), and nothing in the earlier Dobbs paper contradicts the findings of the more recent study. Therefore, we confine our assessment to Dobbs (2011).

- An allowed rate of return *below* the ‘true’ WACC – the negative effects of a ‘too low’ return were derived from (i) the supplier choosing not to proceed with welfare-enhancing new investments and (ii) consumers demanding more of the service than is efficient.

The sum of the negative effects of the latter was much greater than the negative effects of the former.

One potential limitation of Dobbs’ model is that he did not take account explicitly the welfare implications of over-investment in network assets by setting the allowed rate of return above the supplier’s true WACC. However, if the risk of over-investment can be eliminated or reduced significantly through regulatory mechanisms (such as the investment test in Schedule D of the Transpower Capital Expenditure IM Determination, as applied by the Commission in New Zealand), the Dobbs model is very useful in illustrating the trade-offs between erring towards an allowed rate of return higher than the 50th percentile of the estimated WACC range.

4.1 General methodology and key model assumptions

The basic framework in the paper involves the regulator setting an allowed rate of return applicable to a regulated supplier and then determining a price control applicable throughout a regulatory control period. The regulator must set the allowed rate of return in an environment of uncertainty, that is, without knowing the supplier’s true WACC. The supplier’s true WACC serves as its ‘hurdle rate’ for any investment decisions.

The paper derives an optimal allowed rate of return for the supplier by maximising a total welfare (i.e. consumer surplus plus producer surplus) function for the regulated service. This function takes account of the rate of return allowed by the regulator and the investment decision faced by the supplier once it has observed the regulator’s determination. Under these conditions:

- If the allowed rate of return exceeds the supplier’s investment hurdle rate (i.e. its true cost of capital), then the supplier invests, but because the regulated price is higher than the efficient level, a reduction in total welfare (i.e. a deadweight loss) arises due to a marginal reduction in demand as compared to the efficient level.
- If the allowed rate of return falls below the supplier’s hurdle rate, the supplier does not invest and total welfare falls due to demand being unserved as a result of a welfare-enhancing investment not proceeding.

Since total welfare is derived as a function of the allowed rate of return, and by virtue of the trade-off above, the regulator may maximise total welfare (i.e. minimise the losses to total welfare) by choosing the allowed rate of return.

Given the complexity of the welfare function, a ‘closed form’ (i.e. analytical) solution to this optimisation problem is not available, even if a very simple WACC distribution is assumed. Therefore, the optimisation problem is solved numerically using Monte Carlo simulation analysis.

In order to show why the optimal allowed rate of return for a regulated supplier was well above the 50th percentile expectation of the supplier’s true WACC, Dobbs separately considered and evaluated the solution for the three types of investment that a regulated supplier may own:

- Sunk investments (i.e. assets already in the RAB);
- Prospective, non-deferrable investments (i.e. future investments that the supplier has no flexibility over in terms of timing, so the choice the supplier faces is to invest now or never); and
- Prospective, deferrable investments (i.e. future investments that may be delayed if the allowed rate of return does not at least equal the investment’s hurdle rate).

Dobbs assumed that:

- A regulated supplier’s true WACC is unknown in advance, and is drawn from a normal distribution.
- The WACC distribution remains constant over time.
- Once determined, the allowed rate of return is used to set the regulated price the supplier can charge to recover its costs, and prices are set such that if the allowed rate of return equals the true WACC for the investment, the NPV of the investment is equal to 0.
- The supplier invests in a new investment if it is expected to be profitable ($NPV \geq 0$), i.e. if the allowed rate of return equals or exceeds the supplier’s hurdle rate, all else being equal.

4.2 Main results

The key modelling result from the study is that the optimal allowed rate of return for a regulated supplier is generally well above the mean (50th percentile) of the WACC distribution. This result is derived from the results for the optimal allowed rates of return applicable to each of the three types of regulated investment (Dobbs, 2011, Table 12, p.18).

Sunk investments

The optimal allowed rate of return for sunk investment is close to the mean WACC because the only welfare effect is the allocative inefficiency caused by prices diverging from long-run marginal cost (LRMC), and this effect is relatively symmetric (Dobbs, 2011, p.16). In summary:

- The optimal allowed rate of return on sunk investments is less than, but close to, the 50th percentile of the WACC distribution (10%).
- In the benchmark case, the optimal allowed rate of return is at the 45th percentile (9.8%) and across the 12 cases it ranges from the 43rd to 45th percentile (9.7-9.8%).

New investments

The optimal allowed rate of return for new investment is considerably higher than the midpoint of the WACC range because an allowed rate of return that is below the true WACC leads to no investment and no economic welfare (i.e. a complete loss of total surplus through unmet demand), whereas an allowed rate for return above the true WACC only causes a relatively small allocative efficiency loss from distorted consumption (Dobbs, 2011, p.17). This is completely consistent with the conceptual analysis set out in section 3.1.

