Yardstick and Incentive Issues in UK Electricity Distribution Price Controls

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Abstract

Electricity distribution is a primary candidate for regulation since it is a natural monopoly whose costs it would be inefficient to duplicate in a competitive market. In the UK since privatisation of the electricity industry in 1990, this regulation has emphasised incentives for cost efficiency through the use of RPI–*X* price capping applied to 14 regional distribution businesses. The paper examines the issues that have arisen in implementation, including the practice of bench-marking the operating and capital expenditures of different companies. It analyses how the price set at the beginning of each review period depends on the determination of cost yardsticks, the weighted average cost of capital and the regulatory asset base of the companies. The analytical model is used to evaluate Ofgem's 1999 Distribution Price Control Review and compares it with other European distribution price regulations.

JEL classification: L51, L94.

I. INTRODUCTION

Incentive regulation and market liberalisation of electricity supply are spreading world-wide, having been pioneered in the UK (Pollitt, 1997). This paper takes up the UK story 10 years after the privatisation of the industry, in order to examine the regulatory issues that have emerged in the second phase of price control reviews, particularly as applied to the distribution sector of the industry. The 12

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distribution companies in England and Wales have been the primary focus of the evolution of RPI–*X* price-cap regulation and they have been regarded as benchmark cases for electricity regulation around the world. Distribution of electricity is frequently organised through regional monopoly franchises, and regulators are therefore naturally drawn to the idea of using yardstick comparisons in reviewing the price controls applying to such companies. In setting *X* factors for price caps, electricity regulators may wish to look outside the industry at national performance in multifactor productivity growth in order to determine the initial incentive mechanism, but, sooner or later, customer pressure is likely to draw attention to the performance of the companies themselves. Regulators must then be prepared to make efficiency and productivity comparisons amongst the companies and use these to determine how price caps will be adjusted. The ways in which this development has affected the regulatory price controls in England and Wales between 1995 and 1999 are the concern of this paper.

Substantial work has already been done in evaluating the success of the UK privatisation programme for electricity generation and transmission, notably by Newbery and Pollitt (1997). These authors find that the net benefits of privatisation of the Central Electricity Generating Board in England and Wales, including the effect of changing fuel mix on meeting environmental objectives, were significantly positive. Nevertheless, the final impact of electricity privatisation on consumers must equally reflect the consequences of regulatory incentives and network utility responses to these, since about 40 per cent of the final supply price of electricity arises in the regulated sectors of distribution and transmission.

This paper concentrates on the regulated segment of the price of electricity, covering, in particular, the distribution function of the electricity network services providers in England and Wales and the price control ideas that are outlined in Ofgem (1999a and 1999b). It begins by summarising briefly some ideas from the regulation literature, before examining the methods used by the Office of Gas and Electricity Markets (Ofgem) in arriving at the 1999 controls. The paper goes on to review the evidence on comparative efficiency and productivity performance, and examines Ofgem's own published work on this *yardstick* issue. It then reviews the decisions of Ofgem about the manner in which and speed with which the companies should implement the efficiency savings that Ofgem has identified. This is the *glidepath* issue in designing price controls.

II. REGULATORY THEORY AND THE FORM OF PRICE CONTROL

The essence of UK utility regulation remains the RPI–*X* price-capping model. To a certain degree, the choice of *X* at privatisation might seem less important than the switch to price capping *per se*, since it will usually represent the first opportunity for the utility to respond to incentives. However, this assumes too

readily that the interests of managers and shareholders are perfectly aligned. A lenient price cap may simply be taken by managers as a binding constraint rather than as a pure incentive. In fact, little attention has been given to whether the incentives in RPI–*X* regulation are as attractive to managers as they are to owners of the companies concerned.

RPI–*X* regulation is designed to combat the moral hazard of utilities' failure to exert cost-cutting efforts. From the shareholders' point of view, they are the residual claimants to all efficiency savings, and efficiency savings are the only way of generating additional rewards. RPI–*X* regulation therefore has the potential to be a very effective form of incentive regulation. In practice, it has been frequently controversial and unexpectedly demanding to implement successfully.

