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Issues and Challenges in Regulation Economics.

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Effective economic regulation demands clear objectives, sound economic reasoning and a careful analysis of the inevitable trade-off between conflicting societal interests. The key problems are linked to the information asymmetry between the regulator and the regulated firms. Although the market principle may provide some useful guidelines, the problems of bankruptcy and windfall profits remain to be addressed. In this overview, we discuss how modern yardstick regimes in combination with franchise auctions provide powerful solutions that may contribute to both societal and industry demands.

Why regulate?

The guiding principle for all economic activity in the Western society is the *market*. Network activities, such as distribution of electricity or water, are examples of natural monopolies or market failures. For electricity distribution, the monopoly is accentuated by (i) the existence of a single supplier of the service for each customer, (ii) no substitute for the offered service and very low price elasticity, and (iii) high economic and legal barriers to market entry.

In addition to the desire to incite productive and allocative efficiency, there may be non-economic reasons to impose regulation on a network industry. Attention paid to public safety, continuity of supply, public service obligations, environmental externalities and information disclosure are examples of such objectives.

Thus, in return for granting exclusive monopoly rights, for a limited or unlimited period of time, the society empowers a regulator to act as a proxy purchaser of the service, imposing constraints on the prices and the modalities of the production. Friedman (1962) clearly states that a natural monopoly *per se* does not necessitate a legal monopoly, it is merely a transient phase in the technological development. Any policy that blocks, hampers or discourages efficient entrants from market access is economically detrimental, cf. Demsetz (1968).

The regulator's problem

In economic theory, the regulatory problem is expressed as a game between a principal (the regulator) and a number of agents (the regulated firms). The objective of the regulator is to maximise social welfare, which may be thought of as the difference between the customers' and the firms' utility (profit) and the costs incurred. Immediately, it is clear that minimization of costs is a societal priority, as well as the inevitable trade-off between the consumer and industry interests. The objective of the regulated firms may be maximization of surplus, which in addition to monetary profit also includes managerial utility (effort level, benefits and conditions).

The availability and access to information is a key issue in the regulatory game. With perfect access to information, the regulator would impose market conditions on the agents, setting prices and service quality to correspond to the long-term equilibrium. However, the information is *asymmetrically* distributed among the regulator and the agents. The regulator faces a double asymmetry, where neither efficient costs, nor optimal efforts are verifiable. Costs and prices in the market are not true reflections of supply and demand, but are set by the actors themselves in a monopsony – oligopoly setting. Since the regulator has an information disadvantage against the agents, the goal of the regulation cannot be to achieve market conditions, but only to *mimic* the market by carefully using elicited information. The closer the regulation gets to market functions, the more stable and viable it will be in the long run. Facing efficiency improvements, innovation and technical development, a misspecified regulation will be likely to dampen progress and achieve lower social welfare.

Common solutions

We may distinguish four types of regulatory mechanisms:

1. Cost-recovery regimes (cost of service, cost-plus, rate of return)
2. Fixed price regimes (price-cap, RPI-X)
3. Yardstick regimes
4. Franchise auctions

Finally, we comment on the hybrid regime proposed by NERA, an American consulting firm.

Cost-recovery regimes

Taking the cost information supplied by the agents for granted the regulator may choose to fully reimburse the reported costs, often padded with some fixed mark-up factor. Unless subject to costly information verification (regulatory administration), the approach results in poor performance with skewed investment incentives (no investment risk, yet fixed return on investment), perverse efficiency incentives (loss of revenue when reducing costs) and lack of managerial effort (distorted market signals and limited managerial rewards). However, even with large investments in information gathering, the information asymmetry and the burden of proof resting on the regulator still cripple the efforts to induce efficiency. Regulatory authorities worldwide, also in the USA, are gradually abandoning these regimes as administratively costly and technologically inadequate.