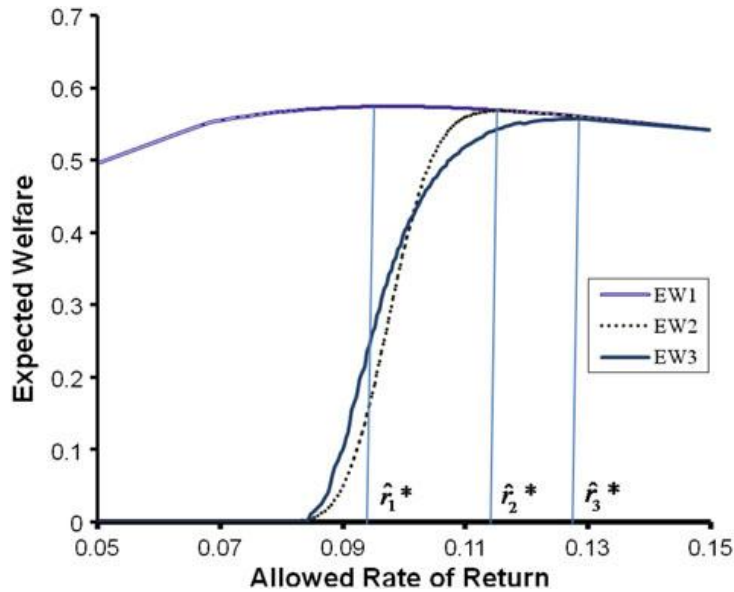
The optimal rate of return for new investment can vary depending on whether the relevant investment is non-deferrable or deferrable. The optimal allowed rate of return for deferrable investment is usually higher than for non-deferrable investment. This is because the supplier can choose to delay deferrable investment to subsequent RCPs, when the true WACC may be lower, or far lower, than the allowed rate of return. Given the option to delay, in order to induce the supplier to invest in the current RCP, the allowed rate of return must be set higher than would be the case with non-deferrable investments.

In summary:

- Non-deferrable investments
 - The optimal allowed rate of return on non-deferrable investment is well above the mean WACC.
 - In the benchmark case, the optimal allowed rate of return is at the 86th percentile (11.6%) and across the 12 cases it ranges from the 68th to 91st percentile (10.7-12.0%).
- Deferrable investments
 - The optimal allowed rate of return on deferrable investment is also well above the mean WACC.
 - In the benchmark case, the optimal allowed rate of return is at the 97th percentile (12.7%) and across the 12 cases it ranges from the 79th to 98th percentile (11.2-13.0%).

The main modelling results (under the benchmark scenario) are presented graphically below in Figure 7.

Figure 7: Key modelling results from Dobbs (2011)



Source: Dobbs, I.M. (2011), 'Modeling welfare loss asymmetries arising from uncertainty in the regulatory cost of finance', *Journal of Regulatory Economics* 39, p. 16.

Notes: EW1 = total welfare from sunk investments; EW2 = total welfare from non-deferrable investments; EW3 = total welfare from deferrable investments

Sensitivities to the modelling showed that the more inelastic is demand for the service, the higher is the optimal allowed rate of return. This is because less elastic demand means a smaller welfare loss from reduced consumption due to higher prices. If deferrable investment is 10% of the total and the elasticity of demand is -1.5, as opposed to -3, the optimal WACC rises from the 74th percentile to the 90th percentile. As electricity is known to have a highly inelastic demand, particularly in the short to medium term, it is likely that Dobbs's results underestimate the optimal allowed rate of return for regulated electricity network suppliers.

4.3 Key conclusion for the Commission

The key conclusion from the Dobbs study is that where the regulator is in the position of setting the allowed rate of return and corresponding price cap for an electricity network supplier with a mix of sunk and prospective investments, then even if a supplier's potential new investment is a small proportion of its existing assets, the optimal allowed rate of return is well above the median (50th percentile) estimate.

For example (Dobbs, 2011, Table 3, p.21):

- If deferrable new investment is 5% of total investment (including sunk), the optimal allowed rate of return lies at the 74th percentile.

- If deferrable new investment is 10% of total investment, the optimal allowed rate of return is equivalent to the 82nd percentile.

Both of these results are based on a demand elasticity of -3; that is, relatively elastic demand. The percentile results would be significantly higher allowing for the relatively inelastic demand for electricity. For example, Dobbs found that keeping the share of new investment to existing assets at 10%, but reducing demand elasticity to -1.5 (still relatively elastic), the supplier's optimal allowed rate of return increased from the 82nd to the 90th percentile.

These overall findings agree very well with the theoretical reasons for Commission's approach of adopting the 75th percentile of the estimated WACC range.

5 Regulatory practice overseas

The Court has used a single, isolated decision by the Australian Competition Tribunal (ACT) to cast doubt on the Commission's practice of choosing a point estimate well above the 50th percentile of the WACC range. The Court failed to recognise in its judgment that there is very wide agreement with, and acceptance of, this approach by regulators and policymakers overseas. For example, it noted in its judgment that:

[1477] Nor is overseas practice suggestive that such an approach has found more than narrow favour, since the only examples from the numerous regulatory decisions made every year were two relating to United Kingdom airports.

This section presents evidence on regulatory practice from Great Britain (i.e. the Competition Commission, Civil Aviation Authority, Ofcom and Ofwat) and Australia (i.e. the Productivity Commission, Australian Energy Regulator and IPART). A more comprehensive recognition of the regulatory practice abroad shows that the Commission's approach of adopting the 75th percentile of the WACC range is very much in line with accepted regulatory practice.