When the UK adopted price-cap regulation as its incentive mechanism for all privatised utilities, its original proponents recognised that resetting the *X* factor at regulatory review raised complex issues of how closely it should be related to the utility's achieved performance without destroying incentives and how much it could be decoupled from that performance without raising populist objections. Beesley and Littlechild (1989) suggest that, in large-scale network industries where regional natural monopoly characteristics are important, it would be difficult to avoid relating the *X* factor to some measure of company performance, especially the rate of return on capital, and consequently yardstick performance measures would become extremely important. This is becoming widely recognised, and electricity network regulatory statements in the Netherlands and Australia are two recent examples of similar analysis (DTE, 1999; IPART, 1999).

Yardstick competition has been a well-established idea in the academic literature since Shleifer (1985). It requires that the regulator stipulate a price cap that is based on any cost information other than the firm's own chosen cost level. This information reflects both current marginal cost and potential cost reduction. The cost information of the 'shadow firm' associated with the firm under regulation may reflect the mean performance of other identical firms or that of any other firm with appropriate allowance for exogenous differences. Bench-marking in this context has a slightly different connotation. The application of yardstick competition is treated in two stages in regulatory applications:

- Firms are *bench-marked* against each other to determine an efficient frontier and then given different cost reduction targets to ensure that each catches up with the frontier over time.
- Subsequently, all of the firms in the group may be given the same cost reduction frontier (for example, the rate of total factor productivity growth in the economy as a whole) in order to implement *yardstick competition*.

III. RPI–*X* REGULATION IN PRACTICE

The application of the price-cap idea in practice has raised issues of both analysis and measurement. The underlying principles of Ofgem's approach are set out here. The critical issues are:

- What is the nature of the price that is capped?
- What is the basic model for choosing *X*?
- What is the form of the control that results?

The Ofgem model targets an average revenue figure for distribution charges,

$$M_t = P_0 \left(1 + RPI - X\right)^t,$$

and computes *M* on the basis of a 50 per cent split between average revenue per kWh-unit distributed and average revenue per customer served. The average in each case is weighted by voltage class of customer.[1] The purpose of this unit load and customer split was to overcome objections to the form of price control used in the first few years of privatisation when many environmental campaigners argued that, if only average revenue per unit distributed were capped, companies would have an incentive to increase load contrary to objectives of decreasing energy consumption for environmental reasons.

The key ingredients in the model have become the P_0 settlement, which is the initial price that is to form the basis for the future revenue flows of the utility from the start of the new control period, and the *X* factor implied in Ofgem's projection of costs. The mechanics of this scheme *as it operated in the 1999 distribution price control review* can be set out in the following steps.

The companies are requested to report their operating costs at the beginning of the control period ($t = 1$), together with their capital expenditure projections up to the end of the control period ($t = n$). Two scenarios are used: existing quality of supply standards and enhanced quality of supply. Quality of supply is measured in terms of *security* (number of interruptions per customer) and *availability* (minutes of interruption per customer).

Ofgem, together with appointed consultants, scrutinises the operating costs and the capital expenditure projections, and carries out a comparative efficiency analysis of the former while drawing up its own capital projections based on agreed guidelines about load growth (*Q*). The outcome is a set of operating and capital expenditure projections and depreciation of the network (*OPEX, CAPEX* and *D*) that Ofgem believes reflects the efficiency frontier amongst the companies. Ofgem calculates the companies' weighted average cost of capital (wacc = *i*) and a rolling series of opening regulatory asset values (V_{t-1}) and

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[1]Details are in OFFER (1994).

closing values (V_t) by adding the capital expenditure flow and subtracting depreciation flow during the period to adjust the starting stock value:

$$V_t = V_{t-1} + CAPEX_t - D_t.$$

The overall purpose is to calibrate the discounted present value (PV) equation:

$$PV(revenues) \equiv PV(MQ) = PV(costs).$$

Explicitly, this reads

$$\sum_{t=1}^{n} P_0 (1 + RPI - X)^t Q_t (1+i)^{-t}$$

$$= \sum_{t=1}^{n} \left[OPEX_t + D_t + i(V_{t-1} + CAPEX_t - D_t) \right] (1+i)^{-t}.$$

