Price Caps and Rate of Return Regulation*

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Abstract

This paper considers the difference between two types of regulation as they affect the regulated firm. Using the electricity distribution industry in Victoria as a case study, we discuss the impact of the periodic resetting of regime parameters which is a standard feature of price cap regimes. We explain why such resets are necessary and how the resulting incentives differ from those generated by rate of return regulation.

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I   INTRODUCTION

Although many authors have made a distinction between price cap and rate of return regulation, the precise nature of the differences between these methods remains somewhat unclear and controversial. Indeed, professional economists recently gave conflicting testimony in a case before the Supreme Court of Victoria which examined exactly this issue. This paper contains the substance of the authors' testimony in that case. It seeks to extract from the literature to date a more general definition of alternative forms of regulation, and hence to inform decisions about the choice of regulatory instrument.

We were asked by the Office of the Regulator General, Victoria, (ORG) to assess whether the electricity distribution price determination issued by the ORG on 21 September 2000 (the Determination) was consistent with the expressions used in the Victorian Electricity Supply Industry Tariff Order (the Tariff Order). Clause 5.10(a) of the Tariff Order which requires the ORG to:

> …utilise price based regulation adopting a CPI-X approach and not rate of return regulation.

In order to form a view as to the coherence of the Determination with this clause, it is necessary to first consider what is meant by the two approaches referred to in the clause. It is widely acknowledged that the purpose of regulation[1] is to substitute for the forces of competition in situations where those forces cannot be effective for some reason. This does not, of course, mean that the attitude of regulators towards a regulated firm should be similar to that which would, in other circumstances, be adopted by the firm's competitors. Rather than trying to gain advantage over, and indeed to injure the firm, regulators aim to arrange the environment in a way that simulates the pressures that the firm would face in open competition.

Regulated firms are generally monopolies providing services regarded as being essential, in the sense that society would be materially worse off if it were unable to receive the service. Continuity of service is therefore likely to be one of the goals of a regulator. This is certainly so in the case at issue: electricity distribution.

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[1]   Throughout, we use "regulation" to mean economic regulation of monopolies, as distinct from behavioral regulations used in other circumstances.

Because continuity of service is so important, regulators will not want regulated firms to become bankrupt, except where this is necessary to emphasise the prudential responsibility borne by the firm's managers. In particular, society would be worse off if the firm were to become bankrupt purely as a result of the regulator's decisions.[2]

This implies that all regulators must have regard to the costs that are incurred by the firm, or would be incurred by an efficient firm providing the same service, including the costs such a firm faces in securing debt and equity finance from competitive capital markets. In short, when reaching determinations, all regulators must have regard to the rate of return on capital that is necessary to provide ongoing service. This does not imply that all regulation is rate of return regulation, but that financial viability of the firm acts as a constraint on regulator's decision making. Clearly, it is necessary to compare contemplated measures against this constraint in order to know whether it has been respected. As a result, all regulators have regard to the firm's rate of return.

In respect of "price based regulation", this is not an expression which is commonly used by regulatory economists. This is in direct contrast to other names which do have widely accepted meanings, such as "rate of return" (known equivalently as "cost of service") regulation, price cap regulation, and CPI-X regulation.

Not only is "price based" regulation not a commonly used term, but there is a reasonable sense in which all regulation could be interpreted as being "price based". The regulated firm derives its income from selling services at some set of prices. Different prices would generate different levels of income, and hence different rates of return on capital. Thus, a regulatory constraint expressed as a maximum allowable rate of return has implications for the firm's pricing. More generally, irrespective of the methods used to derive and specify the regulatory constraints, the regulated firm must represent these constraints to the market through its prices.[3] It is therefore fair to say, as did an early authority on regulation, that:

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[2]   When regulated firms go bankrupt as a result of regulatory decisions, society not only incurs the once-off costs involved in corporate reorganization but must also compensate future providers of capital to the firm for the perceived greater risk entailed in supplying the firm with finance.

[3]   For example, there are industries (though these are not natural monopolies and are rarely viewed as public utilities) where regulation takes the form of controls over entry, without direct limits being imposed either on charges or on rates of return. Thus, the number of free-to-air television broadcasters in Australia is limited by government *fiat*, but no constraints are imposed on how much these broadcasters can charge advertisers. Even in this instance, however, the restriction on entry (together with direct limits on the amount of advertising each

> *"Public utility regulation in the last analysis is price regulation, limited by the fundamental requirement that a firm's solvency must be maintained"* (Bussing, <u>Public Utility Regulation and the So-Called Sliding Scale</u>, *Columbia University Press, 1936 at page 11*).

Since all regulation must have regard to rate of return considerations and involves price in its implementation, how should clause 5.10(a) be interpreted? In our view, the key is in the reference to "a CPI-X approach". Such an approach is generally accepted as referring to "price-cap" regulation, under which the firm's maximum prices are specified directly, rather than through the setting of a rate of return constraint.[4]

In order to understand the distinctions between the approaches referred to in clause 5.10(a), it is necessary to discuss the regulator's problem in more detail. We have already explained the need for the regulator to have regard to rate of return considerations, a need which arises from the assumption of service continuity. This idea can be made more precise through the use of what economists refer to as a "participation constraint". If the firm's funders are free to withdraw, their continued participation must be secured in order to maintain service. The participation constraint effectively sets a floor on the earnings the regulator can allow. If this floor is breached by the regulator, the firm will lose financial support.

Bearing this constraint in mind, the regulator nevertheless wants the firm to pursue ongoing efficiencies, and to share the benefits of these with consumers, just as would occur under competition. Firms selling into a competitive market will lose market share if they become inefficient relative to their competitors, since this will result in higher prices, lower service quality, or both. In seeking to replicate this effect, regulators face what economists call a "moral hazard" problem. Recognising that day-to-day control must be delegated to the firm, how can a service contract be framed so that the firm has an incentive to operate efficiently?

The regulator's task can therefore be viewed as one of maximising incentives for the firm to operate efficiently, while respecting the participation constraint in order to ensure continued

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television station can display) determines the supply of advertising time and has a direct impact on the charges advertisers face.

