

**CHARACTERISTICS OF ALTERNATIVE PRICE CONTROL FRAMEWORKS:
AN OVERVIEW**

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1. Introduction

This paper presents a preliminary and high-level overview of different approaches to price regulation that have been identified in the relevant literature and applied in practice. Its purpose is to present a basic outline of the different features of alternative price control frameworks which could be of relevance to the RPI-X@20 review. Accordingly the review is not intended to be an exhaustive survey of the theory and practice associated with each approach, nor does it present any views as to the likely applicability of any of the approaches for the future regulation of GB energy networks.

As a preliminary point it is important to recognise that there is substantial variety in the form of price control arrangements applied across different jurisdictions and within different regulated sectors. No single or dominant approach can be observed, with most implementations representing hybrid approaches that combine various elements of the ‘standard approaches’ (such as rate of return or price cap arrangements) with adaptations to address specific issues in individual contexts.¹

Such variation in the observed forms of price control arrangements make comparison exercises inherently difficult. Nevertheless, for the purposes of exposition it is useful to begin by discussing the standard forms of price control arrangements – namely traditional rate of return regulation and ‘pure’ price-caps – and use this as a basis to examine the different areas, or dimensions, of choice within these frameworks.²

The principal focus of this paper is on the underlying principles associated with each approach. A separate paper, by Cambridge Economic Policy Associates (CEPA) considers the range of approaches that have been implemented in practice. In the discussion that follows the key properties of each of the different price control frameworks is described, including the incentive features of that approach. Some of the major advantages and disadvantages associated with each approach are discussed, and finally, consideration is given to the economic settings in which the specific approach is likely to be most suitable.

¹ For example, even though it is common in theoretical work to contrast the rate of return (or cost-plus) approach with the price-cap approach, the differences between these frameworks, in practice, may be much less significant than the standard models might suggest. See, for example, P Joskow ‘Incentive regulation in theory and practice: Electricity distribution and transmission networks’ (MIT Center for Energy and Environmental Policy Research Working Paper 15 August 2007) pages 58-59.

² The relevant dimensions over which a framework can differ include: the length of period between regulatory reviews (or regulatory lag); whether maximum prices are set on the basis solely of the costs of the supplier or are linked to exogenous factors (such as price indices); the specific way in which maximum prices are capped; the way in which any productivity gains (X) are determined and shared among suppliers and consumers; the approach to the assessment of future capital expenditure; the treatment of past capital expenditure and whether a regulated asset base is maintained or assets are revalued periodically; and, finally, the extent to which past productivity gains are reflected in future prices (ratchets or resets).

2. The standard typology

2.1 Rate of return regulation

(i) Description of approach

At one extreme of the spectrum of price control arrangements is ‘traditional’ rate of return regulation (a form of cost-plus regulation). In very general terms, rate of return regulation allows a regulated supplier to recover the aggregated costs associated with providing a set of regulated services, including an allowable rate of return on a regulated asset base. Traditionally, this assessment is conducted on the basis of an estimate of the costs and demand associated with a recent historic ‘test’ year.³ In effect, the supplier submits to the regulator information about consumer demand and its estimate of the total operating expenses and capital costs (including a post-tax return on investment) of supplying the relevant services in that test year, which amount may be passed through to consumers in the prices charged.⁴

The determination of allowable costs, and the setting of regulated prices, proceeds in three stages under this approach.⁵ First, the set of products or services to be supplied is determined, and, in most cases, ranges are estimated for the likely volumes of supply. Second, given these expected volumes, the costs of supply are estimated. These costs include a reasonable return on capital within the category of capital costs. Finally, prices for the provision of the regulated services are set in such a way such that prices and costs are closely aligned. This does not mean that each individual price must reflect the specific costs of providing that service, and in practice, the regulated supplier may be given some discretion in setting individual prices subject to the condition that in aggregate it recovers no more than a predetermined return.

(ii) Advantages and disadvantages

A primary benefit of this price control approach is that it ensures that prices will always closely reflect the given level of costs associated with supplying the relevant services which, in principle, should promote allocative efficiency. In addition it is argued that rate of return regulation may be more effective than other price control approaches in attracting capital investment in a regulated sector because investors are effectively guaranteed the recovery of their operating and investment costs. In doing this, however, pure rate of return regulation

³ Conceptually this could be either a historic test year or a forecast test year. However, in most implementations, the assessment is based on a historical annual “test year” cost of service. These estimates may take into account future changes in inflation or any expected and measurable future changes in costs.

