Price-Cap Regulation and Its Use in Newly Privatized Industries

by

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The goal of re-structuring electricity and natural gas industries is to introduce competition wherever it is technologically feasible to provide firms supplying these products with strong incentives to produce at minimum cost. Because transmission and distribution networks—the bottleneck facilities that originally led to government regulation or ownership—are still required to deliver the final product, the prices charged for use of these facilities must be administratively determined. For countries such as the United Kingdom, where these industries were once government-owned monopolies, this re-structuring process has therefore required the formation of a regulatory agency to set prices for the use of bottleneck facilities. The price-cap regulation has been used throughout electricity industry for this purpose. In setting the X-factor in the price-cap or RPI – X regulatory process for the Regional Electricity Companies (RECs), the Office of Electricity Regulation (Offer) underestimated the magnitude of the efficiency gains the RECs could achieve and this led to profit rates that many observers felt were excessive. This general displeasure culminated in an excess profits tax by the Labour government which takes back some of these profits in the form of a company-specific lump-sum tax.

The failure of price-cap regulation to control adequately the profits of the RECs and many newly privatized companies in the UK is largely due to the use of a regulatory scheme that is poorly suited to account for the uncertain productive efficiency gains possible under a privatized, competitive market structure. The price-cap or RPI – X regulatory scheme sets the maximum rate of increase for regulated prices equal to the rate of increase in the retail prices index (RPI) less an X-factor. Assuming zero economic profits at the initial prices, constant returns-to-scale in production and cost-minimizing behavior by the firm, the X-factor that maintains zero economic profits for the firm takes fairly simple form. It equals the rate of growth of total factor productivity (TFP) for the firm less that for the entire economy plus the difference in the cost-share-weighted average growth in input prices for the entire economy less the cost-share-weighted average growth in input prices for this firm.

The first term in the X-factor is straightforward to understand. If the rate of technical change in the firm's production process is greater than that for the economy, the firm's output price does not need to increase as rapidly as the output price for economy as represented by the RPI. The second term is more difficult to understand, because to a first approximation, all firms pay the same prices for inputs. However, firms can differ significantly in the intensity with which these inputs are employed. The electricity supply industry is significantly more capital intensive than the economy at large. Suppose there are only two inputs, capital and labour, and that the price of capital remains constant over time and the price of labour increases at 4% per year. Suppose the cost share of capital at this firm is 0.75, whereas the cost share of capital in the economy is 0.25. These assumptions yield the following cost-share weighted average rates of aggregate input price changes:

$$\text{Industry} = 0.75(0\%) + 0.25(4\%) = 1.0\%$$
$$\text{Economy} = 0.25(0\%) + 0.75(4\%) = 3.0\%.$$

In this example, the electricity supply industry more intensively uses the input whose price is growing more slowly and this yields in an X-factor that is 2 units higher than if the cost shares of capital were the same for the firm and the entire economy.

To understand why a price-cap scheme is inappropriate for setting prices for newly privatized industries, it is useful to review the economic logic underlying this form of price regulation. Traditional cost-of-service price regulation has the well-known problem that if the firm knows that higher costs are reimbursed in the form of higher prices, then inefficient modes of production may lead to higher profits. By choosing a non-minimum-cost mode production, this firm may cause the regulator to set even higher prices and therefore earn higher profits than if it produced its output at minimum cost. The goal of a price-cap scheme is to break this relationship between output prices and actual costs. Because regulated firms must by law produce all that is demanded at the regulated price, if the regulator sets prices independent of the firm's costs, total revenues are also independent of costs. Under this scheme, a profit-maximizing firm would like to minimize the cost of producing the output it sells. The major challenge to the regulator in price-cap scheme is to set the X-factor so that if the firm produces its output at minimum cost, the resulting prices will yield the firm sufficient revenues to cover its costs. However, if X-factors are set annually and estimates of the firm's costs are used to determine these magnitudes, then price-cap regulation simply reduces to cost-of-service regulation. Consequently, price-cap regulation differs from cost-of-service regulation only to the extent that the firm's X-factor is set independent of its costs and the greater is the length of time that X-factors are set for a each rate review. Longer durations of known X-factors provide strong incentives for profit-maximizing firms to minimize production costs over longer time horizons. If a firm's X-factors are set for the indefinite future, its revenues for this same period of time are independent of its current and future costs. The firm will maximize the discounted present value of future profits by minimizing the discounted present value of the costs associated with producing time path of output demanded at the resulting prices. Setting X-factors for very long-horizons has the potential to yield efficient long-term investment decisions, which is particularly important in industries with large amounts of long-lived investments such as electricity supply.