[4] In this framework, the X factor can be interpreted as a benefit consumers receive as a result of the firm becoming more efficient.

service. Seen in this light, regulatory regimes that do secure ongoing service (i.e. the vast majority) can be compared by looking at the extent to which each offers efficiency incentives. This defines a broad spectrum of regimes, along which the balance between insurance and risk differs.

At one extreme on this scale, regulation offers the firm full insurance against the possibility of making a loss. There are no circumstances under which the firm will be allowed to go bankrupt, and the return to funders is guaranteed in each period. Thus, prices are allowed to rise to maintain earnings during periods of slack demand. Conversely, there are no circumstances in which the firm is permitted to earn more than its costs. Because costs are fully insured, however, a firm subject to this form of regulation has no incentive at all to pursue cost efficiencies.

If it were actually possible to contrive such a regime, which must be regarded as extremely unlikely, the firm would receive compensation each period for its actual costs: neither more nor less. Since return on capital is an important component of costs, it is reasonable to describe such a scheme as a pure form of "rate of return" regulation. The rate of return is regulated to ensure that it exactly matches the cost of capital in each period. Such a regime is focussed entirely on the participation constraint and does not attempt to "optimise" against this constraint, for example by offering incentives for greater efficiency.

At the other extreme of the "income insurance" scale, one could conceive of a regime in which a set of minimum service standards (including in terms of the prices the firm can charge) were specified, and the earnings of the firm were otherwise completely unconstrained. If the firm was able to reduce costs while conforming to the regulated standards, the resulting profits could be retained or distributed irrespective of their size. Conversely, if demand in some period(s) was unexpectedly weak, the firm would suffer the consequences even if these imposed severe losses.

Such a scheme involves no earnings insurance, and offers the strongest possible efficiency incentives. Notice that this applies even though the targets will generally have been set with regard to the cost of service including the cost of necessary capital. As noted above, the participation constraint obliges the regulator to consider the cost of service. At the time it enters

into the regulatory arrangement, the firm must therefore expect to at least earn its cost of capital. This does not, however, imply that the earnings of the firm are being insured, since the firm remains fully exposed to the variability of actual earnings from expected earnings.

At least in theory, an extreme form of price-cap (CPI-X) regulation lies at this latter extreme of the spectrum of regulatory regimes. However, although price-caps such as these were originally thought to offer the strongest possible efficiency incentives, it is now acknowledged that practical considerations limit the extent to which this can be achieved. [5] Thus, we are not aware of any instance in which the extreme price-cap of the kind set out above has ever been successfully implemented. [6]

Thus, the end points of the continuum we have described are not feasible. There is no regime that offers full earnings insurance, and there is no regime that offers zero earnings insurance. Rather, all known regimes lies somewhere in the interior, with each reflecting its own balance between efficiency incentives and earnings insurance. Additionally, few economists would regard the extreme points as being attractive, as they take the merits one side of the continuum or the other offers to excess, completely sacrificing any element that can be obtained from the other. [7]

Returning to the question at issue here, it is now possible to be more explicit about how we propose to answer. We begin in the next section by setting out the key features of different types of regulation, with particular attention to those close to the endpoints of the continuum we have described. This is followed by an evaluation of the Determination relative to the trade-off

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[5]   Even in 1983, Professors Beesley and Littlechild noted that the benefits of the price cap regime imposed on BT depended on temporary character of the controls it imposed. More specifically, they recognized that "the one-off nature of the restriction is precisely what preserves the [regulated] firm's incentive to be efficient, because the firm keeps any gains beyond the specified level." They therefore argued that the controls should be strictly transitional in character (Beesley and Littlechild (1983) "Privatisation" Lloyds Bank Review).

[6]   The Kiwi Share Obligation (KSO) imposed on Telecom New Zealand may seem similar to this extreme form of price cap, as it is effectively open-ended in duration. However, the KSO may only be applied so long as that application does not jeopardize Telecom's financial viability. Moreover, since the KSO was put in place, the NZ authorities have on several occasions reviewed Telecom's profitability, and assessed the extent of any losses Telecom may incur as a result of the KSO. These provisions and inquiries clearly distinguish the KSO from the extreme form of price cap set out above.

[7]   In theory, each regime trades incentives for efficiency (which amounts to a weighting of producer profit) against a weighting placed on consumer surplus. The socially optimal balance between these depends on the marginal cost of taxation and income redistribution. It is only when the marginal social cost of taxation is zero and income redistribution are zero that it is clearly optimal to place the entire weighting on securing efficient production.

between insurance and incentives. Finally, we offer a critique of expert statements lodged by the plaintiffs in this case.

II   TYPES OF REGULATION

Rate of Return Regulation

The meaning of the term "rate of return regulation" is not controversial. It refers to any arrangement that restricts the earnings of a firm to be no greater than the cost of providing the regulated service. The defining feature of this form of regulation is that the returns accruing to holders of equity in the regulated entity are directly proportional to the amount of capital deemed to be in use by that entity. In particular, fluctuations in the strength of demand for regulated services will not affect the earnings of the supplying firm in respect of those services, since the firm is entitled to adjust its prices so as to earn its allowed rate of return. Thus, at least in theory, rate of return regulation can offer the firm full insurance against variations in income.

Rate of return regulation has been used for more than a century, motivated in the USA by concern over the market power of railroad companies. These firms were first directly regulated in the 1880's, and debate over the measurement of costs and the relationship between costs and regulated prices has continued since that time. For example, the exchange between Taussig (1913) and Pigou (1913) in the <u>Quarterly Journal of Economics</u> touches on issues that still arise today.

There is, of course, considerable diversity in the practice and decisions of individual regulators using rate of return regulation. This diversity arises from several attributes including the nature of the industry, the date at which decisions are made, and the views of the people involved. Nevertheless, the mechanics of the regulatory process is broadly similar within all regimes that use rate of return regulation. Berg and Tschirhart (1988, 298) characterise this rate setting process as using the following three steps:

- The firm's costs are reviewed, and costs deemed to be unnecessary are eliminated;
- A rate-of-return judged to be fair for the firm is specified;
- Prices and their structure are set to generate enough revenues to cover costs and provide a fair rate of return.

