

Industrial Economics

Regulation

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Part A – Introductory remarks

- There are two main reasons for regulation:
 - ① Natural monopoly in a mature industry with little technical development
 - ② Important external effects (externalities).
- There are two principal forms of control:
 - ① Sectoral regulation dedicated to an individual sector requiring good technical knowledge of the sector (particularly necessary in the case of significant externalities).
 - ② A competition authority (antitrust) controlling monopoly power requiring theoretical competence and good knowledge of industrial economics.
- The distinction between the two is not always clear, as certain authorities combine the two (e.g., ARCEP for telephony in France). Sometimes countries experiment with hybrid forms (e.g., the Bundesnetzagentur in Germany).

Part A – Introductory remarks

- A frequently used measure of market power is the Hirschmann-Herfindahl Index (HHI) which is defined as:

$$HHI = \sum_i (100 \times p_i)^2$$

where p_i is the market share of company i . In monopoly, the HHI is thus equal to 10 000. In perfect competition, it is equal to zero. Frequently, regulatory intervention is warranted with $HHI > 2500$. Much depends on the definition of the appropriate market.

Three major challenges in regulation

- **1. Information** (the most important): the regulator needs to have the necessary information, in particular on the costs of the regulated firm to set the appropriate tariff. However there exist asymmetries in information:
 - Moral hazard: the regulated firm holds private information about the variables that control itself (e.g., its effort);
 - Adverse selection: the regulated firm holds private information about exogenous variables (e.g., its costs).
- Periodic controls limit but do not completely erase these informational asymmetries. Under regulation, by definition, the regulated entity has a certain degree of autonomy.

Three major challenges in regulation

- Informational asymmetries exist both on the supply and the demand (customer) side. Usually the supply side is more important.
 - On the supply side (principally costs and effort); moral hazard is strong, but the issues and parameters are well defined.
 - On the demand side (concerns quality of service, interruptions, coverage etc.) moral hazard is lower (but not inexistent, think of demand response programmes), but the data is more complex but more qualitative or fuzzy.

Three major challenges in regulation

- **2. Transaction costs**
- Regulation needs to take into account the costs of negotiation, contract formulation, supervision and, most importantly, information retrieval.
- It thus needs to strike the equilibrium between informational simplicity and theoretical economic efficiency. For example, the economically efficient rule “equalize tariffs with average costs at each moment” may require large amounts of data. Instead the rule, “determine average costs once and leave tariffs unchanged for the next five years” requires much less data.

Three major challenges in regulation

- **3. Regulation needs to take into account the administrative and political environment.**
- The regulator is constrained by the law and its independence and powers vary from country to country. There is always the possibility of the regulated firm (usually large and well versed in lobbying) to take direct recourse to lawmakers and the political sphere. Who controls the controllers? There is also the quid pro quo between efficiency and transparency (control). Arms-length oversight of the regulator might allow smooth functioning but may lead to “regulatory capture”, where the regulators identify with the objectives of the regulated firm.

Part B – The Incentive Structure

- The key challenge of the regulator is to determine the form of regulation that determines the transfer t , the rent, net profit or benefit of the regulated business.
- The big question in this context is to which extent the transfer shall depend on the effort of the regulated firm? In order to answer it, it is useful to express t as follows:

$$t = a - bc$$

where c is the cost of production of the regulated firm and a and b are parameters.

- We are primarily interested in the two limiting cases:
 - $b = 0 \rightarrow t = a$: The transfer (benefit, profit, rent) is independent of effort. There is thus very little incentive to reduce costs.
 - $b = 1 \rightarrow t = a - c$: The transfer corresponds to the residue after costs. There is thus a strong incentive to reduce costs.

- We can thus distinguish:

	Role of costs	Form of incentive	Time perspective	Adjustment	Force of incentive
A	$b = 0$	Rate of return regulation (ROR)	ex post	Frequent	low
B	$0 < b < 1$	Incentive contract	Periodical	Middling	average
C	$b = 1$	Price cap	ex ante	Rare	strong

- **A. Rate of Return Regulation:** This is the classical case and the oldest form of regulation. It takes place in two phases (1) the determination of cost and the rate of profit (return on capital) and (2) the determination of tariffs.
- Advantage: Tranquillity and security for both the regulated firm, its employees and the public; high quality of service.
- Disadvantage: High tariffs, technical stagnation, inefficiency and wasteful overinvestment (gold-plating).
- A key question in this context is the length of the regulatory regime. ROR, in principle, requires permanent ex post tariff adjustment. In practice this is unlikely and adjustments are periodical? The pure cases thus do not exist in reality. If periods between adjustments are too long, even ROR evolves into a form of B or C.