X is fixed to achieve cost savings over the control period that reflect the shift in the frontier efficiency of the companies. The only undetermined number is the initial price correction, and this can be solved as

$$P_0 = \frac{\sum_{t=1}^{n} \left[OPEX_t + D_t + i(V_{t-1} + CAPEX_t - D_t) \right] (1+i)^{-t}}{\sum_{t=1}^{n} (1 + RPI - X)^t Q_t (1+i)^{-t}},$$

or, more simply, as

$$P_0 = \frac{PV\left[OPEX + D + iV \right]_1^n}{PV\left[(1 + RPI - X)Q \right]_1^n}.$$

Consequently, the distribution price per unit of output may be considered as the sum of[2]

- the allowed operating costs, *OPEX*;
- an allowance for depreciation of the regulatory asset base, *D*; and
- a return on the appropriate regulatory asset base, *iV*.

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[2]Ofgem, 1999a, p. 83.

   The incentives explicit in the Ofgem model can be illustrated as in Figure 1, in which two price control reviews, for 1995 and 2000, are shown, together with a pre-control initial price. The symbols are p^* the price control, r^* the forecast of allowable operating cost and k^* the forecast of allowable capacity cost. The return on regulatory asset value is $p^*-(r^*+k^*)$. At the beginning of the first control period in 1995, the initial price is moved down by Δp_0 to take account of projected cost savings over the succeeding period. The shaded area shows the operating and capacity cost savings actually made by the company over the control period, $r^*(t)-r(t)$ and $k^*(t)-k(t)$. The company retains these benefits for shareholders. At the beginning of the second control period in 2000, new forecasts and a new initial price are set, with the one-off price reduction Δp_0 now delivering to consumers the cost savings already achieved by the company. These one-off price reductions at the commencement of each new control period are referred to as P_0 adjustments. In Figure 1, the focus is on a single utility, and all of the cost savings realised in a given period are passed to consumers in the P_0 adjustment for the next period, so that the utility starts again from the beginning with a price control that reflects a return on the regulatory asset base equal to the weighted average cost of capital.

FIGURE 1

Ofgem Model of RPI–X Review of Price Controls

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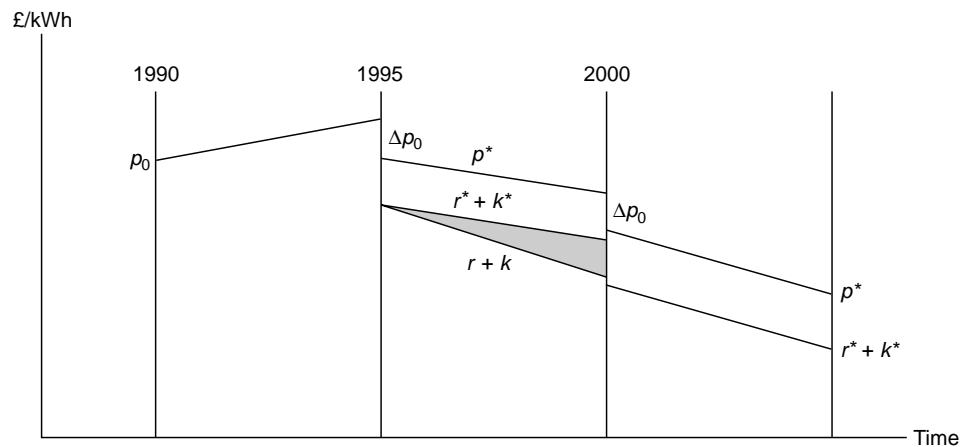
IV. CRITICAL ISSUES FOR THE REGULATOR
AND THE COMPANIES

The brief description above of the mechanics of the UK price controls in electricity reveals substantive issues of dispute between the regulator and the companies. These concern:

- the allowed operating cost, *OPEX*;
- the glidepath of cost adjustment;
- the projected capital expenditure and related quality of supply targets, *CAPEX*;
- the resulting regulatory asset base, *V*;
- the weighted average cost of capital, *i*; and
- most importantly, the P_0 adjustment for individual companies.