In practice, the unnecessary costs eliminated in step (1) are those associated with recent investments that the regulator subsequently deems imprudent or unnecessary, and hence refuses to add to the "rate base". Teisberg (1993) discusses the effects of the uncertainty created by this practice and conjectures that it has been responsible for utilities favouring smaller projects with short lead times. As a general matter, however, once an asset enters the rate base under rate of return regulation, it remains there, albeit at a value that is progressively reduced by depreciation. Thus, at least in principle, the cost of providing fixed assets required for the production of regulated services is fully refunded under rate of return regulation.[8]

The same is true of the variable costs of production, such as labour and materials. Indeed, reimbursement is often even more direct for these costs. Joskow (1974) reports that once inflation took hold in the late 1960's regulators began pre-approving price increases as compensation for higher variable costs in advance of full rate hearings. Although these higher prices were able to be rescinded later, in the event that cost studies did not demonstrate a need for them,[9] the fundamental point remains. Under rate of return regulation, there is a direct relationship between changes in costs and changes in prices such that legitimate increases in the former cause increases in the latter, other things being equal.

Problems with Rate of Return Regulation
Under the purest forms of rate of return regulation, in which regulated revenues are held to a level just sufficient to cover allowed costs, the regulated firm has no incentive to become more efficient by reducing its costs. Provided full cost recovery is guaranteed, neither shareholders nor managers gain any advantage from streamlining production systems or investing in more efficient technologies. The result is that, although prices reflect costs, these costs are not as low as they might otherwise be.

This weakness has been known for many years, as have other problems arising from rate of return regulation. The most frequently cited work on the consequences of this rate of return regulation is almost 40 years old (Averch and Johnson, 1962). This paper is rather artificial, in

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[8] Obviously, the extent to which reimbursement is complete will depend on the particular features of any scheme of rate of return regulation.

[9] Paul MacAvoy (1992) finds that in practice, rates of return in rate of return regulated industries typically fell below the cost of capital during the period of relatively rapid inflation that lasted from the mid-1970's to the end of the 1980's.

the sense that its predictions of over-capitalisation rely heavily on the assumption that the regulator allows an expected rate of return in excess of the cost of capital. Nevertheless, the paper does date the approximate beginnings of contemporary research into the problems associated with rate of return regulation.[10]

In the intervening period, a great many alternative methods have been proposed as a way of avoiding some of the poor incentive properties of rate of return regulation. Some of these involve apparently quite minor changes. For example, if the period between rate reviews (known as the "regulatory lag") is lengthened, to (say) more than one year, the firm may have an incentive to reduce costs between rate reviews. The strength of this incentive will of course depend upon what happens during the eventual rate review. If the stream of costs over the last regulatory period is compared with the stream of revenues to derive a rate of return over the period, and any discrepancy between the realised and allowed rates used to generate a payment to or from the firm, then the firm remains fully insured. In this case, the longer regulatory lag would have no impact on the incentives facing the firm.

A local example of such an approach is provided by the New South Wales Rail Access Regime. In this regime, the constraint on the access provider (RAC) is couched entirely in terms of the maximum allowable rate of return. If demand in any period happens to be low, RAC is entitled to increase its prices in order to maintain the allowed rate of return.[11] Conversely, if demand is very strong so that existing prices result in profits above the allowed rate, these are placed into a fund and subsequently rebated to customers. Thus, even though there are no annual rate reviews, this system of "overs and unders" has the effect of smoothing RAC's rate of return over the period between reviews.

Similarly, the determination by the Independent Pricing And Regulatory Tribunal (IPART) in respect of electricity distribution businesses in New South Wales regime contains very explicit

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[10] Note, however, that the problems were already familiar to earlier scholars. Bussing, for example, noted that under rate of return regulation, "an inefficient plant which charges high prices is permitted to earn as large a return as an efficient plant which charges low prices. Thus no reward is offered for efficiency as such, which leaves little incentive for management to improve its operating standards. The result is higher prices in many instances than the public should be required to pay." (Bussing, 1936 page 11). Echoing the earlier work of C. S. Morgan (1923), Bussing proposed a modified form of rate of return regulation, in which the regulated entity would be allowed to keep, at least for a few years, that share of the economic profits it made that resulted from managerial initiative.

[11] There are some constraints on RAC's ability to do so resulting from the combinatorial ("floor/ceiling") approach used in the New South Wales regime. Even putting these constraints aside, RAC would still need to find purchasers of its services that had sufficient ability and willingness to pay to cover the entirety of its costs.

insurance against demand variations, again through a detailed "unders and overs account". This is despite the fact that IPART quite accurately describes this regime as being based on a revenue based CPI-X cap.

To summarise, we reiterate our three main points. Firstly, rate of return regulation involves the setting of allowed prices or revenues that are explicitly designed to just recover costs, including a fair rate of return on necessary investments in fixed assets. Reflecting this, there is under rate of return regulation a direct relationship between changes in costs and changes in prices such that legitimate increases in the former cause increases in the latter. Second, the more accurately the regime can calibrate earnings to costs, the weaker are the incentives for the regulated firm to reduce costs. More specifically, the greater the extent to which any excess profits are refunded to consumers, the lower the gain to the firm from effecting improvements that could otherwise enhance its earnings. Finally, the weak incentive properties of rate of return regulation have been well understood for many decades.

Incentive Regulation

Any scheme that attempts to avoid the main problem with rate of return regulation is a form of incentive regulation. The essential feature of incentive regulation is that the shareholders and/or managers of the regulated firm are better off if production costs are reduced, at least under some circumstances. Effectively, therefore, the term incentive regulation refers to methods under which the firm is paid to be more efficient.