⁴ In cases where known changes in costs have occurred in the historic test years used in previous rate hearings, adjustments can sometimes be made to account for these changes at the time of the next rate assessment. Although this is not necessarily always the case.

⁵ A Kahn *The Economics of Regulation* (MIT Press 2nd edition 1988) 26.

effectively shifts the capital risks from the regulated firms to consumers (which can lead to incentives for over-investment as noted below).

It is well recognised that there are a number of potential disadvantages/difficulties associated with the 'pure' rate of return approach. Firstly, in the situation where a regulator has very limited information about a supplier's costs, or is unable to confidently audit the estimates of the supplier's actual costs, the supplier may be able to misrepresent its costs. This can lead the regulator to set prices that are too high, which can work against allocative efficiency gains. In addition, even where a regulator has good measurement and auditing processes in place, this type of approach, in its traditional form, can dampen the incentives for firms to reduce costs, or to innovate over time. This is because any benefits from improvements in efficiency, or from innovation, are quickly passed on to consumers through the pricing mechanism, minimising the reward for the supplier. Finally, traditional rate of return regulation can, it is argued, lead to incentives to over-invest in assets and facilities.⁶ The reason for this, again, is the close relationship between costs and prices; a supplier has weak incentives to be prudent in its investment choices if any capital costs associated with supplying services will automatically be reflected in final prices.

As discussed below, these disadvantages/difficulties have been partly addressed in some implementations of rate of return regulation by: ensuring that the value of the regulated asset base is determined on the basis of efficient costs; extending the length of the regulatory period in between reviews; and by disallowing operating costs assessed as not having been efficiently incurred.

(iii) Issues to consider

In general, this type of regulation tends to be best suited to regulated sectors where limited cost (productive) efficiency gains are possible. In addition, in economic settings where the regulator is able to obtain sufficiently accurate and detailed information about costs and future consumer demand, rate of return regulation can, in principle, allow the regulator to set close to efficient tariff structures. It follows that traditional rate of return regulation is unlikely to be as effective as other forms of price control arrangements in economic settings where either; (a) the existing suppliers are not considered to be fully efficient; or (b) where, the industry being regulated is itself 'dynamic' and is subject to rapid or significant change, such as demand or technological change.

In practice, variants of rate of return regulation have been employed in a range of regulated sectors across a number of jurisdictions, most notably in North America where it has been applied to electricity and natural gas transmission and distribution suppliers. These jurisdictions have typically made adaptations to the approach to address the type of issues

⁶ The so-called 'Averch-Johnson' effect: H Averch and LL Johnson 'Behavior of the Firm under Regulatory Constraint' (1962) 52 American Economic Review 1059-69.

identified above with the traditional form. For example, in the United States, prices are not typically continuously and automatically linked to a firm's costs. Rather, the prices are set in hearings on the basis of audited estimates of the capital and operating costs and an estimate of the cost of capital. The base prices which are determined on the basis of these costs are then effectively fixed until they are reviewed by the regulator again. In addition, the period between reviews – or regulatory lag – is often a period extending beyond a single year and can be several years. This introduces an incentive aspect into the rate of return framework as the prices for services are effectively 'fixed' for a specific period, allowing suppliers to benefit from any cost decreases during that period.

2.2 Price-cap regulation

(i) Description of approach

At the other extreme of the spectrum of price control arrangements are price-cap (or revenue-cap) forms of regulation.⁷ In very general terms, price cap regulation involves the regulator setting a maximum allowable average price (or revenue) path for a set of relevant services for a specified period, which to some degree is independent of the actual costs associated with the provision of those services. In its simplest form, the regulator establishes the rules for the price path in advance, and movements in these prices are then typically adjusted according to movements in exogenous variables such as movements in general inflation (RPI) and an assumed rate of productive efficiency growth (X). The value of X is set by the regulator to reflect potential savings of the supplier as a result of increased efficiency or as a result of technological progress.⁸

The key generalised aspect of price cap regulation, and one that distinguishes it from traditional rate of return regulation discussed above, is that average prices are set so as to be independent of the *controllable* costs of the supplier for a significant period of time.⁹ At the end of this significant period of time – assuming that the relevant services are still subject to price regulation – the regulator may make an adjustment to initial prices to reflect any changes in underlying costs (a so-called Po adjustment) and will also reset X as part of the continuing regulatory process. The basis on which X is reset is within the discretion of the regulator and a range of factors can influence this decision as to what value X is set at, including: past

⁷ Revenue cap regulation and price-cap regulation are conceptually similar, the principal difference being that in the former the level of revenue is adjusted by an efficiency factor.