Fixed price regimes (price-cap, RPI-X)

In response to the apparent problems of the cost-recovery regimes, Littlechild (1983) launched a so-called "high-powered" regime allowing the regulated firms to retain any realised efficiency gains. In the price-cap regime, the regulator caps the allowable price or revenue for each firm for a pre-determined period. To maximise profits, the firms minimise their costs and optimise their efforts, achieving cost efficiency. However, in practice, the price cap is regularly reset with hindsight to the realised profits in the past period, which limits the efficiency incentives. Recent empirical research (Giulietti and Waddams-Price, 2000) has shown that utilities indeed do play strategic games under price-cap regimes in anticipation of future price-cap reviews. Another difficulty is the initial price/revenue level when firms initially charge differing prices. Either the conditions are homogenous, in which case the price differences reflect inefficiency, or the price levels reflect heterogeneous delivery conditions. In any case, the initial price caps would have to strike a careful balance between informational rents, incentives for restructuring and bankruptcies.

Further, the price cap is usually linked to the retail price index (RPI) as a measure of inflation and a productivity improvement target (X). In spite of its conceptual transparency and autonomy, the initial caps, the periodicity of review and the determination of the X-factor face the regulator with the same challenges as other solutions. In particular, since initial windfall profits are retained by the industry and dynamic risks are passed on to consumers, there is a potential risk of regulatory capture by consumer or industry organisations.

Yardstick regimes

The idea behind yardstick regimes is to mimic the market by using real observations to estimate the production function. Lazear and Rosen (1981), Nalebuff and Stiglitz (1983) and Schleifer (1985) show condition for the implementation of first-best solutions for correlated states of nature. The results carry over even for imperfectly correlated states of nature (Tirole, 1988). Hence, the comparators do not have to be identical, but the relative difference in the exogenous operating conditions has to be known. The regime is attractive in the sense that the revenue of the firm is not determined by his own cost, but by the performance of the market (the other firms). Exogenous and dynamic risks will directly affect the costs in the industry, lifting the yardstick. Innovation and technical progress will tend to lower the yardstick. Thus, the regime endogenises the ubiquitous X-factor and caps the regulatory discretion at the same time. However, the pure approach, only to consider the observed cost in each period, is attached with some risks in implementation. First, a set of comparators or correlated operating conditions has to be established. Second, if the comparators are few and under similar regulation, there is risk of collusion. Finally, a yardstick system that is not preceded by a transient period of asset revaluation or franchise bidding will face problems with sunk costs and/or bankruptcy. The crucial question in terms of yardsticks in electricity distribution is how to preserve the competitive properties while assuring universal and continuous service.

Franchise auctions

A simple mean to elicit accurate cost information while assuring participation is to arrange franchise auctions (Demsetz, 1968, Laffont and Tirole, 1993, Baldwin and Cave, 1996). The idea is to award the delivery rights and obligations based on an auction among qualified bidders. The regime conserves the simplicity of the fixed-price regimes, but limits the informational rent. It also offers perfect adjustment to heterogeneity, since prices may vary across franchises. Problems are for limited markets with high concentration (like the Dutch) that bidding may be collusive, that excessive informational rents may be extracted and that competition may be hampered by asymmetric information among incumbents and entrants (McMillan, 1992). Even under more favourable circumstances, the problems of succession and investment incentives remain to be addressed (Williamson, 1976).

NERA "best practice cost-based incentive regulation"

NERA (2001) proposes a cost-recovery method under the misleading name "best practice cost-based incentive regulation". Alas, the method has neither anything to do with "best practice", that suggests a competitive quality, nor with incentives, since it is based on full recovery of all incurred costs (unless the regulator provides "strong evidence"). The suggested revenue cap is set based on an automatic inflationary mark-up on the asset base, moderated with a general productivity factor with unclear properties. Given the informational advantage of the providers in the proposed set-up, the regulator has to "buy" any cost efficiency with high informational rents, i.e., fixed consumer prices for a long period. As seen above, the idea of cost-based revenue caps is a particularly poor solution, combining the managerial inefficiency of the cost-recovery regime with the costly rent transfer of the fixed-price regime.

DEA as regulation instrument

A specific benchmarking approach, Data Envelopment Analysis (DEA), has been applied by several electricity regulators as an element of a yardstick regime. Not surprisingly, the approach has met some resistance from the regulated firms, fearing unreasonable cost targets and severe revenue cuts. In this section, we offer a brief but state-of-the-art perspective, commenting on the pros and cons of the approach.