The idea of incentive regulation is almost as old as the rate of return method, with the works of Morgan and Bussing providing early expositions of the concept. An even earlier discussion can be found in a survey of the UK experience with regulation written by Whitten immediately before the 1st World War.[12] These early writings had little practical impact. Nonetheless, by the early to mid-1960's, the desirability of reforming regulatory arrangements so as to provide incentives for greater efficiency was well-recognised by economists,[13] though technical analyses of the options for achieving this goal was still in its infancy.

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[12] R. Whitten Regulation of Public Service Corporations in Great Britain, Public Service Commission of New York 1913.

[13] H. Trebing (1963) "Towards an incentive system of regulation" 72 Public Utilities Fortnightly at 22.

The original motivation for offering firms efficiency incentives differed by location. While the debate in the USA focussed on how to avoid the obvious problems with cost reimbursement, European analysts were drafting operational rules and guidelines for nationalised industries that attempted to secure efficiency gains for consumers and shareholders (i.e. taxpayers).[14] The similarity of these problems is perhaps best reflected in the title of a text book written by two of the world's leading economists: "A Theory of Incentives in Procurement and Regulation".[15]

In this book, Laffont and Tirole frame the problem faced by regulators in very general terms, depicting it in terms of the two dimensions we discussed above. More specifically, the regulator should design a contract which is (a) acceptable to the firm and (b) as good as possible for society as a whole. Notice that condition (a) is just saying that the firm's participation constraint must be respected, or equivalently, that the effect of the regime must not be to drive the firm bankrupt. Similarly condition (b) implies that the contract must give the firm an incentive to be efficient.[16]

Because the regulator has imperfect information, and more specifically cannot identify the precise contours of least cost production, the outcome under such a contract will generally leave the firm with some profit. Indeed, the economic profit the firm is allowed to earn under incentive regulation can be seen as the rent the firm obtains on its accumulated stock of information about production opportunities. This information is available to the firm at a lower cost than would be incurred by the regulator should the regulator seek to duplicate it. The firm then obtains a payment to act on that information, the extent of the payment reflecting (among other factors) the cost penalty the regulator would face in seeking to replicate the firm's information base.

This "cost of information" analysis is important here because the *extent* of the ORG's investigations into the electricity distribution companies and their operating environment has

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[14] The UK debate over rules for nationalized industries is familiar and well-covered in texts such as R. Rees <u>Public Enterprise Economics</u>, Weidenfeld and Nicholson, 1976 at pages 12 and follows. However, analytical insights closer to those set out in later discussions about price caps were generated by the debate over the appropriate long term trend for the price level of Electricite de France, surveyed, for example, in J. F Picard et. al. <u>Histoire de L'EDF</u>, Dunod 1985.

[15] Jean-Jacques Laffont and Jean Tirole, <u>A Theory of Incentives in Procurement and Regulation</u>, MIT Press, 1993.

[16] "Efficiency" needs to be interpreted here in terms not only of cost-minimization, but also of setting prices on a basis that maximizes the community's overall well-being – that is, that ensures that society secures the greatest value from the resources it consumes.

been cited by King (2000) as being inconsistent with the Tariff Order. The fact is, however, that nothing can be said about whether the ORG gathered too much information without considering the opportunity cost of the information, relative to the benefits that resulted from the use of this information.

A regulator seeking the most efficient outcome under an incentive regulation approach should invest in reducing the information asymmetry between it and the regulated firm up to the point where the marginal cost of doing so exceeds the net social cost of the payment that would need to be made to the firm for it to act on the marginal unit of information at issue. To show that ORG's information collection activities were inconsistent with incentive regulation (and with the proper setting of a price cap in particular), King cannot properly point to the mere fact of ORG collecting information; rather, he would need to show that the information being collected did not meet the test just set out. King, of course, does no such thing, and even fails to mention the nature and substance of the relevant test.

Price Cap Regulation

Many forms of incentive regulation have been proposed in the economics literature, though most of these have never been implemented to our knowledge. In current practice, the most frequently used form of incentive regulation is the "price-cap" method.[17] This method originated in the UK where it was most famously used for controlling British Telecom following the opening to competition of telephony markets in that jurisdiction.

Compared with other incentive regulation schemes, the basic idea of a price cap is particularly simple, though an ideal implementation of the concept is far from simple. In essence, the regulator decides on an appropriate initial level of prices, which may well be lower than the current prices (in which case the difference is often referred to as a p-nought adjustment), and then imposes a requirement that the real price must decline by some X percent each year until the next rate review.

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[17] In price cap regulation, an index of the prices is controlled directly by restricting movements in the index to be no greater than CPI-X. Unless otherwise stated, when we use the term CPI-X in this document we refer to a price cap expressed in terms of a CPI-X constraint. It is of course possible to constrain some other variable, such as an index of revenues, using a CPI-X cap, but the properties of such a regime would differ from price cap regulation.

The incentive properties of price cap regulation are highly sensitive to the length of this period as can be seen by imagining that the period was one year. In this case there may be no substantive difference between a price cap and rate of return regulation.[18] The longer is the tenure of the cap, the greater incentive the firm has to cut costs immediately. However, even if a long tenure is used, as the review date approaches the incentives change for the firm. Now it wants to look like a high cost firm because this will lead the regulator to reset the cap at a higher level.[19]

Cost reduction incentives are strongest if the cap is never reset. In this case, the firm is a residual claimant on all cost savings indefinitely and will therefore devote an efficient amount of effort to improving profitability through cost cutting. However, such an approach may become politically untenable if the firm earns huge profits at any stage. Indeed, the best example of this occurred during Professor Stephen Littlechild's tenure as the regulator of electricity supply in the UK. Littlechild felt obliged to revise one of his determinations as to electricity prices after this induced a surge in the share prices of the regulated firms.

