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From the Editor

How does the regulator establish what a regulated company's costs are going to be? This question is important when the costs of a regulated company do not follow a stable trend. In recent regulatory reviews, British regulatory offices (Ofgem for energy, Ofwat for water) have struggled to establish how much network companies will/should spend on capital investment during the next regulatory period. They have tried expert investigation of investment plans, but the results have been frequent disputes and large errors. In the most recent regulatory review of electricity distribution price controls, Ofgem tried out a new technique based on economic theories about information and contract design. Ofgem's application of the theory has some odd features, but it shows how real conditions complicate the design of price caps, and how economic theory can produce a clear and rationally designed price cap formula.

—Graham Shuttleworth, Editor August

Using Incentives to Inform Regulatory Decisions

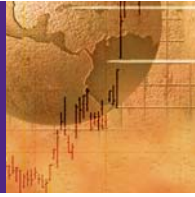
By *Graham Shuttleworth*

How the Aim of Regulation is Changing

The British electricity distribution networks were restructured and privatised in 1990/91. In the immediately following years, the main aim of the energy regulator¹ was to encourage distribution companies to cut costs. To do so, the regulator set relatively simple price caps at the start of each 5-year regulatory period which defined a maximum average revenue. These relatively simple price caps increased from year to year in line with the Retail Price Index (RPI) and declined from year to year at a steady rate (X) in anticipation of efficiency gains—hence the name “RPI-X price caps”.

These price caps encouraged distribution companies to reduce costs, because the companies increased their profits by doing so. The distribution companies were able to cut their costs quite rapidly by reducing both operating expenses (opex), which had swelled during the time under state ownership, and capital expenditures (capex), to which they applied new techniques of asset management and expenditure control.²

In recent years, a significant proportion of network assets have reached the end of their useful life. The distribution companies have also taken on new responsibilities, such as connecting more “distributed” generation to their low voltage networks. In these conditions, incentives to cut costs are no longer sufficient; the price caps must also allow for increasing investment.



One of Ofgem's stated goals during the latest distribution price control review was to "provide clear and consistent incentives to DNOs to help ensure they provide an appropriate quality of service to consumers—including incentives for timely and efficient investment in the network."

The challenge facing any energy regulator is to ensure that the formula for revenues to cover the cost of new investment will encourage regulated companies to spend money efficiently, not just to increase expenditure (or to relax expenditure controls).

Potential for Disputes due to the Regulator's Lack of Information

All network regulators face a similar problem: they do not have as much information as the distribution company about the technical state of the network, the trend in local demand and other factors that determine the optimal level of capital investments. Different firms will have differing needs to spend money on investment, and those needs are not visible to the regulator. The regulator's lack of knowledge about

the companies is known in economic literature as "asymmetry of information". It affects the way the regulator and the companies interact and has been the subject of a great deal of study.

Providing information about future expenditure plans is cheap (relative to the expenditure, at least). Under simple price cap regulation, distribution companies have an incentive to provide inflated forecasts of capital expenditure, in the hope that the regulator sets a higher price cap as a result. The companies would then earn extra profits from "saving" costs that they were not intending to incur in the first place. Regulators spend time and effort trying to prevent companies from capturing such unnecessary profits. The fear of inflated investment forecasts has led to major disputes between regulator and company over the appropriate level of capex to build into the next price cap³ and even to the formal "claw-back" of revenue allowance for capex that the company did not appear to need.⁴

Solving Information Problems with Incentives

The question facing the regulator at the start of the price control period is: What is the right level of expenditure for any given distribution company? To answer the question, Laffont and Tirole (1993) examined the economic incentives facing regulator and company in their bargaining process, in order to provide insight into this problem.⁵

Let us assume that there are several different types of firms and each type requires a different level of investment in the next five years. The regulator wishes to set a revenue control for each company, which Laffont and Tirole analyse as if it were a contract between regulator and company. Part of this contract covers the company's reward for spending money on capital expenditure.


If the regulator knew exactly what type each company was, it would know how much the company should spend, and it would be possible to offer a fixed price contract. However, in practice, regulators do not know

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enough about regulated companies to determine their future expenditure with precision. The companies also face uncertain demand for investment, but their understanding of the true level of investment is much better than the regulator's. The task facing the regulator is to try to elicit from the company what its true level of investment is. To do this, the regulator has to offer a profit incentive for telling the truth—alongside the normal incentives to minimise costs.

The method set out by Laffont and Tirole – and put into practice in the latest distribution network price controls by Ofgem—is to offer companies a choice of different regulatory schemes (a “menu of contracts”) and to learn about the company *from the scheme that it chooses*.