5.1.1 Great Britain

Competition Commission

In its last four major final regulatory determinations, the Competition Commission (the UK's appeal body for all economic regulatory determinations) has adopted WACC values well above the 50th percentile of the range:

- In the its Bristol Water determination (2010), the CC estimated a WACC range of 3.8% to 5.0%, and adopted a point estimate was 5.0%, which is the 100th percentile of the range.
- In the Stansted Airport determination (2008), the CC estimated a WACC range of 5.20% to 7.54% and adopted a point estimate of 7.10%, which is the 81st percentile of the range.
- In the Heathrow Airport determination (2007), the CC estimated a WACC range of 4.77% to 6.39% and adopted a point estimate of 6.2%, which is the 88th percentile of the range.
- In the Gatwick Airport determination (2007), the CC estimated a WACC range of 4.91% to 6.77% and adopted a point estimate of 6.5%, which is the 85th percentile of the range.

In addition, the Competition Commission has been explicit about its reasons for permitting allowed returns towards the top of its estimated WACC range. In its

2007 determination on regulated charges for Heathrow and Gatwick Airports, the Competition Commission said:²⁴

150. Given the uncertainties in cost of capital estimates, we considered the cost of setting an allowed WACC that was too high or too low. If the WACC is set too high then the airports' shareholders will be over-rewarded and customers will pay more than they should. However, we consider it a necessary cost to airport users of ensuring that there are sufficient incentives for BAA to invest, because if the WACC is set too low, there may be underinvestment from BAA or potentially costly financial distress. Annex 5 illustrates how the weight to be put on these costs will flow into the decision-making process.

151. Given the significance to customers of timely investment at Heathrow and Gatwick, we have given particular weight to the cost of setting the allowed WACC too low. Most importantly, we note that it is difficult for a regulator to reduce the risks of underinvestment within a regulatory period.

152. Taking these factors into account, we concluded that the allowed WACC should be set close to the top of our range.

In its 2008 determination in relation to Stansted Airport, the Competition Commission stated:²⁵

115...

(b) The second was that there were asymmetric consequences from setting returns too high and too low. Specifically, there was a significant detriment to users if Stansted was deterred by inadequate financial returns from investing in new facilities which more than outweighed the costs of setting returns too high and asking users to pay higher charges than strictly necessary.

116. The conclusion that we drew from this is that it would have been wrong for us to select a value at the mid-point of between our upper and lower limits, or lower, but also that we would have to believe that very substantial costs would result from under-investment in Q5 in order to justify choosing a point estimate at the very top end of the range.

Civil Aviation Authority

During the Q4 price controls for the London Airports owned by BAA, the CAA stated:²⁶

4.48 In the view of the CAA, given the investment focus of the CAA review in terms of meeting the CAA's statutory objectives and the consequential risk of adopting a cost of capital (and thus cost of equity figure) which is too low, it is prudent to adopt a figure higher than the mid-point.

²⁴ Competition Commission (2007), BAA Ltd (Heathrow Airport Ltd and Gatwick Airport Ltd), 28 September, Appendix F.

²⁵ Competition Commission (2008), Stansted Airport Ltd: Q5 price control review, 23 October, Appendix L.

²⁶ CAA (2003), Economic Regulation of BAA London Airports (Heathrow, Gatwick and Stansted) 2003 – 2008: CAA Decision, February.

4.49 The CAA endorses the Competition Commission's analysis and accepts its recommendation. It has therefore adopted a figure for the cost of equity in the upper half of the range rather than the mid-point.

During the Q5 price controls for Heathrow and Gatwick Airports, the Civil Aviation Authority (CAA) said:²⁷

11.77 For the purposes of its modelling of indicative price caps at each airport, the CAA has selected point estimates from the above tables of 6.2 per cent at Heathrow and 6.7 per cent at Gatwick. This reflects the need to apply caution in making judgements in the assessment of the cost of capital, and recognition of the potentially greater risk associated with under-, rather than over-, estimation of the cost of capital.

Finally, at the most recent (i.e. Q6) price controls for Heathrow and Gatwick Airports, the CAA maintained its view from previous price controls that the costs of setting allowed returns too low outweigh the costs of setting allowed returns too high:²⁸

8.18 The CAA agrees with Europe Economics in respect of two explanations of why it might be appropriate that the point estimate higher than the mid-point: the best estimate might not be the mid-point and the asymmetric costs of getting the point estimate wrong. The CAA disagrees that it should aim up for reasons of financeability as the concerns about transitional costs in the event of corporate failure are best addressed by other tools such as the financial resilience and continuity of service licence conditions.

8.19 Significant capex compared to the RAB might be a genuine reason to aim up, significant relates to both the monetary value and its importance to the passenger. Therefore, just because the monetary value of capex compared to the RAB might not be as high as in Q5, it does not mean that the capex is less important than Q5.

Ofcom

In past consultations on BT's cost of capital, the UK's communications regulator, Ofcom, considered that:²⁹

3.27 Excessive rewards may lead to consumers paying prices that are above the competitive level, leading to an overall welfare loss, and to investments that are not fully justified by consumer demand being made (and, possibly, investments in other areas that are justified by consumer demand not being made as a result).