This link between realised, or realisable, profits and the parameters of a price cap regime is well known. Even if political considerations are discounted, the regulator simply cannot avoid considering the cost base of the firm, including the cost of its capital, because doing so would risk driving the firm bankrupt. This much is accepted by Professor Littlechild in his statement to this court (at paragraph 11). Since a compensatory return on necessary capital invested is required to avoid bankruptcy, price-cap regulation cannot be implemented without considering, at least implicitly, the regulated firm's rate of return. Bergman et.al. (1998, 99) put it this way:

> *"In practice, [rate of return] regulation and price cap regulation are not too dissimilar.*
> *This is because when setting a price cap, the value chosen for X takes into account a*
> *firm's rate of return."*

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[18] Whether there is any difference will depend on the particulars of the regimes being compared. For example, the "overs and unders" mechanisms used in the NSW rail access regime mean that at the end of the year, the firm can do no better than secure its allowed rate of return. Conceivably, under a 1-year price cap, it could keep whatever surplus it had achieved (or continue to bear whatever loss it had incurred). However, its performance over the year would likely be taken into account in setting the new level of the cap, and hence its income performance in any one year would affect its income expectation in subsequent years.

[19] As discussed below, Antony Cohen's affidavit incorrectly suggests that this effect only arises when the regulator imposes a p-nought adjustment at the outset of the regime.

Another way of understanding this is to recognise that, as noted above, pure rate-of-return schemes are extremely rare, if not unknown.[20] Rather, between periods firms typically do manage to claim some profit if they can cut costs, especially if these are not readily identifiable, and hence are unlikely to evoke any backdating at the review. This is well-known and was first outlined in detail by Schmalensee (1989). When reviews occur infrequently and are forward-looking, even under rate-of-return regulation firms will have incentives to cut costs, and such schemes take on aspects of price cap regulation.

Summary

The relationships between the forms of regulation discussed above can be summarised using Figure 1. The horizontal line in the centre of this figure is a scale representing the extent to which the earnings of the regulated firm are insured by the regulator. The extreme points on this scale, corresponding to zero insurance and 100% insurance are purely theoretical benchmarks which do not have real world counterparts. Regulators can, however, provide relatively high levels of insurance by adopting rate of return regulation, while the regime can be tilted away from earnings insurance and towards the provision of efficiency incentives through the choice of a price cap regime. It is our belief that the Tariff Order at issue here instructs the ORG to avoid the right hand end of this scale, while remaining silent on just where the insurance/incentive trade-off should be struck.

Figure 1
Comparing Regulatory Regimes

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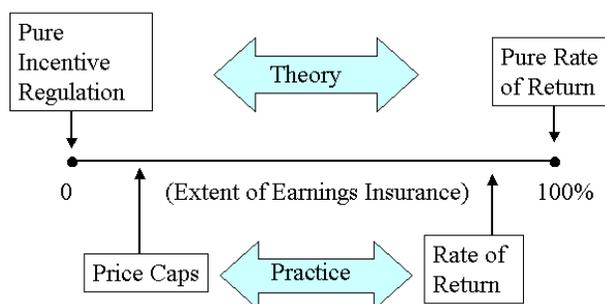
[20]   Thus, even the NSW rail access regime exposes the access provider to some income risk, as a result of the ceiling test imposed on the allowed access revenues.

III   EVALUATING THE DETERMINATION

With this background in mind, we now consider the Determination in more detail in order to explain our view that it has not breached the prohibition on the use of rate of return regulation. We have argued above that no regime in practice can be pure rate of return regulation. Even if the ORG deliberately set out to fully insure the income of distributors (and hence impose pure rate of return regulation), it is extremely unlikely to be completely successful in doing so. Nevertheless, there remains an open question as to just where on the continuum between full income insurance and maximum efficiency incentives this regime lies.

In our view, there are several tests which could be applied, each of which indicates a different point in the relevant scale.

- The weakest test is simply to ask whether the firms' income is fully insured.   If the answer is in the negative, the determination is a form of incentive regulation and hence is not pure rate of return regulation.
- Secondly, we could ask whether changes in either costs or demand between review dates are allowed to be reflected in prices. If so, this is a form of rate of return regulation, and hence lies towards the right hand end of the scale as depicted in Figure 1.
- Thirdly, we could ask whether (and if so to what extent) any profits the firm earns between review dates must be returned to consumers. The less significant is the profit sharing required, the stronger are the efficiency incentives and the less the regime resembles rate of return regulation.
- Finally, we might consider whether the regulator felt the need to place explicit controls on service quality. Such controls would indicate that the regulator believes that the firm has incentives to cut costs, including by degrading the quality of the service provided to end-users.

Statement of Grounds

Before applying these tests, it will be useful to examine the claims of the plaintiffs. In the Amended Statement of Grounds filed on 6 December 2000, two reasons are offered by the plaintiffs in support of their claim that ORG breached the terms of the Tariff Order. These are:

- that the X factors were calculated with regard to the specific costs of distributors (rather than external variables) to ensure that each distributor's rate of return is at a fixed level in 2001 and expected to be at the same level in 2005; and

- that an efficiency carry-over is provided to some distributors which rewards them for past improvements in efficiency, a measure that would be unnecessary if the X factors were calculated solely on the basis of external factors.

We deal with the second of these claims in our direct tests of the Determination below. The first claim needs to be considered prior to the implementation of our tests, however. This claim, which finds its strongest support in the affidavit by Kaufmann (2000), implies that the ORG should have set X without reference to the costs of the regulated firms. It is quite wrong in three distinct respects: Previous costs are relevant to setting the X factor; the costs of individual regulated firms are relevant; and the Tariff Order requires regard to be had to firm level costs. We now establish these points separately.

Previous costs are relevant

The regulatory economics literature contains many heuristic discussions about how to set the X factor, but very little formal guidance.[21] A notable exception is the theoretical treatment of the selection of X presented by Bernstein and Sappington (1998), who derive the following basic rule:

> *"…the X factor should reflect the extent to which the regulated industry has historically achieved higher productivity growth and faced lower input price inflation than other industries in the economy…"*

Thus, the future time path of prices is set with reference to past performance.[22]

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[21] Writing in 1983, Professors Beesley and Littlechild argued that setting the "X" factor would be relatively simple for ".. the level of X would, in practice, be the outcome of negotiation between BT and the government; an exhaustive costing exercise is not called for". As noted above, such an approach would be quite inconsistent with efficient regulation (which invariably requires that the regulator make some investment in reducing the firm's relative information advantage) and of course bears no relationship to what regulators (including Professor Littlechild) subsequently did. Rather, regulators have devoted substantial resources to the task of setting X.