The trick is to design the menu so that every company has an incentive to tell the truth about its investment plans, and is actually worse off if it supplies misleading information. Such a menu of contracts is described as

“incentive compatible”. The sliding scale mechanism designed by Ofgem to incentivise capital expenditure by Distribution Network Operators (DNOs) is, in essence, an incentive compatible menu of contracts.

Ofgem's Sliding Scale

The scheme is summarised in the table below, which comes from Ofgem's final proposals in the distribution price control review for the period 2005-2010.⁶ Each column stands for a different regulatory contract. Each contract is represented by the ratio of two investment forecasts (Ratio DNO/PB Power), as follows:

- forecast capital expenditure, as declared by the Distribution Network Operator
- forecast capital expenditure, as prepared by Ofgem's consultants, PB Power.

The DNO could choose which contract would define its regulatory regime for the next five years by choosing what *forecast capital expenditure to declare*.⁷ This declaration defined the ratio

with PB Power's forecast and hence the applicable column. For example, if the DNO *forecast* capital expenditure which was 120% of PB Power's forecast, the contract in column 5 would apply.

Having chosen a contract column, the DNO must choose how much it will actually spend during the current regulatory period. Each row in the table represents the DNO's *actual* capital expenditure, in terms of the ratio to PB Power's forecast. These ratios depend on the capital expenditure that the DNO actually makes during the regulatory period. The figures in the cells show the reward, or a penalty, that the DNO will get for each combination of declared and actual capital expenditure.⁸

Ofgem designed this “sliding scale” mechanism to be incentive compatible, i.e. to encourage DNOs to tell the truth about their forecasts of capital expenditure. It works as follows.

Suppose that a DNO believes it will need to invest 120% of PB Power's forecast. In order to find the best

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Ratio DNO/PB Power %	100	105	110	115	120	125	130	135	140
Efficiency Incentive	40%	38%	35%	33%	30%	28%	25%	23%	20%
Additional Revenue %	2.5	2.1	1.6	1.1	0.6	-0.1	-0.8	-1.6	-2.4
Rewards and penalties									
Allowed Capex	105	106.3	107.5	108.8	110	111.3	112.5	113.8	115
Actual Capex									
70	16.5	15.7	14.8	13.7	12.6	11.3	9.9	8.3	6.6
80	12.5	11.9	11.3	10.5	9.6	8.5	7.4	6.0	4.6
90	8.5	8.2	7.8	7.2	6.6	5.8	4.9	3.8	2.6
100	4.5	4.4	4.3	4.0	3.6	3.0	2.4	1.5	0.6
105	2.5	2.6	2.5	2.3	2.1	1.7	1.1	0.4	-0.4
110	0.5	0.7	0.8	0.7	0.6	0.3	-0.1	-0.7	-1.4
115	-1.5	-1.2	-1.0	-0.9	-0.9	-1.1	-1.4	-1.8	-2.4
120	-3.5	-3.1	-2.8	-2.5	-2.4	-2.5	-2.6	-3.0	-3.4
125	-5.5	-4.9	-4.5	-4.2	-3.9	-3.8	-3.9	-4.1	-4.4
130	-7.5	-6.8	-6.3	-5.8	-5.4	-5.2	-5.1	-5.2	-5.4
135	-9.5	-8.7	-8.0	-7.4	-6.9	-6.6	-6.4	-6.3	-6.4
140	-11.5	-10.6	-9.8	-9.0	-8.4	-8.0	-7.6	-7.5	-7.4

strategy, the DNO looks at row “120” to find out what rewards are on offer for spending that amount. The maximum payoff in this case is -2.4, which is found in the fifth column. This column corresponds to a declared forecast (see column heading) of 120. Hence, the best strategy for this DNO

is to declare a capital expenditure forecast of 120, i.e. to forecast its capital expenditure honestly.

Similarly, for each value of actual capital expenditure (each row), the DNO can only realise the maximum possible payoff by declaring this

capital expenditure truthfully in advance (see the shaded cells). This aspect of the table shows how the scheme encourages truth-telling by DNOs.

In addition, the scheme maintains incentives to reduce capital expendi-

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ture once the DNO has declared a forecast and chosen a contract. For instance, a DNO that declared 120 could still increase its reward by reducing its capital expenditure. If it cut expenditure to 100, for instance, its reward would increase to 3.6. Cutting expenditure all the way to 70 would increase its reward to 12.6. Thus, companies can still increase their profits by being efficient.⁹ However, if a DNO believed it would spend only 100 at the time when it chose the contract, its best strategy would have been to declare 100, for which its anticipated reward would have been 4.5. Thus, the incentive to cut capital expenditure during a regulatory period does not undermine the incentive to declare forecasts honestly at the start of the period.