3.28 However, while setting rewards too low will lead to consumers benefiting from lower prices in the short run; it may also lead to discretionary investment being discouraged, meaning that the levels of infrastructure-based competition and

²⁷ CAA (2007), Airport price control review – CAA recommendations to the Competition Commission for Heathrow and Gatwick Airports, March.

²⁸ CAA (2013), Estimating the cost of capital: a technical appendix to the CAA's Final Proposal for economic regulation of Heathrow and Gatwick after April 2014, October.

²⁹ Ofcom (2005), Second consultation in relation to BT's equity beta, 23 June.

innovation are at a sub-optimal level. In dynamic markets, there may also be a negative impact on incentives to innovate.

3.29 Given the duties and objectives outlined above, Ofcom believes that the costs associated with setting too low a cost of capital are greater than those associated with setting it too high. This has been taken into account in the arguments outlined in its discussion of interpreting the available evidence regarding BT's group equity beta.

Similarly, Ofcom stated in a past decision on wholesale mobile voice call termination that:³⁰

A8.90 We maintain our belief that the downside of setting an ERP [equity risk premium] too low is worse than the downside of setting the ERP too high. We therefore tend to favour setting the ERP towards the upper end of a 4.5% to 5% range.

Ofwat

During the PR09 price controls for water networks in England and Wales, Ofwat's advisers on the cost of capital, Europe Economics, estimated a WACC range of 2.9% to 5.4% (Table 45, Ofwat PR09 decision), and recommended a point estimate of 4.3%. This range, and recommended point estimate, embodied a 'mark-up' "to take account of asymmetric consequences associated with the risk to customers of setting the cost of capital too low" (Ofwat, 2008, p.127).³¹ In its report to Ofwat, Europe Economics noted:³²

(a) First, the extent to which the consequences of setting the WACC too high or too low are asymmetric. As discussed above, we consider that there are serious consequences from both over- and under-estimation, but on balance we consider the consequences of the latter to be more serious in the long run.

(b) Second, the degree of uncertainty which surrounds one's best view of the "true" value of the WACC. The more uncertainty which surrounds estimation, the more one should aim up by to avoid the potentially serious consequences of underestimation.

Ofwat considered Europe Economics' proposed range and chose a value of 4.5%, which was well above the midpoint of the range (64th percentile), and even higher than the value proposed by Europe Economics.³³

³⁰ Ofcom (2005) re Wholesale mobile voice call termination: Modelling Annexes, 15 March.

³¹ Ofwat (2008), Future water and sewerage charges 2010-15: Final determinations.

³² Europe Economics, 2009, Cost of Capital and Financeability at PR09: Updated Report by Europe Economics, 22 October, pp.104-105

³³ In arriving at this point estimate, Ofwat undertook a range of cross-checks on the WACC estimates and satisfied itself that its preferred WACC allowance was within a reasonable range.

5.1.2 Australia

Productivity Commission

In its 2001 review of Australia's National Access Regime, the Productivity Commission stated:³⁴

For the reasons outlined above, the Commission does not subscribe to the view that, in a regulated environment, the community faces a choice between incurring the allocative efficiency costs of over-compensation and (more serious) dynamic costs of under-compensation. Both types of error are likely to influence investment outcomes and therefore have dynamic efficiency implications.

Nonetheless, the Commission accepts that there is a potential asymmetry in effects:

- Over-compensation may sometimes result in inefficiencies in the timing of new investment in essential infrastructure (with flow-ons to investment in related markets), and occasionally lead to inefficient investment to by-pass parts of a network. However, it will never preclude socially worthwhile investments from proceeding.
- On the other hand, if the truncation of balancing upside profits is expected to be substantial, major investments of considerable benefit to the community could be forgone, again with flow-on effects for investment in related markets.

In the Commission's view, the latter is likely to be a worse outcome. Accordingly, it concurs with the argument that access regulators should be circumspect in their attempts to remove monopoly rents perceived to attach to successful infrastructure projects.

Since then, the Productivity Commission has reiterated this view on a number of occasions. In a follow-up review of the National Access Regime, concluded in 2013, the Productivity Commission stated:³⁵

Given that regulators are unable to set optimal access prices (prices that would maximise overall economic efficiency) with precision, there is scope for regulatory error in the setting of access terms and conditions. As Allan Fels acknowledged, 'setting the appropriate price requires much detailed, difficult to obtain information about industry cost and demand conditions, making some degree of regulatory error inevitable' (sub. 40, p. 46). Several participants highlighted examples of, or the scope for, errors in the setting of access terms and conditions (APA Group, sub. DR60; Aurizon, sub. DR72; BHP Billiton, sub. DR65; Business Council of Australia, sub. DR69).

Regulatory error can involve prices that are set either too high or too low relative to the optimal level. If the regulator sets prices above the level required for investment to proceed, infrastructure services will be under-consumed relative to their efficient

³⁴ Productivity Commission (2001), National Access Regime: Productivity Commission, No. 17, 28 September, p.83.

³⁵ Productivity Commission (2013), National Access Regime: Productivity Commission, No. 66, 25 October, pp.103-104.

level. Prices that are set too low can lead to delayed investment, or the non-provision of some infrastructure services (PC 2010).