Solving for the X-factors that yield zero economic profits over long time horizons for a firm currently earning zero economic profits that is employing a constant returns-to-scale production process in a cost-minimizing manner is an extremely difficult, but well-defined problem. Forecasting the future TFP growth rate and the aggregate input price growth rate differentials that determine the X-factor even for the following year is a complex process with many opportunities for error. For longer horizons, this process is even more complex and substantially more imprecise. Setting the X-factors too low can lead to very high profits for the firm. Setting the X-factors too high can lead to very large losses. Both errors cause the regulator to alter the X-factors in a direction that yields revenues more in line with the firm's incurred costs, making price-cap regulation resemble cost-of-service regulation

Computing the correct X-factor for a newly privatized electricity supply company introduces a significant amount of guesswork into this relatively well-defined process because all of assumptions necessary for the validity of the simple equation for the optimal X-factor given above are likely to be invalid. Initial output prices are usually set significantly above the level necessary to generate zero economic profits to guarantee enough investors for the initial privatization process to succeed. The output of the firm formerly government-owned firm is not produced at minimum-cost. In fact, a rationale given for most privatization decisions to provide stronger incentives for firms to choose minimum-cost modes of production. Finally, there is a long history of scientific and anecdotal evidence in favor of increasing returns-to-scale in production in these industries. Tremendous uncertainty about the initial level of economic profits and the unknown magnitude of the initial

deviation from minimum-cost production by these firms makes it impossible to set with sufficient accuracy X-factors that yield zero economic profits over a multi-year time horizon. It is therefore not surprising to see the regulatory outcomes where the X-factors were initially set too low because the regulator underestimated the extent of reductions in production costs possible and the amount that initial prices were set above the zero economic profit level as occurred in the UK. The very high X-factors for the RECs that followed were designed to take account of this underestimation of cost reductions. As more of the potential privatization cost reductions are realized and output prices are set at levels closer to those that yield zero economic profits, the process of setting future X-factors comes closer to following the formula given above. However, as the above logic illustrates, during the initial stages of the privatization process, the process of setting X-factors is sufficiently difficult that the initial X-factors are at best educated guessed that are bound to be grossly incorrect. Consequently, these X-factors cannot be reliably set for a long enough time to realize of the benefits of increased productive efficiency from price-cap regulation relative some other form of price regulation.

If price-cap regulation is destined to fail to achieve its promised benefits during the initial years following privatization, what form of regulation should be used to set prices for bottleneck facilities? Because of the tremendous of uncertainties associated with the initial conditions in the industry immediately following privatization, a superior regulatory strategy may be to implement a less high-powered price-setting process that builds in safeguards for large errors in setting the X-factors. Cost-of-service regulation in its most basic form is very low powered in the sense of translating a one pound increase in costs into a one pound increase in revenues. Price-cap regulation in its most basic form is very high-powered in the sense of translating a one pound increase in costs into a zero pound increase in revenues. Conversely, the regulatory risk, the probability that the firm will earn very high profits or negative profits, associated with price-cap regulation is significant, whereas pure cost-of-service regulation has zero regulatory risk. Consequently, a regulatory price-setting process that balances the risk of regulatory failure against the greater incentives for efficient behavior that pure price-cap plans provide is a plan which translates a one pound increase production costs into less than a one pound increase in total revenues. There are variety of price-setting schemes with these properties and which one the regulator selects depends on his or her attitude towards regulatory risk versus providing the maximal incentives for efficient production by the firm.