⁸ In some implementations a 'K' factor has also been employed to allow the supplier to increase its maximum allowed prices at a rate faster than RPI, for example, RPI+K systems in the water sector.

⁹ This does not mean that prices are fixed during the regulated period. In RPI-X approaches, for example, prices are indexed to movements in *non-controllable* changes in the rate of inflation. In other implementations, elements of costs deemed to be beyond the influence of the supplier can also be incorporated into price changes (such as in RPI - X + Y approaches).

efficiency performance; the need to finance future investments and expected changes in growth and earnings.¹⁰

A consequence of this approach is that the prices for supplying a service at any one point may not be directly linked to the costs associated with providing that service at that point in time. Although there is no set ‘significant period of time’ over which prices are set under this framework a typical period in the energy sector is in the order of five years. The actual prices of different services are rarely specified by the regulator under this approach. Rather, suppliers are typically given a degree of flexibility to set prices which, in aggregate, allows for the recovery of an amount which satisfies a predetermined specific revenue requirement, or, as determined by an assumed basket of prices for different services. In practice, however, some constraints on the setting of relative prices have been introduced – so-called price sub-caps – to prevent undue discrimination in pricing.

In settings where a supplier provides both access and retail services it has been suggested that a form of ‘global price cap’ may be most appropriate.¹¹ In general terms, a global price cap imposes a price ceiling set for a weighted-average basket of access and retail services and the supplier retains the discretion to set access and retail prices subject to this overall constraint. Consequently, no distinction is made under this approach between the access product and the retail product and, it is argued, that it is this property that will encourage the supplier to develop a structure for access and retail prices which can, under certain assumptions, be efficient.¹² However, the potential also exists under this pricing framework that the substantial discretion of the supplier to determine both access and retail prices can, in some circumstances, result in predatory pricing (such as a margin or price squeeze).

Types of price-cap regulation

It is widely recognised that the particular basis on which the price-cap is determined — total revenue, average revenue or weighted average revenue—can have important effects on the incentives of a supplier to: reduce costs; set efficient tariff structures; expand demand and improve the quality of supply. There are four main types of price cap regulation that have been applied in practice.

¹⁰ ME Beesley and SC Littlechild ‘The regulation of privatized monopolies in the United Kingdom’ (1989) 20 RAND Journal of Economics 457-460. In addition, it has been suggested that factors such as the value of existing assets, the cost of capital and the progress of competition are relevant when X factors and other licence conditions relating to pricing are reviewed: M Armstrong and S Cowan and J Vickers *Regulatory Reform: Economic Analysis and British Experience* (MIT Press Cambridge Mass.1994) 174, 182-183.

¹¹ JJ Laffont and J Tirole *Competition in Telecommunications* (MIT Press reprint 2001) 174.

¹² The relative efficiency of the pricing structure will depend, among other things, on whether in determining the level of the global price cap the regulator can accurately set the weights to be applied to forecasted services supplied, and are actually based on the realisations of output.

The first type is where a supplier's total revenue is capped *ex ante* such that the revenue that may be earned is constant, and is independent of fluctuations in the quantity supplied. The allowed revenue is therefore always equal to expected revenue at the time the price control is set. Consequently, under this approach, the risks associated with demand volatility fall largely on consumers, and suppliers with significant fixed costs are effectively protected from demand volatility risk: prices tend to rise when demand is falling and decrease when demand is rising, an outcome similar to that of pure rate of return regulation. Given the nature of this form of price-cap arrangement a supplier may have perverse incentives to reduce the volume of sales and degrade the quality of services (insofar as costs are linked to demand). In addition, in order to induce a reduction in demand, a supplier may have incentives to set inefficient price structures by setting prices above marginal cost on the most elastic services.¹³

An alternative approach is to cap the average revenue of a supplier by setting an allowable revenue per unit of "output" *ex ante*.¹⁴ Although the *average* revenue per unit is capped under this approach, the amount of revenue that is actually earned on each individual unit of output is not, and, as a consequence, the (positive and negative) risks associated with demand volatility fall on the supplier: if demand is lower than expected when the average unit price is set some fraction of fixed costs will not be recovered by the firms, conversely, where demand is higher than expected, the supplier will over-recover relative to its fixed costs. So, for example, in the event that actual demand is *greater* than that expected at the time the price control is set, a supplier will earn higher profits than anticipated. Under this approach a supplier therefore has clear incentives to expand demand beyond that forecast by the regulator at the time the price cap is set. Consequently, the supplier may have incentives to increase the quality of services offered to high-demand customers only, or similarly, may have incentives to set tariffs in such a way so as to encourage greater usage by high-demand customers (including by setting inefficiently low prices).