[22] The term "productivity" here refers to "total factor productivity" or TFP, and is typically measured using an index. Thus, individual TFP values are meaningless and information is only gleaned from comparisons over time or across firms, regions etc. TFP indices are formed as the ratio of outputs to inputs, where each of these is a value weighted index. As costs are reduced, the input term falls relative to the output term, and the TFP index rises.

It should be acknowledged that many of the less formal statements of the factors that should be reflected in X happen to be consistent with this rule. For example, Armstrong et.al. (1994) and King and Maddock (1996) cite forecast changes in industry demand, input prices and underlying efficiency as being relevant. Like other lists derived from introspection rather than theory, this one contains a redundancy. In this case "forecast changes in industry demand" is redundant, because it is merely a component of expected productivity growth.[23]

Bernstein and Sappington go on to explain how the basic rule should be modified if any of four complicating conditions are present, these being:

    (i)   not all of the firm's activities are regulated;

    (ii)   structural changes in the industry are expected so past performance is less relevant;

    (iii)   the wider economy is not fully competitive; and

    (iv)   the regulated prices are a significant contributor to overall price inflation

The second of these conditions is the only one that weakens the link between past performance and the future level of X. Even in this case, however, past performance is seen as the starting point for the analysis.

There is another, perhaps more obvious, way of understanding the relevance of historical data. It is well known in the forecasting literature that the recent past typically provides the most accurate guide to the future. Thus, the most accurate estimate of the potential for productivity gains in the future will be formed with knowledge of the performance over the recent past.

Firm level costs are relevant

It has been suggested in the Amended Statement of Grounds that regulators using the price cap method should not consider the "specific costs of distributors" when setting the X factor. Rather, only "external variables such as changes in technology, demand and input supply prices" should have been used. This claim would only be true if all firms being regulated faced similar cost and demand conditions. Moreover, it is impossible to know whether this is so without considering the "specific costs of distributors".

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[23] Demand growth requires output growth, at least for regulated firms that are required to provide service. If costs rise proportionately, the TFP index will not change and the fact that demand is expected to rise will be irrelevant to the pricing of the firm.

To see why this condition is necessary, consider what would happen if it did not hold. To be concrete, suppose that one distributor was expected to gain many customers while another was expected to lose customers, through intra-state migration caused by changes in the location of industry, for example. In this case, these firms could have dramatically different potential for productivity gains, and this should be reflected in the X target each faces. Failure to do so will either damage the firm (in the event that the target is unachievably severe) or provide unnecessarily weak efficiency incentives. Exactly the same considerations apply in the event that distributors differ in their unit costs rather than the demand each faces. The most obvious way to see this is to note that the unit cost of service for an electricity distributor is heavily dependent on the number of customers served, so changes in demand cause changes in unit cost.[24]

Tariff Order requires consideration of firm level costs

In our opinion, it would not be possible to comply with clause 5.10 of the Tariff Order without having regard to the costs of each firm. The most obvious manifestation of this is in 5.10(d) which requires the ORG to have regard to the need to:

- *provide each Distributor with incentives to operate efficiently*
- *ensure a fair sharing of the benefits achieved through efficiency gains between customers and the Distributors;*
- *ensure appropriate incentives for capital expenditure and maintenance in the Distributor's Distribution Systems;*

The first of these provisions makes it explicit that ORG is to apply a form of incentive regulation that is effective at the level of each individual firm. As discussed above, information is the most significant constraint on the construction of optimal incentive contracts. In particular, information about each firm's cost is important if the objective is to provide each with incentives to operate efficiently. Benchmark targets derived from simple averages of industry costs are not sufficient, because if this were used to define the standard, those firms that are more efficient

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[24]   This point is hardly new or indeed controversial. Indeed, it was familiar to Bussing who, in distinguishing between the factors that should and should not give rise to allowable economic profits, discusses changes in load factors as an example of a factor which is not generally under direct managerial control (and hence should not give rise to allowable economic profits) at pages 163 and following.

than the industry average would be able to become less efficient while still meeting the targets. This would be a clear violation of 5.10(d)(i). The same considerations apply to more sophisticated ways of constructing performance yardsticks.[25]

The relevance of firm level costs is even more obvious in respect of the "fair sharing" provision in 5.10(d)(ii). To understand this, note first that any fair sharing rule must allocate some positive fraction of the efficiency gains to customers. Suppose there were only two firms, and the fair sharing rule specified that customers were to receive half of the efficiency gains with the other half going to the firm that achieved the gains.[26] In order to determine how much each firm should receive, information is required on the firm level efficiency gains. This in turn requires that the ORG has, at the very least, some estimate of the changes in costs for each. Thus, the requirement to have regard to fair sharing of efficiency gains means that the ORG must estimate costs at the level of the individual firm.

Finally, clause 5.10(d)(iii) also requires the ORG to have regard to firm level costs. To understand this, note first that this clause clearly refers to each individual Distributor. Secondly, the clause requires that the ORG recognise the need for maintenance of existing assets and investment in new assets, which are alternative ways of preserving the service potential of the relevant network. Though a "first best" approach to this problem would require the ORG to consider the extent to which capital and operating costs should be traded off (and would therefore require information on the relative costs of these), even a liberal interpretation of the ORG's role in respect of this clause would call for some understanding of firm level costs. For example, the annual maintenance cost of attending to line faults is likely to depend on a range of factors that vary across distributors, including the length of the network, the type of terrain covered, and customer density.

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[25] Weighted averages require even more firm level data than simple averages. Similarly, the estimation of a production frontier which would provide the most accurate performance yardstick is not possible without firm level data (this applies irrespective of whether one uses stochastic or deterministic methods to estimate the frontier).

[26] This last point is the only important assumption in this argument. If firm A is allowed to share in gains made by firm B, then gains can be averaged at the industry level and firm level cost data is not required. However, there is no apparent reason why inter-firm sharing should be permitted, and indeed this would be completely inconsistent with the requirement in 5.10(d)(i) to provide efficiency incentives at the firm level.