Since Charnes, Cooper and Rhodes (1978,79) first proposed it, Data Envelopment Analyses (DEA) has become a tremendously popular relative performance evaluation tool. A recent bibliographic survey (**www.deazone.com**) identified more than 1000 papers analysing all sectors of society. Currently, DEA is also used as the basis for regulation regimes in different areas. In the regulation of electricity distribution, for example, countries like Norway, Holland, and Finland have introduced DEA based revenue and price cap systems, and DEA has – together with more traditional statistical methods – been used to determine reasonable cost norms in countries like Australia, England, New Zealand and Sweden.

This is not the place to attempt an in dept coverage of technical details about DEA. There are by now several textbooks covering DEA, cf. e.g. Charnes, Cooper, Lewin and Seiford (1994), Coelli, Rao and Battese (1998) or Cooper Seiford and Tone (2000). Instead we shall try to highllight the principal properties of DEA from a regulatory viewpoint.

Conservative cost estimates

Any attempt to handle the fundamental information problem in regulation has to make some comparisons of costs and services across firms. The distinctive characteristic of DEA is that the comparisons are very cautions and that individual units are given the full benefit from any doubt concetning the technology, cost drivers, demand characteristics, social preferences etc. These properties stems from the use of very weak *a priori* assumptions about the industry and from the use of the so-called minimal extrapolation principle. The consequence is that DEA generates conservative estimates of improvement potentials, which are well adapted to regulatory uses.

The ability to work with very weak a priori assumptions and flexible production opportunity models is one of the primary reasons for the success of DEA in regulation and elsewhere. No parametric statistical model or accounting cost model allows for a similar flexibility in the technology. There are several versions of the DEA approach corresponding to the use of different a priori assumptions. In all cases, however, the imposed a priori structure is mild compared to competing approaches.

Transparent model and results

Another important and popular property of DEA is its high transparency. Conceptually, it is based on a straightforward idea of comparing the performance of a given unit against an explicit combination of similar units. The comparators, the so-called peers, as well as their relative importance are made entirely explicit. This makes it easy to identify and test the appropriateness of the cost norm in for example appeals cases. This may not make the life of a regulator easier, but it fits nicely with the idea of regulatory accountability. It limits the burden of proof on the firm. Rather than having to invalidate the entire sample, as in a statistical econometric model, a DEA regulated firm can concentrate on a few selected comparators.

Noise

The single most problematic feature of DEA is the risk of mistaking noise for efficiency or inefficiency. And similarly, to mistake best practice for the most lucky practice. If a DMU by chance faces particularly favourable circumstances, not accounted for in the model, or if the registration of the outputs by luck (or intent) is biased upwards and the inputs downwards, the unit will appear to have performed particularly well and have little or no inefficiency. Similarly, there is a risk of non-favourable circumstances or registrations leading to groundless accusations of inefficiency in a DEA analysis. The first case is particularly problematic since it might influence the evaluation of others that may now face tougher standards by being compared to a unit with a windfall gain.

Of course, this problem of mixing up noisy and inefficiency is not unique to DEA. It is present in any relative performance evaluation. Still, it has played – and still does play – a more prominent role in the critique of DEA because the development of a statistical foundation has only picked up over the last 10 years. For a recent coverage of state of the art, see Simar and Wilson (2000). As of now, however, it is fair to say that there are several ways to cope soundly with the problem of individual noise and windfall gains and losses. The toolbox of moderns DEA includes advanced so-called sensitivity analyses, stochastic programming and hypothesis testing via bootstrapping, re-sampling or asymptotic theory. Add to this that with small sample sizes, the DEA norm is more generous. It is our view therefore that given these abilities to cope with idiosyncratic noise elements and given the superior ability to handle structural noise, the use of DEA in developed countries should not be foregone because of the noise problem.

Optimality of DEA based schemes

A recent line of research in the DEA literature is the design of optimal incentive plans. A survey is contained in Bogetoft (2000). This line of research combines the general ideas of modern regulation theory with the ability to model a complex reality with DEA. It not only examines the effects of DEA based regulation, but it also identifies contexts where a DEA based scheme is optimal.