The principal points at issue concern the way in which the cost projections for different companies are arrived at and the use that is made of them. In simple terms, what is the basis for choosing *X* and implementing different P_0 values for different public electricity suppliers? The idea of bench-marking or yardstick comparisons immediately becomes inseparable from the decision about *X* and P_0.

The practice of making efficiency and productivity comparisons amongst public utilities has been strongly developed in the last few years, and most regulatory offices have provision for bench-marking the utilities under their remit. There are two areas of interest: comparing the efficiency of production amongst utilities at a specific point in time (efficiency analysis) and measuring the productivity growth of utilities over time (productivity analysis).

Productivity change measures the rate of increase in outputs (y_r) relative to inputs (x_i) by estimating total factor productivity (TFP):

$$TFP = \frac{\sum_{r=1}^{s} w_r y_r}{\sum_{i=1}^{m} v_i x_i}.$$

Under the assumption that output and input markets achieve productive efficiency (output prices equal to marginal cost, input prices equal to value of marginal product), the weights, w_r and v_i, applied to outputs and inputs are estimated by output and input shares in total revenue and costs, resulting in the

discrete Tornqvist index. Productivity growth (the proportional rate of change of TFP) spills over to consumers in aggregate, and it represents the shift over time of the production correspondence between inputs and outputs, i.e. technological change. The underlying assumptions are unlikely to apply to the analysis of privatised utilities in network industries, both because of their residual market power and because of their known history of productive inefficiency under state ownership.

Färe, Grosskopf and Lovell (1994) indicate how TFP can incorporate efficiency change as well as technological change if a Malmquist index approach is used instead. This requires that the output and input weights are estimated directly, and the non-parametric programming methods of data envelopment analysis (DEA) are useful for this. Alternatively, stochastic frontier analysis (SFA) can be used to estimate the efficiency change component of productivity growth if relatively strong assumptions are made about the production function and error distribution. In both cases, a set of panel data on the outputs and inputs of different firms observed over time is needed.

Several such measurement exercises have been carried out, and they are surveyed in Waddams Price (1999). For example, O'Mahony (1999) estimates that labour productivity in UK electricity supply rose at an annual rate of 7 per cent over the period 1990–96, while in comparison labour productivity in manufacturing rose by 3.5 per cent per year in the same period. Several other studies (for example, Burns and Weyman-Jones (1996) and Tilley and Weyman-Jones (1999)) use SFA or mathematical programming (DEA) to evaluate this efficiency change in the regulated electricity distribution industry, with conflicting results. In the immediate aftermath of privatisation, productivity growth seemed not to differ markedly from pre-privatisation experience, but, following the 1994 control, considerable improvement can be seen. A model that is by now standard in the literature uses real operating expenditure and real value of the network capital stock (or alternatively transformer capacity and circuit length) as inputs and number of customers, units distributed and maximum demand as outputs, and allows for environmental variables such as quality of supply, customer density and market structure (high voltage share of distribution). For example, Tilley and Weyman-Jones (1999) show that, over the 1990–98 period, companies have varied widely in performance, with three clusters averaging 8.5 per cent, 6 per cent and 5 per cent annual TFP growth. Productivity growth improved very substantially after 1994, and all of the measured TFP growth for the industry is concentrated on the shifting frontier, with none due to companies generally moving closer to the frontier.

Ofgem (1999a) describes an efficiency frontier to bench-mark *OPEX* derived as follows. Collect operating cost data for each company and remove the non-controllable items:

Controllable operating cost (by Ofgem definition)
= Operating cost – Network depreciation – Network rates
– National Grid Company exit charges
– Profit (or loss) on sale of fixed assets.