The third type of price-cap combines the total revenue and average revenue approaches into a 'mixed' or 'hybrid' cap which allows for both fixed and variable revenue constraints. Under this approach a supplier's final revenue is a function of a few important fixed and variable revenue drivers, including the total quantity of output, but also other factors.¹⁵ The mixed cap therefore differs from the average revenue cap in that it introduces additional drivers of revenue apart from the expected level of output, and in so far as it allows the revenue constraint

¹³ S Stoft 'Revenue caps vs. Price caps: Implications for DSM' in 4-2 in G. A. Comnes, S. Stoft, N. Greene and L. J. Hill *Performance-Based Ratemaking for Electric Utilities: Review of Plans and Analysis of Economic and Resource-Planning Issues - Volume I* (Energy & Environment Division University of California, Berkeley) November 1995.

¹⁴ The 'output' measure used can vary across sectors. In the electricity sector, for example, it has generally been measured in terms of MWhs of electricity supplied. In other sectors, such as in relation to airport charges the 'output' measure has been on a per passenger basis.

¹⁵ When applied to transmission or distribution companies this might include factors such as the number of customers or the number of miles of transmission/distribution coverage.

to potentially incorporate fixed revenue components as well.¹⁶ The amount of revenue that is actually earned under this approach will depend on the form that the revenue function takes, and in particular, on whether the parameters are set in such a way so that the marginal revenue closely approximates the marginal cost of each unit sold. So, for example, if the parameters are set such that marginal revenue from each unit sold closely approximates the marginal cost of supplying that unit then the supplier will recover an amount which approximates that expected at the time the price control is set.¹⁷ It follows that under this approach the incentives to expand demand, increase the quality of services and set efficient tariffs will depend on how the marginal revenue is determined, and in particular, the difference it creates between the marginal revenue and marginal cost for the services supplied.

Finally, under a weighted average price cap approach the allowed price increases are ‘capped’ on the basis of a weighted average price for the supply of a basket of services. Under this approach the amount of allowable revenue is typically calculated by applying the quantities of services supplied in the previous year to an expected demand for that service in the current period. Once this weighted average price is established the supplier has complete discretion to determine the individual prices for its different services subject to an overall average price constraint. The feature that distinguishes this approach from the other forms of price cap discussed above is that it establishes a link between the (disaggregated) marginal revenue from a particular service and the price of that service. On this basis it is argued that, in principle, a weighted average price cap approach will result in efficient price structures emerging as suppliers will have incentives to set prices at close to marginal cost for elastic services, and charge higher prices for inelastic services.

(ii) Advantages and disadvantages

It is argued that there are two immediate benefits associated with price cap approaches as compared to rate of return regulation. First, through detaching average prices from costs for a specified significant period of time, price-cap regulation gives strong incentives for suppliers to improve cost efficiency, as until the time that prices are next adjusted, any reductions in the costs of the supplier will translate directly into higher profits. Second, price cap approaches can allow for the risks associated with demand and cost changes to be borne to a greater extent by the supplier, although precisely how this risk is shared depends on the form of the price-cap arrangements (as discussed above).

¹⁶ The effects of the mixed cap on supplier behaviour will generally lie somewhere between the those described above under the total revenue cap and average revenue cap approaches, and will depend on how the demand volatility risk is shared between customers and suppliers as reflected in the weights given to the two constraints.

¹⁷ However, if the parameters are set such that marginal revenue set is *greater* than marginal cost then the supplier will recover an amount greater than that anticipated at the time the price control was set (assuming that the expected level of demand is satisfied).

There are, however, a number of recognised disadvantages/difficulties associated with ‘pure’ price-cap regulation. Among the most significant of these is that such regulation can create incentives for suppliers to reduce or degrade the quality of service relative to rate of return regulation.¹⁸ In simple terms, this is because, within this framework, suppliers can reduce costs – and increase their profits for a given level of revenue – by offering a lower quality of services to customers. In addition, the price-cap approach can provide inappropriate incentives for firms not to reduce costs toward the end of a regulatory period.