In a series of papers, the problem of determining optimal revenue (or price) caps for local monopolies has been examined. A general conclusion of these papers is that with considerable uncertainty about the appropriate cost model and with risk neutral firms, the optimal revenue cap is the DEA cost norm plus possibly a output independent up-front payment. This corresponds well to a combination of a yardstick contract awarded at a franchise auction. Furthermore, if that firms must exercise non-verifiable effort to reduce costs, the optimal scheme involves reimbursing the actual cost plus (minus) a fraction of the cost saving (overrun) compared to the DEA norm. These characteristics of the optimal system carries over to dynamic setting and give rise to DEA based yardstick competition schemes. With non-trivial amounts of idiosyncratic noise, the optimal schemes are more complicated to characterise, since they depend on the specific details of the distribution of the noise terms. Again, however, cases have been identified where optimal schemes depend on DEA based evaluations.

The optimality of these schemes are derived from the fact that with considerable uncertainty about the impact of different cost drivers *a priori*, we need to give the individual firms the benefit of the doubt in the sense of using a minimal extrapolation norm, if we want to avoid unwarranted market exit.

European and American regulation

For any regulatory mechanism to be effective, it needs to be embedded in an accountable, credible and stable institutional framework. Unless the regulatory body convincingly presents their principles, decisions and trade-offs, industry reactions may be negative and the cost of capital may increase. To protect public and private interests against potentially errant regulatory discretion, rulings may normally be challenged in administrative courts, cf. Baldwin and Cave (1999).

The industry in several countries have suggested a US-style enforcement of regulatory rulings, under which the regulator is heavily constrained as to interventions, procedures and information disclosure. This reaction is at large a response to the not yet mature European regulatory framework, which in e.g. the U.K. has been somewhat dependent on the personal profile of the regulator in office. However, a judicialization of regulation is likely to distort economic decision-making, to provoke defensiveness and, paradoxically, to promote less transparent out-of-court settlements. Cf. Bardach and Kagan (1982) or Prosser (1997). Although such formalism in Europe signals legalism and asymmetric manipulation, it is more natural in a US context. The US legal system often takes an independent role in the protection of private interests, such as private utilities' investments; the European approach to governance suggests a more open political discussion of regulation. The industry structure is also vastly different, with publicly owned utilities that earlier may have benefited from tax levies and direct subsidies.

Given the informational asymmetry between the regulator and the firms, the procedure is socially costly. The societal cost of having a less informed party bearing burden of proof for the behaviour of the better informed will in this case directly translate to either excess administrative costs or increased consumer prices. The idea of a benchmarking regime is exactly to solicit information from the better-informed party by using comparative studies. Rather than having the regulator second-guessing the operating conditions of a particular firm, it seems intuitively preferably that the regulated firm provides justification for costs that surpass the best practice norm. By focusing more at the *rights* of the licensee, not at the *obligations* that are attached to the contract, Mr Sleutjes openly sides with his client. In a monopsonistic (single buyer) situation like pharmaceuticals, nobody would suggest the *buyer* to challenge cost items. In a situation with renewable licenses, the analogy is more applicable than it may first seem.

The Development of Regulation Economics

Regulation economics was long considered as a fairly uninteresting application of industrial organisation. Early regulatory theory largely ignored incentive and information issues, heavily drawing on conventional wisdom and industry studies. The kind of institutional regulatory economics that Bonbright (1962) and Philips (1969) represented was challenged already in the seventies with economists as Friedman, Baumol, Demsetz and Williamson questioning the organisation and succession of natural monopolies. However, the main breakthrough came in the late eighties with information economics and agency theory (Holmström, Laffont, Tirole). An authoritative reading in the area is Laffont and Tirole (1993). Contemporary economic theory pursues the private goals and strategic behaviour of the individual agent, with particular emphasis at the access, cost and use of information. The practical applications from this stream of research have had a profound impact on modern markets, market instruments, contracts and economic restructuring. We believe that negligence to address the information asymmetry and the distribution of risk and rewards in regulation would be, at best, a repetition of past mistakes, if not outright naiveté.

Conclusion

Regulation is a tough business. Risks of capture by industry or consumer groups lure on the regulator, undermining the viability of a sound incentive regulation that gives the right signals. However, slipping into the post-war American judicial cost-recovery regime will be a loss for all involved. The regulator, swelling into a costly pseudo-manager; the firms, hampered by the intrusion into their technology and budget; the consumers, ultimately paying for the lack of efficiency incentives. The only relative winner in such an administrative system, constructed on the slowly grinding wheels of administrative appeals courts, would perhaps be the industry of consultants and legal counsel.

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