The Commission considers that the consequences for efficiency from setting access prices too low are, all else equal, likely to be worse than setting access prices too high. This is because deterring infrastructure investment (from setting access prices too low) is likely to be more costly than allowing service providers to retain some monopoly rent (from setting access prices too high) (PC 2008b). The Commission noted in its recent review of electricity regulation that regulators should err on the side of allowing higher returns to regulated businesses to allow for this asymmetry (PC 2013a).

There are some arguments that suggest regulators have a tendency to set access prices too low (Hausman 2008; NEEG 2001). Given the greater efficiency consequences of setting access prices too low, this bias would increase the expected costs associated with regulatory error.

Australian Energy Regulator

The AER completed, in December 2013, a comprehensive review of its Rate of Return Guideline, which sets out its methodology for the estimation of WACC. Under its current Guideline, the AER does not estimate an overall WACC range as the Commission does. Rather, the AER estimates ranges for certain parameters (e.g. the equity beta, market risk premium), and then chooses point estimates from within those individual parameter ranges based on a range of evidence and models. These point estimates are then combined together to derive an overall WACC estimate.

The only WACC parameter for which an estimated range is given in the AER's Guideline is the equity beta. The AER proposed an equity beta range of 0.4 to 0.7. Having considered the available evidence, it selected a point estimate at the very top of this range, 0.7. In doing so, it stated:³⁶

We consider the evidence currently before us is sufficiently strong to justify applying an equity beta point estimate at the upper end of the 0.4 to 0.7 range of empirical estimates. Adopting a point estimate around the mid-point would be more reasonable if our intention was to base the allowed return on equity on the Sharpe–Lintner CAPM and empirical estimates alone. However, the rules require us to have regard to relevant estimation method, financial models, market data and other evidence when determining the allowed rate of return. When this information is taken into account, we consider it reasonable to select a point estimate from the upper end of the range of empirical equity beta estimates.

More broadly, the Chairman of the AER has commented that in the context of recent changes to the National Electricity Rules:³⁷

³⁶ AER (2013), Better Regulation, Explanatory Statement Rate of Return Guideline (Appendices), pp.76-77.

³⁷ Reeves, A., *Promoting efficient investment – protecting consumers from paying more than necessary*, AER Chairman's Address, AER Public Forum, 23 November 2011.

...there is a need to have regard to the economic costs and risks of the potential for under and over investment by a regulated network service provider. In part, this principle relates back to the first one I have listed in that it is recognised that the economic cost of under-investment in services is greater than the economic cost of a small over-investment. This asymmetry is well understood in regulatory economics and is key to the deliberations of regulators. Again, this asymmetry is something that the AER has explicitly acknowledged and addressed as part of our rule change proposal.

IPART

In December 2012 IPART began a review of the methodology it uses to estimate WACC when regulating certain industries (e.g. water networks, energy retailers) in New South Wales. It published its revised methodology in December 2013. One of the key changes to IPART's methodology is a move away from adopting the midpoint of the WACC range as its default point estimate. Under IPART's new approach, the chosen point estimate depends on IPART's assessment of the level of economic uncertainty (as measured by an 'uncertainty index' constructed using various measures of market volatility, e.g. volatility indices and credit spreads).

In developing its approach, IPART said that:³⁸

We consider that an indicator of economic uncertainty may be useful in our WACC determination process. The level of uncertainty in the economy may be relevant to the estimation of the WACC in that:

- Like other economic models, our WACC models may perform less well and be subject to greater volatility when there are higher levels of uncertainty, such as in unusual economic conditions or at economic turning points.
- Other things being equal, a higher level of uncertainty surrounding the economic outlook may be associated with a higher risk premium on investment and hence a higher cost of capital.

³⁸

IPART (2013), Review of WACC Methodology Research — Draft Report, September, section 7.3.1.

6 MEUG's two-tier WACC proposal

In its judgment, the High Court stated that it “would also expect the Commission to consider MEUG’s two-tier proposal in light of our observations” (para [1486]). The Commission’s consultation paper notes that: “Consideration of the two-tiered WACC...would need to be deferred until the comprehensive review of the IMs” (para 33), which is unlikely to occur before November 2014.

Nevertheless, the Commission has signalled that a comprehensive review of the IMs “would likely canvass some of the developments in regulatory theory and practice relating to the cost of capital that have occurred since the IMs were set, or that were not given much attention by either ourselves or interested parties during consultation on the IMs” (para 28). Two of the developments noted by the Commission are:

- Further consideration by the Queensland Competition Authority (QCA) of the ‘split cost of capital’ approach advocated for many years by Professor Dieter Helm in the UK; and
- “recent support for a two-tiered cost of capital from Professor Ian Dobbs”, using a different approach from Professor Dieter Helm.

This section discusses briefly the Helm split cost of capital proposal and the two-tier WACC proposal, which though not identical, share a number of features.