Price-caps may also reduce incentives for investment. Specifically, if a supplier is uncertain as to whether or not it will be able to recover efficiently incurred costs, including a return on capital, associated with any investments made when prices are re-set this can act to dampen the incentives for infrastructure investment.¹⁹ Finally, it has been argued that some forms of price-cap regulation have disadvantages in terms of allocative efficiency, as they do not allow cost changes to be quickly reflected in price changes. While in principle this is correct, the expected significance of this effect will depend on the specific characteristics of the services being provided.²⁰

(iii) Issues to consider

In practice, the limitations associated with price-cap approaches have been recognised by some regulatory authorities and measures have been introduced which focus on: ensuring that a particular level of quality of service is defined and monitored and incentives are introduced so that these performance standards are met; the use of various rolling or glide-path mechanisms to ensure that suppliers have constant incentives to reduce costs over time; the introduction of measures and procedures whereby the regulator pre-commits to reward appropriate investments over time. So, for example, many price cap mechanisms now incorporate quality and performance standards which allow for a supplier to be rewarded for exceeding (or penalised for failing to satisfy) these performance standards.²¹ Likewise, to ensure that suppliers have

¹⁸ On this point see the exposition of ‘second-best’ relationship between rate of return regulation and product quality in M Spence ‘Monopoly, quality and regulation’ (1975) 6 *Bell Journal of Economics* 417.

¹⁹ There are two aspects to the reduced incentives for investment relating to the *timing* of when any investment is undertaken, and the incentives to undertake any investment at all. Both aspects depend critically on the credibility and nature of the regulatory regime. For example, if a supplier is concerned about extreme regulatory opportunism, and specifically that any sunk investment undertaken will be disallowed entirely at the time of the next price review then it will obviously have very limited incentives to undertake investment of any form. Alternatively, in less extreme circumstances, the supplier might simply decide to delay investment until the regulator credibly demonstrates that it will allow for the recovery of past investments undertaken. For a more general treatment of these issues see G Guthrie ‘Regulating Infrastructure: The Impact on Risk and Investment’ (2006) 44 *Journal of Economic Literature* 925–972.

²⁰ In particular if the overall elasticity of demand for different services is relatively low then the effect is expected to be small, especially if the structure of prices reasonably reflects the structure of costs.

²¹ PL Joskow ‘Incentive Regulation and Its Application to Electricity Networks’ (2008) 7 *Review of Network Economics* 555.

constant incentives to improve efficiency over multiple regulatory review periods some implementations of price caps have incorporated ‘glide paths’ that allow for the supplier to retain a (decreasing) proportion of any efficiency gains in one regulatory period in the following regulatory period.

In sum, most price cap mechanisms implemented in practice have evolved to combine the various elements discussed above with aspects of traditional rate of return regulation, benchmarking or yardstick approaches, and other more specific incentive mechanisms.²²

²² For example, it is generally the case that some form of cost-based approach (similar to that used in a rate of return review) is used to determine the efficient level of costs on which to base the initial set of prices (or P_0). In addition, in many implementations, the approach to the determination of future capital costs is generally based on a traditional rate of return approach. See, for example, P Joskow ‘Incentive regulation in theory and practice: Electricity distribution and transmission networks’ (MIT Center for Energy and Environmental Policy Research Working Paper 15 August 2007) pages 32.

3. Variations of the standard typology: hybrids

The standard typology of traditional rate of return and pure price-cap regulation represent two ends of a spectrum of possible price control frameworks and, in practice, the forms of price setting observed tend to lie somewhere between these two end-points, and many approaches combine elements of both. At a general level, this reflects the fact that regulators have had to address various trade-offs regarding: the appropriate allocation of risk; quality of service considerations; information asymmetries; and appropriate cost sharing arrangements.

In some circumstances, where there have been distinctive features of the regulated sector, or particular areas of concern regarding the economic setting in which prices are being regulated, a number of specific adaptations have been made to the standard approaches. The most important of these are discussed briefly below.

3.1 Yardstick and benchmarking approaches

Yardstick competition is an approach to the setting of regulated prices that links the prices charged by one supplier to the performance of other similar suppliers. There are two general variations of this approach: full yardstick performance competition and partial yardstick reporting or benchmarking approaches.

According to full yardstick competition each supplier has no control over its prices as these are determined on the basis solely of an index of the performance of other suppliers. As implemented in practice, this approach typically involves the *ex ante* estimation of a productivity change for the sector as a whole, which is then compared to the actual productivity for each supplier at the end of the regulatory period. Any difference between the anticipated sector-wide productivity change and a given suppliers' productivity is automatically reflected in the prices that the supplier can charge in the subsequent regulatory period. This approach is seen to mimic the operation of competitive markets whereby the performance of any one supplier is relative to the performance of other suppliers in undertaking the same activities.