Standardise these for different accounting procedures amongst companies and then adjust for regionally differing wage rates. The resulting figure, *C*, is 'base operating costs'. These are assumed to be a combination of a fixed cost and a constant-returns-to-scale (CRS) Cobb–Douglas function of customers (*N*), units distributed (*U*) and network length (*L*):

$$C = A + BN^{\alpha}U^{\beta}L^{\gamma}.$$

Instead of carrying out a multiple regression, compute for each company (*j*) a composite variable for the right-hand side, called the composite (network) size variable[3] (N_j^*):

$$N_j^* = N_j \left[1 + b\left(\frac{du_j}{\bar{u}} \right) + g\left(\frac{dl_j}{\bar{l}} \right) \right].$$

Here, *u* is units per customer and *l* is network length per customer, and *du* and *dl* are the deviations from the sample means, $\bar{u}$ and $\bar{l}$. The parameters *b* and *g* are chosen by Ofgem to be 0.25 in both cases. Regress $C_j = a_0 + a_1 N_j^*$, as illustrated in Figure 2. The (average) regression through the means excludes the data on the frontier companies. Now Ofgem constructs a line starting at the regression intercept just calculated and passing through the lowest observations. This is Ofgem's 'efficiency frontier'. It is not based on one of the usual frontier estimation methods; in particular, it is not equivalent to corrected ordinary least squares, although it does appear to provide a ranking of companies quite similar to the rankings produced by other studies that do use conventional frontier estimation methods (for example, Tilley and Weyman-Jones (1999)).

The use made of this efficiency study[4] by Ofgem takes two forms. It appears to be critical in setting the *X* factor and to be critical in setting the allowed operating costs of the individual companies. In what follows, I attempt to set out how the process seems to have worked in Ofgem's price control proposals. The

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[3]The construction can be made to work using the binomial expansion and ignoring terms greater than first order.

[4]Ofgem, 1999a. Ofgem (1999c) supplements the cross-section regression for 1997–98 with a company-by-company efficiency study by consultants to identify cost savings. The match is relatively close for the two studies.

Ofgem documents are not the model of clarity that might be expected, perhaps because the final controls are in some sense an outcome of bargains with the regulated companies. Beesley and Littlechild (1989) cite this as one of the advantages of the RPI–*X* model. What follows is therefore an attempt to make coherent sense of documents that may not be intended to be entirely transparent (something in which they succeed admirably). Figure 3 illustrates the general approach.
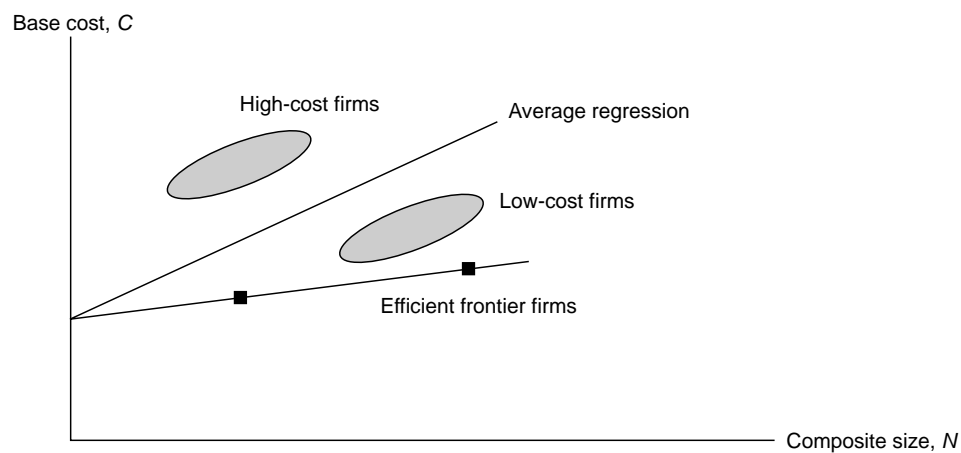
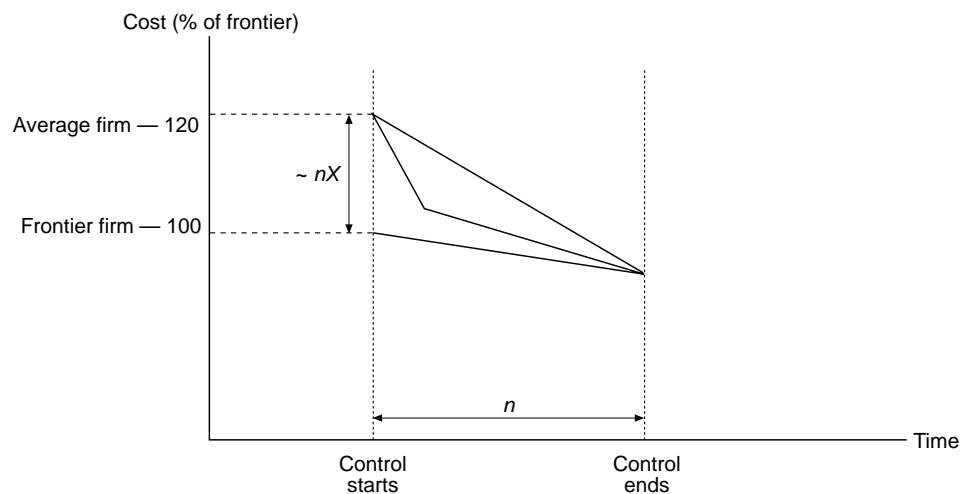FIGURE 2