6.1 The Helm split cost of capital idea has been rejected widely by regulators overseas

The Helm split cost of capital idea assumes that sunk and prospective investments have fundamentally different risk profiles and, therefore, regulators should allow different rates of return on those different investments. In particular, Helm argues that sunk investments (i.e. those already included in the RAB) should be remunerated at the supplier’s cost of debt, and any new expenditure (i.e. opex and capex) should be remunerated at the cost of equity until such time as these expenditures are capitalised within the RAB.³⁹

³⁹ Helm argues that once investments have been made, and capitalised in the RAB, there is an implicit regulatory guarantee for investors, which he claims virtually eliminates equity risk. On this basis he argues that sunk investments may be funded entirely using debt capital, so the relevant rate to apply to this portion of the asset base is the expected cost of debt. In contrast, argues Helm, future opex and capex involves much more equity risk. On this basis, he argues that it is appropriate that this expenditure be remunerated (funded) at the cost of equity until it is incorporated within the RAB. See, for example, Helm, D. (2009), ‘Infrastructure investment, the cost of capital, and regulation: an assessment’, Oxford Review of Economic Policy 25(3), pp.307–326.

The Helm split cost of capital is similar to MEUG's two-tier WACC approach in the sense that:

- Sunk investments would be permitted a relatively low rate of return (i.e. the cost of debt); while
- The non-RAB elements of the firm would be permitted a relatively high return (i.e. the cost of equity).

Of course, in practice, the Helm approach and MEUG's approach might result in different allowed rates of return; it would be purely coincidental if the 50th percentile of the WACC range were to correspond to the cost of debt, and if the 75th percentile of the WACC range were to correspond to the cost of equity.

6.1.1 Consideration by regulators in the UK

Helm's split cost of capital proposal is not a new development. It has been debated in the UK for at least a decade.⁴⁰ Almost every regulator in the UK has considered the proposal explicitly and yet none has adopted the approach. The Appendix to this report summarises the views expressed by the Competition Commission, Ofgem, Ofwat, the CAA and the ORR when rejecting the split cost of capital approach.

We note that the idea that different divisions or activities within a diversified business might have different risk profiles and, therefore, different WACCs is uncontroversial. This is also a well-accepted proposition by regulators.⁴¹ However this notion is quite different from Helm's (and MEUG's) proposal, which differentiates between assets **used to deliver exactly the same service**, depending on whether those investments are sunk or prospective. The conceptual and practical difficulties associated with treating sunk and future assets used to deliver the same regulated service are expressed most clearly by the UK's Competition Commission:⁴²

9. Members of the CC's Cost of Capital Panel met with Professor Helm during our review to make sure that they had properly understood Professor Helm's ideas and to discuss with him some of the questions that they had about his proposals. The main difficulty that they had with the split cost of capital framework was the idea that Stansted's revenues could somehow be separated into two component parts with very different risk profiles. In practice, airlines pay one set of regulated charges,

⁴⁰ Helm, D. (2003), 'Whither water regulation', *Water, Sustainability and Regulation*, The Oxera Press, August, pp. 1-12.

⁴¹ For instance, the UK communications regulator, Ofcom, has for some time treated the network infrastructure part of British Telecom (BT), Openreach, as less risky than the rest of BT. See, for example, Ofcom (2012), Charge control review for LLU and WLR services – Statement: Annexes, 7 March.

⁴² Competition Commission (2008), Stansted price control review: Final report, Appendix L, Cost of capital.

capped according to a formula set by the CAA, and an airport delivers one overall profit to one set of investors—a return that, by definition, varies according to all the risk factors that Professor Helm has identified.

10. This regulatory design means that the return that investors earn on historical investment (as reflected in the RAB) is inextricably linked to the demand at the airport, the cost of operating, maintaining and renewing built assets, and the ongoing service quality provided to customers. The convention of using the RAB as an input into the calculation of price caps gives investors the opportunity to recoup their investments, but deliberately puts that return at risk (i.e. it is conditional upon the efficient and competent operation of the assets that are built). As such, it is entirely conceivable (and, indeed, desirable) that the actual return on the RAB will turn out to be higher or lower than the expected return seen in the WACC x RAB calculation.

11. Professor Helm was not able to persuade Panel members that the return of and on Stansted's RAB is somehow 'safe' and capable of being disentangled from an airport's performance against its price cap, or that the financiers of historical investment included in the RAB would not see the value of their capital increase or diminish in line with the fortunes of the regulated business. As a consequence, it was not appropriate for us to use a split cost of capital in this review.

6.1.2 Consideration by regulators in Australia

We also note that no regulator in Australia uses the Helm split cost of capital approach. In Australia, only the QCA has investigated this proposal closely and, despite having gone through an extensive process of considering the approach, has not adopted it. In a discussion paper published in February 2014, which the Commission refers to, the QCA notes that:⁴³

- The proposal (in its full form) has not been adopted by any regulator;
- There are a number of implementation issues associated with the split cost of capital approach; and
- It would be premature to adopt the approach unless these implementation issues can be resolved

In that discussion paper, the QCA stated that (p.33):

However, given the innovative nature of the concept and recognising the potentially significant implications for the allowed cost of capital it is important to be cautious. The main recommendation of this paper is that the split cost of capital concept should continue to be investigated rather than being adopted as the key determinative benchmark.

The QCA also made clear that if the split cost of capital approach were to be used in future, it would not be used as a primary method for determining allowed returns (pp.54-55):

⁴³ QCA (2014), The Split Cost of Capital Concept, February.