In practice, a yardstick approach has also been applied in a more partial benchmarking manner, particularly as part of comparative exercises when estimating the possible productivity gains (X) in price cap type approaches where there are a number of comparable suppliers which allow for some form of statistical comparison. When used in this way the maximum allowable prices that a firm can charge is determined, in part, on its performance (in terms of indicators such as operating costs and quality) relative to other suppliers in the sector.²³ This relative performance information is used in setting the initial values of maximum prices (Po) and in the determination of the future path of prices (X) so as to encourage improvements in cost efficiency and performance, particularly for the least efficient suppliers, over time.

²³ In some implementations the performance of a particular supplier is benchmarked against various broader productivity measures of the performance of the general economy, for example, the total factor productivity approaches.

It is well recognised that benchmarking approaches are most suited to economic settings where suppliers are sufficiently similar in terms of the services offered and where they face similar cost and demand conditions.²⁴ Such an approach is still possible in less symmetrical environments, but for it to be effective it is necessary that suitable adjustments are made to account for differences between the suppliers operating environments. The information requirements associated with benchmarking approaches can be substantial and the data required to perform the relevant analysis effectively is not always available. Where reasonably accurate information can be obtained, benchmarking or yardstick approaches can provide strong incentives for efficient performance. However, even in settings where such detailed information are not available, it is argued that some form of relative comparison of supplier performance can still act as an incentive for improvements in supply provision.

3.2 Profit-sharing, error-correction mechanisms and sliding-scale approaches

Where a regulator is likely to be at a substantial information disadvantage as compared to a supplier it is sometimes argued that so-called ‘sliding-scale’ or ‘profit-sharing’ mechanisms may present an appropriate regulatory framework.

Profit-sharing approaches

Broadly speaking, under these approaches the rate of return that the supplier can earn within a period is ‘bounded’ in some way to the observed changes in actual variables (such as costs), and adjustments can be made to prices *within* that period to ensure that the rate of return lies within the bounds of a target rate of return. So, for example, should the supplier’s earnings exceed the upper bound of a predetermined rate of return, it will be required to automatically reduce its prices within that regulatory period (and conversely increase prices should its profits lie below a predetermined floor). In this way, profit gains (and losses) are more readily shared between the supplier and the consumer. It is argued that such mechanisms offer an intermediate option to that of traditional rate of return regulation and pure price-cap approaches insofar as they can provide incentives for cost reduction, and at the same time, ensure that prices track underlying cost movements within a reasonable band.²⁵

Error correction mechanisms

A related initiative involves incorporating ‘error correction mechanisms’ into price control arrangements. In very simple terms, these correction mechanisms allow for automatic within period adjustments to prices to reflect changes in the value of underlying exogenous variables, for example, to reflect unanticipated changes in demand and cost variables within the

²⁴ A Shleifer ‘A theory of yardstick competition’ (1985) 16 RAND Journal of Economics 330.

²⁵ TP Lyon ‘A model of sliding-scale regulation’ (1996) 9 Journal of Regulatory Economics 228.

regulatory period that are beyond the control of the individual supplier.²⁶ Such a mechanism allows for these exogenous changes to be passed-through to final prices within the regulatory period.

Sliding-scale approaches to capital expenditure

At a general level, it has been argued that one way to address the information asymmetry between a regulator and suppliers is to present each supplier with a range, or ‘menu’ of regulatory contracts which contain different profit-sharing possibilities, and that this approach will be more efficient than providing only a single regulatory contract.²⁷

A specific application of this approach can be seen in relation to the assessment of the future level of capital expenditure, an area of recurring difficulty under various price control arrangements. This is a common area of contention between regulatory agencies and suppliers, and substantial differences can arise between a supplier’s assessment of the required level of investment and a regulator’s assessment. In addition, suppliers may have incentives to over-estimate or inflate their expected capital expenditure when a price control is being set, and then subsequently ‘underspend’ on the target level of expenditure during the price control period.

To address this issue, some price control frameworks have introduced a menu-based, or sliding-scale, approach to determining the required level of capital expenditure.²⁸ In broad terms, regulated suppliers are offered a choice among a ‘menu’ of different regulatory contracts when the price control is being set, with each contract featuring different combinations of capital expenditure and with returns on investment linked to whether the supplier meets its target level of capital expenditure. For example, a supplier can choose a contract that features low levels of capital expenditure but allows for higher expected return on investment if they beat their expected target investment levels. Alternatively, a supplier can choose a contract that provides for high levels of capital expenditure but with a correspondingly lower share of any difference between actual and target spend levels.