Ofgem's Average and Frontier Regressions

FIGURE 3

Two Cost Glidepath Gradients

Ofgem decided to apply a single *X* factor of 3 per cent to all the companies. The arguments for allocating the revenue reduction between P_0 and *X* are finely balanced (Ofgem, 1999c, pp. 48–9). Customers were assumed to prefer larger immediate price cuts and companies to prefer financial profiles that did not deteriorate over time. High levels of *X* might be unsustainable, but low levels of *X* could underestimate the scope for efficiency gains. The inefficiency of the typical company relative to the *OPEX* frontier companies is to be eliminated over the next control period. The range of inefficiencies is from zero to 40 per cent, with an average of about 20 per cent (Ofgem, 1999a, p. 33; Ofgem, 1999b, p. 24). Over the seven years from the date of the Ofgem (1999a) study (1997–98) to the end of the next control period (2004–05), the companies, with some allowed adjustments, should be able to eliminate the average level of inefficiency (Ofgem, 1999a, pp. 35–6). This produces an *X* factor of approximately 3 per cent per year for the next control period, used in the Ofgem (1999c) analysis. This is illustrated in Figure 3 by the link between *n* and *nX*; the diagram crystallises the glidepath issue. However, the inefficiency ratings for each company are also used to reduce its projected controllable operating costs for the next control period. For the frontier companies, this means that they must continue to reduce prices each year of the next control by the average annual rate of cost reduction needed to reduce the average level of inefficiency in the 1997–98 operating costs to zero (approximately *X* = 3 per cent per year). For the inefficient companies above the frontier in 1997–98, their individual levels of allowed operating cost are also to be reduced by all of the measured inefficiency in the 1997–98 costs. Adding in the projected non-controllable costs gives a profile of allowed operating cost (*OPEX*) for each company over the next control period. The rate of cost reduction each year is referred to as the cost 'glidepath'.[5] In negotiation with the companies, Ofgem has made adjustments to the projected costs but increased the gradient of the glidepath from its initial smooth profile over seven years by requiring that three-quarters of the cost inefficiency of a company is eliminated in the first two years of the next control (Ofgem, 1999b, p. 25; Ofgem, 1999c).