The focus of the research would be on obtaining reference estimates of allowed rates of return and hence prices and revenues derived from the split cost of capital. The reference estimates would not be determinative by themselves but rather would be used to inform the determination of appropriate cost of capital parameters used in a single WACC approach.

If the Commission were to adopt the split cost of capital approach, or the two-tier WACC approach, it would be the first regulator in the world to do so, as far as we are aware.

6.2 MEUG's two-tier WACC approach would likely distort investment incentives

The Commission has expressed previously a number of concerns about MEUG's proposed two-tier WACC approach (para [1435] of the Court's judgment). The most egregious of these problems is the distortions to future investment incentives the approach would create. The essence of the problem is summarised by the Commission's adviser, Dr Martin Lally, in the context of the Gas Authorisations (cited in the High Court judgment, para [1445]):

Such a course of action will damage the investment incentives of firms that are contemplating investment in areas that are currently unregulated, but which may be subject to regulation at some future point.

In relation to MEUG's two-tier proposal, the High Court suggested in its judgment that (para [1484]):

In principle, that proposal is stronger, because by providing the likelihood of higher than normal returns on new investment it overcomes any disincentives that may be claimed to exist (compared to the use of the mid-point); although we are not convinced as to the reality of those disincentives.

The flaw in this reasoning is that at the point that new expenditure is rolled into the RAB, under MEUG's approach, those investments would cease to be remunerated at the 75th percentile WACC and instead be remunerated at the 50th percentile WACC.

As discussed in earlier sections of this report, the Commission's rationale for applying the 75th percentile WACC, which we consider is correct, is that such an approach reduces, relative to the 50th percentile WACC, the chances of under-compensating investors. If this is correct, then moving from applying the 75th percentile WACC to the 50th percentile WACC simply raises the probability of the allowed rate of return failing to reflect the true WACC associated with the investment, and increases the risk of under-compensating investors in future, once the investment is rolled into the RAB.

Under these circumstances, a rational firm contemplating new investments would anticipate a lower allowed rate of return if and when those investments become sunk. The firm would factor into its original investment decision the certainty

that the allowed return will drop significantly at the next price reset (and, therefore, the increased future likelihood of investors not being permitted to earn the true WACC). In other words, the firm would realise that at some point in the future, it would be deprived of the difference between the 75th percentile and 50th percentile WACC for the remaining lifetime of the assets. All else being equal, this would reduce the probability of the investment being worthwhile from an economic perspective, thereby lowering the likelihood of the investment proceeding.

6.3 Recommendations for considering the two-tier WACC approach

Given the conceptual and practical difficulties associated with MEUG's proposed two-tier WACC approach, and the potential for adverse investment incentives to arise, in our view, any consideration of a two-tier approach should occur only as part of a wider review that involves comprehensive consultation, and a thorough analysis of the implications of adopting such an approach. We therefore recommend the Commission defer any consideration of the two-tier approach until such a review can be conducted properly.

Appendix – Views of regulators in Great Britain on Helm’s split cost of capital proposal

This appendix surveys the views expressed by regulators in Great Britain on Professor Dieter Helm’s split cost of capital proposal, which the Commission has referred to in its consultation document. Every regulator in Great Britain that has considered the proposal has rejected it.

The Competition Commission has rejected the split cost of capital approach

During the Q5 price controls for Stansted airport, the UK’s Competition Commission considered the Helm split cost of capital proposal and stated the following:⁴⁴

7. The only new methodological issue that we considered in this review was the concept of a split cost of capital as recently developed by Professor Dieter Helm of the University of Oxford. Professor Helm had last year been critical of our decision to use a single rate of return in the calculation of price caps for Heathrow and Gatwick airports, arguing that it is better for a regulator to apply different rates of return to the RAB and to on-going opex and capex. His proposition, in its original form, is that a regulated income stream combines two very different types of cash flow:

(a) the return of and on the RAB, where risk is (very) low so long as the regulator commits to including the costs of historical investment in future price controls; and

(b) payment for on-going opex and capex, where risks are considerably higher.

8. In Professor Helm’s view the RAB has a low cost of capital and the capex and opex have a high cost of capital, and these distinct costs of capital should be reflected in a regulator’s price cap calculations via a split rate of return.

9. Members of the CC’s Cost of Capital Panel met with Professor Helm during our review to make sure that they had properly understood Professor Helm’s ideas and to discuss with him some of the questions that they had about his proposals. The main difficulty that they had with the split cost of capital framework was the idea that Stansted’s revenues could somehow be separated into two component parts with very different risk profiles. In practice, airlines pay one set of regulated charges, capped according to a formula set by the CAA, and an airport delivers one overall profit to one set of investors—a return that, by definition, varies according to all the risk factors that Professor Helm has identified.

10. This regulatory design means that the return that investors earn on historical investment (as reflected in the RAB) is inextricably linked to the demand at the airport, the cost of operating, maintaining and renewing built assets, and the ongoing

⁴⁴ Competition Commission (2008), Stansted price control review: Final report, Appendix L, Cost of capital.

service quality provided to customers. The convention of using the RAB as an input into the calculation of price caps gives investors the opportunity to recoup their investments, but deliberately puts that return at risk (i.e. it is conditional upon the efficient and competent operation of the assets that are built). As such, it is entirely conceivable (and, indeed, desirable) that the actual return on the RAB will turn out to be higher or lower than the expected return seen in the WACC x RAB calculation.