²⁶ Specific examples noted in the literature include the effect of changes in temperature on demand in gas or changes in labour costs attributable to general changes in sectoral wage price indices. See C Mayer and J Vickers ‘Profit-sharing regulation: an economic appraisal’ (1996) 17 *Fiscal Studies* 13.

²⁷ In particular, the regulator should discriminate between different types of firms on the basis of their relative efficiency; an efficient supplier should not be offered the same regulatory contract as an inefficient firm. JJ Lafont and J Tirole *A Theory of Incentives in Procurement and Regulation* (MIT Press 1st edition 1993) 40.

²⁸ Sliding-scale or menu approaches have also been applied to other aspects where there is a substantial information asymmetry between a firm and the regulator. For example, in the incentive mechanism that has been applied to the costs of system balancing services and system losses for transmission system operators.

3.3 LRIC-type approaches

In regulated industries subject to rapid and significant technological change, the price control framework has allowed for prices to periodically adjust to reflect the costs associated with a hypothetical efficient supplier. The underlying logic of this approach is that, in basing prices for different services on estimates of the forward-looking long-run incremental cost associated with these services (including the most currently efficient technology and an optimally configured network), this will provide efficient signals to new entrants. This approach is most common in the regulation of telecommunications services and is based around the notion of some variant of forward looking, or total, incremental cost of providing a set of services.²⁹

In practice, the general approach to estimating the forward looking long-run incremental cost is broadly similar to the other approaches described above in that the allowable prices are determined on the basis of the expected operating costs and capital costs associated with supplying the services over the long-term. There are, however, some important differences.

First, unlike the standard implementations of the rate of return or price-cap frameworks, no regulatory asset base or regulatory asset value is maintained over time. In effect, the asset base of the supplier is re-valued at the time of each and every price review. The primary argument for the adoption of this approach is that it provides the appropriate entry and investment signals, and that, given the likelihood for technological change in the sector which can significantly alter costs and demand, there is the need to continually reflect the current replacement value of the assets at each time a price review is undertaken so as to encourage efficient investment choices. A second difference is that unlike most implementations of price-cap regulation the regulator typically determines the prices for different services directly on the basis of estimates of the incremental costs associated with providing such services (including an allowance for joint and common costs). An important consequence of this approach is that a supplier has less discretion to determine the structure of prices for the various services it provides, with the result that the price structures are effectively determined by the regulator. Finally, other areas of difference between ‘LRIC’ type approaches and the approaches discussed above can include: the requirement that the regulator reconfigure and optimise the network at each and every price review; and the limited use of specific incentive mechanisms within this framework to improve cost efficiency and service quality.

The principal advantage of LRIC-type approaches (as described above) is that, in settings subject to substantial and rapid changes in costs and demand these approaches should, in principle, promote efficient infrastructure investment decisions on the basis that prices will continually reflect the current costs (including the replacement value of the assets) of supply.

²⁹ Variations include Forward Looking Long-run Incremental Cost (FL-LRIC); Total Element Long -run Incremental Cost (TELRIC); and Total Service Long-run Incremental Cost (TSLRIC). Related approaches that have been adopted in practice involve the use of forward-looking current cost estimates associated with providing a set of services.

On the other hand, it is often observed that in practice such an approach provides significant discretion to the regulator who is required to employ a range of assumptions and judgements in order to continually estimate the prices associated with services.³⁰ Moreover, where there is substantial uncertainty as to how the regulator will exercise this discretion it is argued that this can have the effect of acting as a disincentive for new investment and innovation.

³⁰ Laffont and Tirole note for example note that ‘This broad regulatory consensus in favour of LRIC unfortunately is supported by little economic argument. As a matter of fact, an economic analysis reveals several concerns about the whole endeavour’ JJ Laffont and J Tirole *Competition in Telecommunications* (MIT Press reprint 2001) 148-149.

4. Conclusions

The purpose of the above review was to briefly describe and consider the key attributes of the different price control frameworks that may be relevant to the RPI-X@20 review. It is clear from this discussion that while there are some key similarities across the approaches, there are also important differences which can impact on the appropriateness of each approach for specific economic settings.

This section briefly summarises how the approaches compare to each other in relation to various aspects that are likely to be important in any form of regulatory arrangement (these points are summarised in Table 1 below for traditional rate of return and pure price cap approaches).