Incentives for Cost Reductions

We now turn to the application of the tests described above. These tests are necessarily couched in terms of the *effect* of the determination on the regulated firms. As discussed above, the objective of all forms of incentive regulation, including price cap (CPI-X) regulation, is to offer the firm an incentive to reduce costs. The *process* by which the regulatory constraints are designed, and which is emphasised almost exclusively by the Plaintiffs, is of secondary importance to the effect these have on the firm's incentives. This does not mean that the process followed by the ORG is completely irrelevant. Our point is simply that the principal tests of whether (and to what extent) efficiency incentives have been provided, must relate primarily to the impact the regime has on the firms, rather than on the way the parameters of the regime were set.

Thus, in deciding whether the Determination is consistent with the requirements of clause 5.10(a), it is sufficient to examine the rules which are contained within the Determination. Provided the effect of the Determination is that distributors have and retain significant cost reduction incentives, 5.10(a) is satisfied.

In our view, this is manifestly the case. There are three primary reasons for this view. First, the distributors themselves retain all benefits from cost savings for at least five years. They are what economists call the "residual claimants" on cost savings, and as such have a strong incentive to make these savings. Secondly, the Determination embodies significant incentives for providing adequate service quality, which would verge on being unnecessary unless the regime were a form of incentive regulation. Finally, the "efficiency carryover" ensures that these incentives are not substantially weaker towards the end of the 5 year period. We now elaborate on each of these issues in turn.

Distributors are Residual Claimants

Under the terms of the Determination, the tariffs that can be set by distribution businesses are controlled directly. The details of these controls are set out in Chapter 2 of Volume II of the Determination. In particular, clause 2.3.2 of that Volume presents the formula by which tariffs will be assessed. This formula is reproduced below:

$$\frac{(1+CPI_t)(1-X_t)(1+S_t)}{(1+S_{t-6})} \geq \frac{\sum\limits_{i=1}^{n} \sum\limits_{j=1}^{m} p_t^{ij} q_{t-2}^{ij}}{\sum\limits_{i=1}^{n} \sum\limits_{j=1}^{m} p_{t-1}^{ij} q_{t-2}^{ij}}, \quad i = 1,...,n; j = 1,...,m.$$

The tariffs of each distribution company enter into the "p" terms on the right hand side of this formula. The "q" terms on the right hand side are quantities sold under each tariff term (i.e. under each p), and these act as "weights" for averaging the tariff components (the averaging occurs over the i and j terms which represent different services and customer groups). The only difference between the terms on the top and bottom of the fraction on the right hand side is in the dating of the p and q terms. The top term is the weighted average of time t tariffs, and the bottom term is the weighted average of time (t-1) tariffs, with the same weights being used to calculate each of these averages. Thus, the right hand side can be interpreted as the percentage change in prices for a distribution company. If a company's prices were 3% higher this year than last year, the right hand term would be 0.03.

Now consider the left hand term of the formula. Here, the CPI term is the percentage increase in the consumer price index over the last year, covering all goods and measured across the eight state capitals (with minor modifications to reflect GST and transitional arrangements into the new regulatory period). The S terms, which are discussed further in the next section, represent the quality of service that the distribution business has delivered over the last year, and the X factors reflect productivity improvement embodied in the ORG's benchmarks. Thus, the left hand side provides the constraint on average price increases.

As discussed above, it is incumbent on the ORG to ensure that the productivity benchmarks reflected in X are not unreasonable. Hence, the ORG is obliged to consider past productivity gains along with unavoidable input price movements when setting X. The same is true of the service quality targets that are included within the S term: the ORG's objective is to set targets which it is reasonable to expect the distribution businesses to be capable of meeting.

Once the X and S are set, the constraints on distribution business tariffs are established for the next five years. There is nothing in the formula, or elsewhere in the Determination, that permits

the ORG to change the rules in the event that one or more distribution businesses earns substantial profits. Thus, if a distribution business can earn profits while remaining within the targets, those profits may be retained or distributed in any way. The only way a distribution company can generate such profits themselves is by reducing costs without breaching the service quality targets. Thus, the firms do have an incentive to reduce costs, because they are the residual claimants on the savings so generated.[27]

Finally, for the sake of completeness, we note that there is no constraint on the rate of return that the firm can earn under this Determination. Suppose, for example, that a firm found a way to deliver acceptable service with far less capital input, perhaps by inventing an electrical counterpart to wireless telephony. Under the terms of the Determination, any resultant increase in the return to invested funds is irrelevant. All that matters is whether consumers receive adequate service at a price consistent with the Determination.

Service Quality Incentives

As we have discussed above, the primary difference between rate of return regulation and incentive regulation (including by means of a CPI-X price cap) is that the firm's costs are reimbursed under the former but not under the latter. The fact that prices do not directly depend on costs under incentive regulation is precisely why this approach gives the firm an incentive to reduce costs. These cost reductions can, however, be achieved in two ways: by improving productivity; and/or by reducing service levels, since these are costly to maintain. As a result, *any* form of incentive regulation that concentrates solely on prices is vulnerable to the unintended consequence of declining service levels.

This is much less of a problem when rate of return regulation is used, because in this case the firm gains no direct advantage from cutting service levels.[28] Thus, one test of whether incentive regulation is in use is whether the regime pays explicit attention to service quality. This is, of course, a rather weak test. Even under rate of return regulation the regulator will likely want to

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[27] Unexpected increases in demand may also create profits for the distribution business, but from the firm's perspective demand is likely to be far less controllable than costs.

[28] Indeed, if service is capital-using (so that providing higher levels of service requires relatively higher levels of capital intensity), and the firm's expected rate of return exceeds its weighted average cost of capital, firms regulated by rate of return regulation can have incentives to "gold plate": that is, to supply too high a level of service.

monitor service quality, if only to ensure that this is not compromised through managerial slack (or made excessive through "gold-plating").