The Struggle Between Information Asymmetry and Omniscience

Although the matrix in the table above is incentive compatible, one curious feature stands out. If actual capital expenditures exceed PB Power forecast by 15% or more, the DNOs receive a negative reward, i.e. they are penalized by not being able to recover the cost of investment, *even if they had truthfully declared their forecast of required capital investment*. Here, the reality departs from the theory.

Under the scheme of Laffont and Tirole, every firm would recover its costs if it made an honest declaration, on the grounds that the regulator has no basis for denying cost recovery when the company is best placed to know what expenditure is required, has an incentive to declare truthfully what it is required, and spends it. The sliding scale shown here demonstrates Ofgem's belief that PB Power's forecasts are correct (at least to within 15%).¹⁰ However, if Ofgem really believed it knew (on the basis of PB Power's forecasts) what each DNO should spend, there was no need for the sliding scale to elicit this information. Instead, the scheme would merely reward DNOs for forecasting the same capital expenditure as PB Power, or less. In other words, Ofgem appears to be rewarding DNOs for agreeing with the regulator's consultants, rather than for telling the truth. If Ofgem had fully recognised the asymmetry of information, the rewards for telling the truth (in the shaded cells) would all have been zero or more. However, Ofgem's desire to punish different forecasts from its own does not remove the incentive for DNOs to submit honest forecasts.

Conclusion

Ofgem's sliding scale appears to be an attempt to harness the power of profit incentives to overcome regulatory problems—in this case the “asymmetry of information” that puts regulators at a disadvantage relative to regulated companies. In reality, the “menu of contracts” Ofgem presents is misleading, in that it suggests an approach which Ofgem is not actually taking. Instead, Ofgem is imposing its own view by not allowing the theory to work. Given that there is no easy way to avoid the need for detailed regulatory scrutiny of investment, this may well have been inevitable. Next time around, perhaps, Ofgem will bite the bullet and accept the need for objective investigation of past and future investment projects.



Notes

- 1 From 1990 to 2000, the Energy Act 1989 vested regulator powers over the electricity sector in the "Director-General of Electricity Supply", who also ran the Office of Electricity Regulation (Offer). The Utilities Act 2000 transferred regulatory powers for electricity and gas to the Gas and Electricity Markets Authority (GEMA) and the associated Office of Gas and Electricity Markets (Ofgem).
- 2 Opinions differ as to the speed with which the distribution companies actually cut their costs, as evidence from their accounts is confused by many changes in accounting rules. The large price cuts imposed by the energy regulator in 1995 and 1996 derived largely from such changes. In 1995 (and 1996), the energy regulator declared new, lower values for the regulatory asset base (asset value). In 2000, the regulator reallocated large amounts of cost from distribution businesses to retail supply businesses. The overall x-factors observed during the period since privatisation therefore offer little clue as to the trend rate of efficiency gains, i.e. the true reductions in costs.
- 3 Capital expenditure does not enter directly into the price cap, but increases the forecast value of the fixed assets. This increased value of fixed assets then raises forecast costs in the form of depreciation and the return on assets.
- 4 In 1997, the Monopolies and Mergers Commission agreed with the proposal of the Northern Irish regulator to take back some of the revenue allowed to Northern Ireland Electricity over the previous 5 years to cover depreciation and return on new investment that did not in fact take place.
- 5 Jean Jaques Laffont and Jean Tirole A Theory of Incentives in Procurement and Regulation, the MIT Press 1993.
- 6 Ofgem (2004), Electricity Distribution Price Control Review, Final Proposals, November 2004, Chapter 7.
- 7 Ofgem initially overlooked this important aspect of the scheme and published the table after the DNOs had submitted their forecasts. However, Ofgem eventually allowed companies to resubmit their forecasts in the light of the incentives offered by the table. Without this flexibility, the scheme would not have provided the incentives described here.
- 8 The values are expressed as percentages of the PB Power forecast. The bottom right figure, for example, is calculated as $-7.4 = (115 - 140) \times 20\% - 2.4$
- 9 It is well known that incentive regulation gives the regulated company an incentive to cut costs and that the company can do so by letting the quality of the service decline. Incentive regulation usually requires some kind of quality target or incentive, to prevent the company from inefficiently cutting quality. DNOs are subject to many such targets and incentives, which help to determine the required level of investment. This paper does not discuss such incentives, but takes them for granted.
- 10 It should be pointed out that PB Power never claimed such accuracy for its forecasts.

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