11. Professor Helm was not able to persuade Panel members that the return of and on Stansted's RAB is somehow 'safe' and capable of being disentangled from an airport's performance against its price cap, or that the financiers of historical investment included in the RAB would not see the value of their capital increase or diminish in line with the fortunes of the regulated business. As a consequence, it was not appropriate for us to use a split cost of capital in this review.

12. The analysis that follows is for a single rate of return which is to be applied to both the existing RAB and new capex.

Ofgem has rejected the split cost of capital approach

When developing its present RIIO system of regulation, Ofgem also considered the split cost of capital approach:⁴⁵

12.6. We have considered alternative approaches to setting the allowed return. One such alternative is the —split cost of capital...

12.7. We appreciate a number of the concerns that this model is aimed at addressing. However, we think that Sustainable Network Regulation addresses the issues raised without the disadvantages associated with creating new boundaries between RAV and new investment, or between RAV and price control expenditure...

Ofwat has rejected the split cost of capital approach

When Ofwat was developing its approach to the rate of return for regulated water networks in England and Wales, as part of PR09, Ofwat's Director of Regulatory Finance and Competition set out Ofwat's position on the split cost of capital approach as follows:⁴⁶

We note the points made, in the argument for a split cost of capital, between the average and marginal cost of capital. We do not think that there is evidence that there needs to be an increase in marginal returns to facilitate new capital investment. Neither do we agree that returns on 'sunk' investment should be lower than the average return for the reasons set out above. It is also questionable whether a split cost of capital would reduce the required level of return unless total risks were reduced

Taking account of these issues we have concluded that the concerns raised by respondents outweigh the potential benefits and we will not adopt a split cost of capital for PR09. We will however continue to consider the evidence arising from the

⁴⁵ Ofgem (2010), Regulating energy networks for the future: RPI-X@20 Recommendations: Implementing Sustainable Network Regulation – Supporting paper, 26 July.

⁴⁶ Open letter from Keith Mason, Director of Regulatory Finance and Competition, Ofwat, 'Risk allocation, investment incentives and the financing of regulated businesses', 18 October 2007

continuing upward trend in gearing and the implication for our assumption on gearing and therefore for the allowed overall return in the cost of capital assessment.

The CAA has rejected the split cost of capital approach

During the latest price controls for the regulated London airports, Q6, the Civil Aviation Authority's (CAA) initial proposals for Heathrow Airport stated:⁴⁷

9.18 On balance, the CAA considers that, although the split cost of capital may have some academic attractions, it is not persuaded that it should employ it for HAL for Q6. There is a risk that implementing it, without changing the regulatory framework, would not reduce risk but merely apportion it between two theoretical parts of the business. While arguments for a split cost of capital on the basis of market inefficiencies could also be made, the CAA has not received evidence on this matter. The CAA considers that the potential reduction in the cost of capital from changing the regulatory contract (for example by eliminating all risk from the RAB) would not benefit passengers. Given the open-ended risk future passengers would adopt here it could be contrary to the passenger interest. The CAA also notes that one of the assumptions of the split cost of capital – that the RAB is completely risk-free – may not always be the case for HAL, especially if it faces stronger competitive constraints in the future. The CAA notes that the split cost of capital has been considered but not subsequently adopted by any of the other UK sector economic regulators such as Ofgem, Ofwat and the CC.

Subsequently, in its final proposals for the London airports, the CAA said:⁴⁸

3.6 The initial proposals concluded that it was not appropriate to adopt the split cost of capital for Q6. The CAA did not receive any subsequent responses in favour of adopting the split cost of capital. The CAA proposes not to adopt the split cost of capital for Q6.

The ORR has rejected the split cost of capital approach

In its latest price controls for Network Rail's regulated charges, the Office of Rail Regulation stated that:⁴⁹

4.27 We have considered whether we should use a split cost of capital approach, in line with that set out by Professor Dieter Helm. We think that the most significant issue highlighted by the split cost of capital concept is the importance of understanding the risks that Network Rail faces. In order to understand those risks, the split cost of capital structure does not need to be put in place.

⁴⁷ CAA (2013), Economic regulation at Heathrow from April 2014: initial proposals, April.

⁴⁸ CAA (2013), Estimating the cost of capital: a technical appendix to the CAA's Final Proposal for economic regulation of Heathrow and Gatwick after April 2014, October.

⁴⁹ ORR (2012), Periodic review 2013: Consultation on financial issues for Network Rail in CP5, August.

Frontier Economics Pty Ltd in Australia is a member of the Frontier Economics network, which consists of separate companies based in Australia (Melbourne & Sydney) and Europe (Brussels, Cologne, Dublin, London & Madrid). The companies are independently owned, and legal commitments entered into by any one company do not impose any obligations on other companies in the network. All views expressed in this document are the views of Frontier Economics Pty Ltd.

Disclaimer

None of Frontier Economics Pty Ltd (including the directors and employees) make any representation or warranty as to the accuracy or completeness of this report. Nor shall they have any liability (whether arising from negligence or otherwise) for any representations (express or implied) or information contained in, or for any omissions from, the report or any written or oral communications transmitted in the course of the project.