In the Determination at issue service quality is treated very explicitly, to the point of being embedded into the allowable tariffs through the S terms identified above. The definition of S is presented in clauses 2.3.8 to 2.3.10 of Volume II of the Determination. These clauses define S relative to three *target* measures of service quality across each of three customer groups. Effectively, S is the average change in the performance gap, measured across all nine targets with a lag of two years. Each performance gap is the difference between target and actual performance, defined such that under-performance is recorded as a negative number. The net effect is that if service quality performance is deteriorating, S is negative and prices must be lower than would otherwise be the case.

Thus, the Determination does not only provide firms with an incentive to reduce costs, it also offers an incentive to at least maintain service quality. The explicit incorporation of service quality incentives into the price cap reinforces our conclusion that the Determination is a form of incentive regulation and not rate of return regulation.

Efficiency Carryover

One of the most serious difficulties with the price cap variant of incentive regulation is that the strength of the incentives varies over the course of the regulatory period, which in this case is five years. This effect, which has been noted by several authors, arises because of the existence of a review date. Contrary to the suggestion in Cohen's (2000) affidavit, this effect has nothing to do with whether the regime begins with a p-nought adjustment to prices.

If the future were highly predictable, one might envision a regime in which the firm contracts to provide a specified level of service in perpetuity, at prices that follow some CPI-X formula. Such a contract would be very risky for both parties, however, which helps to explain why finite regulatory (*i.e.* implicit contract) periods are ubiquitous (and infinite regulatory contracts without review clauses unknown). It is generally explicit in the regulations, or sometimes in the enabling legislation, that the constraint settings will be reviewed between periods.

In the early years of the regulatory period, productivity improvements are largely profitable for the firm because it is not required to adjust its prices to reflect these gains. As the review date approaches, however, the incentives change, because the firm knows that the regulator will be looking at its potential for further productivity gains when considering the X factor to apply from the start of the new five year period. Thus, the firm reasons, if productivity gains are tapering off as the review date approaches, the regulator may be persuaded that the potential for improvement has declined, and will therefore set a low X.[29]

The Determination at issue addresses this problem explicitly with the intention of increasing the incentive for productivity gains as the regulatory period comes to a close. In our view, the provisions designed by the ORG do in fact have this effect. These provisions are described in chapter 5 of Volume 1 of the Determination, with additional details being available in chapter 6 of the Draft Determination. A brief explanation of the workings of the efficiency carryover will be useful.

As discussed above, detailed information about the cost and demand influences on the regulated firm's operations are relevant to the efficient setting of the price path embodied in any price cap regulation. In reaching its Determination in this case, the ORG used forecasts of both "sides" of the market – that is, of costs and demand. The cost side forecasts form the basis of the efficiency carryover, on the (we believe reasonable) assumption that the actual costs are largely within the sphere of managerial influence whereas the actual demand is not. If a firm reduces costs below the benchmark provided by the forecast, it is permitted to retain the cost savings for a period of 5 years. This means that all cost savings made in any 5 year regulatory period will be retained into the subsequent regulatory period.

The effect of this provision is to assure the firm that cost savings made in (say) year 4 will not be used by the regulator in deriving a p-nought adjustment at the commencement of the next regulatory period. Rather, the firm will be able to retain these savings until year 4 of the next regulatory period. This has the effect of increasing the incentive for productivity improvements towards the end of the regulatory period.

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[29] This is because the regulator is likely to give more weight to recent rather than more distant developments in forecasting future developments.

Benchmarking

An additional incentive for efficiency gains is provided by the use of benchmarking studies in deriving the parameters of the Determination. These studies, discussed in the Draft determination at section 5.1 and in Volume 1 of the Final Determination at section 4.1 and following, are used to ensure that the overall efficiency of the industry does not get out of line with efficient performance in other jurisdictions.

Differences relative to rate of return regulation

To further explain the reasons behind our view that the Determination is not rate of return regulation, we will briefly consider the following thought experiment. How would this Determination be different if the ORG had instead been instructed through the Tariff Order to impose rate of return regulation? In our opinion there would be at least two important differences:

- there would be no efficiency carryover; and
- there would be an "unders and overs" account.

The efficiency carryover is utterly inconsistent with rate of return regulation. If a distribution business finds a way to provide the same level of service with fewer costs, its profit rises. Thus, the rate of return on assets increases. Under rate of return regulation, such a firm could expect that its prices would be cut by way of a price review. If this were not done, the firm's rate of return would not be being regulated.

In the Determination at issue, the firm is permitted to earn the resulting higher rate of return for a minimum of five years, after which it *begins* to share the *subsequent* gains with consumers. There is no clawback of the super-profit collected by the firm during the first five years. Thus, there is no sense in which the firm's rate of return is regulated over this horizon.

A rate of return regime would replace the efficiency carryover with an "unders and overs" account that would operate in a broadly similar manner to those imposed by the NSW regulator on electricity distributors and on the rail track owner. In the case of the NSW electricity regulations, the companies are required to notify any excess revenues earned to the regulator within 30 days of the financial year end. Depending on the amount of the excess, various

remedies are specified, but in all cases the balance of the firm's unders and overs account attracts interest at the rate of 3 year Commonwealth Bonds. By this means, delays in refunding revenues to consumers are compensated through higher nominal refunds when the account is eventually brought into balance.

IV   CONCLUSION

In this case, the court was required to decide whether the form of regulation applied was, or was not rate of return. Our approach was to set out several reasonable tests which could shed light on this issue. These tests centred on the effect the Determination has on the incentives for productivity gains by the regulated firms. The stronger these incentives, the less the Determination resembles rate of return regulation.

Prior to applying this test, we explained why firm level costs, including historic costs, are relevant to the efficient setting of a price path, such as is required by price cap regulation. Then, considering the Determination explicitly, we argued that this is a form of incentive regulation, and hence is not rate of return regulation, for three reasons. First, the firms are the residual claimant on their cost savings. Second, the ORG has considered it necessary to offer firms a financial incentive to maintain service quality. Finally, the efficiency carryover ensures that these incentives do not weaken substantially towards the end of the regulatory period, as is commonly the case in more standard price cap regimes.

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