It is these projections, together with Ofgem's adjustments to the companies' capital expenditure projections, that make up the components of the discounted present value of costs. The third critical issue in the Ofgem model was therefore the nature of the allowed *CAPEX* provisions. Ofgem (1999c, pp. 30–1) demonstrates huge cyclical swings over the period 1950–90, with annual industry distribution *CAPEX* totals varying from less than £0.5 billion to more than £2 billion in constant 1997–98 prices. Initial input into the process was the company forecasts for their *CAPEX* over the review period, and this was benchmarked by Ofgem in two categories — *load-related* (LRE), driven by new

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[5]This is a curious misnomer, since the inefficient companies have a steep gradient of efficiency improvements to climb.

customer connections and load growth, and *non-load-related* (NLRE), driven by replacement, information gathering, network control and quality of supply (Ofgem, 1999a, pp. 41–52). This led to final downward revisions of 13 per cent (£0.95 billion) to the companies' aggregated forecasts for the review period, 2000–05. However, some companies had much higher downward revisions than others, mainly arising under non-load-related expenditure, and, in particular, the company with the largest downward revision of its forecast *CAPEX* was also the company that performed second worst on the *OPEX* bench-marking exercise. Following the start of the new controls, this company disposed of its *supply* business in a general cost-cutting exercise.

Just prior to the final proposals, the regulator toyed with the idea of applying yardstick incentives to the companies' *CAPEX* behaviour and quality of supply targets (Ofgem, 1999b, annexes C, D and E). For example, two possible yardstick mechanisms for *CAPEX* were suggested. The first increased the revenue cap by between 0.25 and 0.5 of a percentage point if the increase in a company's asset base between 1994 and 1999 was less than 5 per cent, but reduced it if the capital base had increased by more than 10 per cent. The second suggested mechanism involved calculating the industry-wide ratio between NLRE and the modern equivalent asset value of the network (4.4 per cent in fact) and increasing or reducing each company's revenue cap according to whether its actual NLRE in 1995–99 fell short of or exceeded this yardstick NLRE value. Despite these attempts to develop yardstick mechanisms to avoid rewarding excessive past *CAPEX*, it is not clear that the final proposals made explicit use of them.

The capital expenditure projections minus the depreciation projections are added to the previous period's closing value of distribution business assets to produce the regulatory asset value, which in turn produces the allowed return when multiplied by the weighted average cost of capital. The opening asset value follows from previous price controls and was initially based on uprated market valuations of the individual companies from the end of the first day's trading at flotation (OFFER, 1994). Ofgem took the view that it was necessary to remain consistent over different review periods in the way that the regulatory asset value was calculated so as to avoid regulatory risk (Ofgem, 1999b, p. 75). The real pre-tax weighted average cost of capital has been calculated on a conventional basis for a number of years and incorporates risk-adjusted equity and debt rates. It has varied between 6 per cent and 7.5 per cent in the different controls applied to the energy utilities and was set at 6.5 per cent for the 1999 final proposals (Ofgem, 1999c, p. 43). In summary, it is

$$wacc = \delta \, (\text{real risk-free cost of debt} + drp)$$
$$+ \, \varepsilon \, (\text{real risk-free cost of equity} + erp)\beta \quad (1.4),$$

where *drp* is the debt risk premium, *erp* is the equity risk premium, δ and ε are gearing ratios both set at 50 per cent, β is the equity beta on the distribution companies and 1.4 is the tax wedge applied to equity finance to account for corporation tax. β is set at 1.0 to reflect 'the low risk nature of the distribution business which has the characteristics of a natural monopoly' (Ofgem, 1999c, p. 41).