- Significant differences can be seen in the types of cost and demand information that is required in setting price controls under the different frameworks. In particular, while traditional rate of return regulation uses historical information, other approaches such as pure price caps or LRIC-type approaches use forward looking estimates of changes in expected demand and costs.
- Approaches differ in the extent to which supplier specific information is used when resetting prices. Traditional rate of return regulation generally only has regard to factors endogenous to the supplier, while pure price caps will refer to changes in exogenous indices outside the control of the supplier. Yardstick approaches will typically refer to changes in overall sector performance, while LRIC-type approaches will include in an assessment changes in technology and underlying asset values.
- There is a clear difference across the approaches in the incentives they present for infrastructure investment. As is well recognised, traditional rate of return regulation can potentially provide strong incentives for prudently incurred investments. However, in some settings, this form of price regulation can lead to incentives for over-investment in assets and facilities. On the other hand, pure price cap regulation and LRIC-type approaches can provide more limited incentives for infrastructure investment in settings where substantial uncertainty exists as to whether the costs associated with such investments can be recovered.
- The incentives for cost efficiency and innovation differ across price control frameworks. In particular, pure price cap regulation can provide strong incentives for ‘within period’ cost reductions and short-term innovation. Similarly, it is argued that yardstick or benchmarking approaches provide strong incentives for cost reductions. There are generally more limited incentives for cost efficiency (including incentives to

innovate to reduce costs) under traditional rate of return regulation and, it is sometimes claimed, under LRIC-type approaches.

- Differences can also be seen across the price control frameworks in how prices for different services are determined. Specifically, prices are generally set by the regulator under some forms of traditional rate of return regulation and under LRIC-type approaches, while under pure price cap approaches the supplier generally retains the discretion to set prices for individual services (subject to an overall or average constraint, and in some cases a price sub-cap).
- The allocation of risk between suppliers and users (and ultimately consumers) differ among the price control frameworks. Broadly speaking, traditional rate of return regulation generally allocates most of the risk associated with inefficient performance onto users and consumers. This is not the case for pure price cap approaches where the supplier is generally exposed to higher levels of risk. Sliding-scale or profit sharing mechanisms offer an intermediate option intended to distribute the risks more evenly between suppliers and users.
- Finally, the timing of the review of the price control arrangements differs across the approaches examined. Traditional rate of return approaches typically involve frequent reviews of price and costs, sometimes annual. Likewise LRIC-type approaches, as implemented, have tended to involve relatively frequent re-assessments of prices. On the other hand, a key feature of pure price cap approaches is that prices are set for a significant period of time.

In considering these observations it is important to recall that they refer to stylised price control frameworks, and as such may not accurately reflect how these arrangements have been implemented or applied in practice. The accompanying supporting paper from CEPA looks at lessons from approaches adopted in practice.

	Traditional rate of return	Pure price cap
Information used to set prices	Backward looking: based on a recent historical test year's cost and demand data.	Forward looking: based on expected future costs and demand.
Factors taken into account when resetting prices	Generally takes account of factors endogenous to supplier such as changes in costs and demand.	Within the discretion of the regulator, but will include reference to changes in exogenous indices beyond the control of the supplier and expectation of productivity improvement.
Incentives for Investment	Strong incentives for infrastructure investment provided it guarantees prudently incurred investments will be recovered. However, can create incentives for over-investment in some settings.	Can present limited incentives for long-term infrastructure investment where uncertainty exists as to whether costs will be recovered.
Incentives for Cost efficiency	Limited incentives to reduce costs as any reductions will automatically be reflected in lower tariffs at next rate hearing.	Strong incentives to reduce costs within the regulatory period as will increase the profits retained.
Incentives for Innovation	Limited incentive to introduce innovations that will lead to reduced costs (for reason given above).	Strong incentives for short term innovation insofar as it lead to cost reductions.
Incentives to Maintain or improve quality	Can provide incentives to improve quality where allows for higher allowed rates.	Generally, weaker incentives to improve quality where raises costs.
Market conditions in which it may be most suitable	Economic settings where it is expected that limited productive efficiency gains are possible.	Economic settings where there is limited need for substantial infrastructure investment.
Trigger/timing of price reviews	Reviews occur frequently (can be annual) or can be triggered by a supplier's desire to change rates.	Price cap set for a fixed 'significant period of time', frequently a period of five years.
Pricing flexibility	Individual prices can be set by regulator, or can be subject to an overall constraint.	Pricing discretion generally rests with the supplier, although sub-caps are sometimes used.
Allocation of risk	Generally rests with users, and ultimately consumers	Greater risk exposure (and potential reward) for supplier