A cost glidepath is only one of the options available to the regulator of electricity network service, and both Australian (IPART, 1999) and Dutch (DTE, 1999) regulatory offices have considered P_0 glidepaths. The issue is whether all of the achieved cost savings of a utility in the previous period should be recouped by customers at the beginning of the new control in the form of the one-off adjustment to P_0. Australian regulators in particular (IPART, 1999) have considered a glidepath for the P_0 adjustment that spans part or all of the next control period. The reason for this is to leave some further incentive reward to the efficient companies beyond the start of the next period. Ofgem has rejected this idea and maintained the objective of passing all of a company's achieved cost savings back to its customers at the start of the next control period. Consider two companies: one is frontier efficient and the other has the average level of cost inefficiency based on costs measured just prior to the start of the next control period, say 20 per cent as in Figure 3. The efficient company has cost savings of 20 per cent to pass on to consumers immediately, and must then lower prices by say $X = 3$ per cent in real terms during the control. If it can do better, it keeps the cost savings until the next control starts. The inefficient firm has no achieved cost savings to pass on to consumers, but it must subsequently reduce its costs by the $X = 3$ per cent factor and the 20 per cent built into the allowable operating costs used to calculate P_0. It has a much tougher target to meet before it becomes residual claimant to its cost savings, but it could conceivably have a smaller P_0 fall in the regulated price than the frontier efficient firm. This does appear to have been the outcome, since the two most efficient frontier companies on *OPEX* bench-marking were given P_0 cuts of 28 per cent and 19 per cent, while the three least efficient had P_0 cuts of 21–24 per cent. The draft and final proposals, although positively correlated, did differ in level and distribution amongst the companies, suggesting considerable last-minute bargaining between Ofgem and the companies over the outcome.

V. INTERNATIONAL DEVELOPMENTS
IN YARDSTICK REGULATION

Ofgem has not been alone in carrying out this yardstick and incentive-based distribution price control. Norway has been trying out DEA-based yardstick mechanisms for some time, and a similar mechanism to the Ofgem model can be seen in the work of the Dutch regulator (DTE, 2000). In the latter case, total costs were bench-marked using a DEA model with constant returns to scale. The

value of the companies' assets (regulatory asset base) and the weighted average cost of capital were derived from financial models reflecting the circumstances of the deregulation of the companies, and P_0 and X factors were derived. Since the P_0 figures were heavily constrained by the legislative form of the deregulation, more weight was given to the X factors. These were capped at 8 per cent but differed significantly amongst companies, in part because of their distance from the DEA-CRS efficient frontier. This control is due to last until 2003, when it may be replaced by an explicit yardstick mechanism that bases X on national total factor productivity growth.

In fact, throughout Europe, there is growing interest in this form of price control for distribution networks. An informal group of European regulators has discussed the possibility of constructing internationally comparable databases for yardstick regulation using the model described here.

VI. SUMMARY AND CONCLUSIONS

Ofgem's responsibility is to set price controls for public electricity suppliers and to foster competition, and these tasks should be considered together. In fostering competition, Ofgem has liberalised the supply market in both retail gas and electricity, and a significant trend in customer switching has already been observed according Ofgem press statements, which suggest that up to one-quarter of customers have switched supplier. In the generation function, Ofgem has made substantial changes to the existing trading arrangements. Its explicit price controls apply to network services, and here, as we have seen, it has introduced three principal ideas. The present value equation of revenues and costs with a predetermined discount rate is used to determine P_0 adjustments that transfer all of the achieved efficiency savings to customers without a price glidepath. A yardstick efficiency comparison based on controllable operating costs is carried out both to set allowed operating costs and to suggest an X factor. Finally, a cost glidepath with a non-linear gradient is used to project allowed operating and capital costs in the discounted present value equation to determine the P_0 adjustment, which transfers achieved savings to consumers. The nature of the yardstick comparisons and the way they are used in the analysis are not as transparent as they could be, and ongoing bargaining seems to characterise the evolution of the controls. The control process is becoming more involved with every period that passes, and in no sense is regulation likely to disappear or diminish for network service providers. Indeed, Ofgem has indicated that ongoing monitoring of the regulatory framework, with an emphasis on ensuring that quality of supply is not endangered by price capping, is the next development. This suggests the need for incentive mechanisms applying to the medium-term performance of the network. In 2000–01, Ofgem began to develop its Information and Incentives Project (IIP) (Ofgem, 2000 and 2001), which is a complete re-examination of the incentives toward meeting quality of supply

targets and determining *CAPEX* profiles; this is likely to be the centre of regulatory attention over the next few years.

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