- **B. Incentive Contracts:** The advantage of this second form of incentive structure is that there is pressure for good performance without large extra-profits. One can also negotiate specific adjustments for important raw materials such as oil, gas or coal).
- If the target profit rate r is between 13% and 15% return on capital, an incentive contract can, for instance, take the following form:
 - Reduce the profit rate by $(r - 15\%)/2$ if $r > 15\%$.
 - Do nothing if $13\% > r > 15\%$.
 - Increase the profit rate by $(13\% - r)/2$ if $r < 13\%$.
- Good performance is thus somewhat remunerated without providing exaggerated incentives for cost cutting. At the same time, there is some insurance in case of hard times. The disadvantage of such incentive contracts may be their complexity, their room for interpretation and lack of transparency.

- **C. Price Caps:** The key challenge is to find the right level of tariff. Set it too low and the regulated monopolist makes losses or reduces service quality. This is an unavoidable risk in this form of regulation. There thus needs to be close monitoring of service quality with precise specifications. Set it too high and the regulated firm can make very high profits.
- The benefit is that price caps provide an excellent incentive to improve efficiency.
- The essential difference between the two approaches is that ROR is retrospective and that Price Caps are forward-looking.
- The pace of revisions and the credibility of the price caps thus is a key issue in regulation.

- There exists the possibility to overcome informational asymmetries and to incentivise businesses to reveal their true costs and ability for cost reduction by offering them a portfolio of contracts to choose from. These contracts are differentiated in terms of length of duration and level of tariff, the longer the contract, the lower the tariff on offer. Efficient terms firms will choose low priced contracts with long durations. Inefficient firms will choose high-prices contracts with frequent revisions. Both choices limit excess profits and provide appropriate incentives. In practice this is a lengthy process of negotiation and learning.

Part C – Determining the long-term marginal costs of the system (average costs of the firm)

- Short-run marginal costs, SRMC, are the result of competition and remunerate variable costs.
- Long-run marginal costs, LRMC, are the result of regulation or contestable markets and will remunerate both variable and fixed costs, i.e., the average costs of the firm. However, we may refer to them as “marginal”, once we look at the electricity system as a whole and consider adding an additional generation plant.
- draw graph here
- The price set by the regulator in such a growing system needs to be $p = LRMC$, so the average cost, which will also compensate adequately the cost of additional capital needed to build additional capacity.

- In the short run (considering capital investments as fixed), we are thus under diminishing returns and in the long term (when capital investments are flexible) under increasing returns.
- **Warning:** Despite its reassuring name, the long-term marginal cost is not the result of competition (except with contestable markets), but the result of a decision by a regulator. The theory was first developed by Marcel Boiteux, chairman of EDF.
- Another way to approach the problem is to consider the pricing of a non-storable commodity whose demand varies throughout the day and to ask the question “how shall I recuperate the fixed costs of the system in an optimal manner, i.e., $p = mc$?”
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- The total costs are:

$$\sum_i q_i \times SRMC + FC = \sum_i q_i \times SRMC + capacity \times K$$

where K is the price of a unit of capital and $SRMC$ is short run marginal cost

- Revenues thus need to be:

$$\begin{aligned} & \sum_i q_i \times SRMC + capacity \times K \\ &= \sum_i q_i \times SRMC + q_4 \times K \\ &= \sum_{i \neq 4} q_i \times SRMC + q_4 \times (SRMC + K) \\ &= \sum_{i \neq 4} q_i \times SRMC + q_4 \times LRMC \end{aligned}$$

- Prices thus need to be: $p_1 = p_2 = p_3 = p_5 = p_6 = p_7 = SRMC$ and $p_4 = K + SRMC = LRMC$
- If the size of the system has been properly determined $q_4 =$ capacity and the budget constraint is respected and firms are profitable.
- The problem is that in a liberalised market with a non-differentiated commodity such as electricity, there will be Bertrand competition and thus also during peak times $p_4 = SRMC$. There is thus a problem to finance adequate investment, also called the “missing money” problem.

- Further considerations concerning the rule $\text{price} = \text{marginal cost}$ (without further indications, marginal costs refer, as usual, to short-run marginal costs)
- We have already seen that with natural monopoly the $p = MC$ rule requires the funding of fixed costs by the government, which creates economic inefficiencies through the taxation required to raise the necessary funds.

- A second consideration is introduced by Coase. If we adhere strictly to $p = MC$, how can we know whether the total value of the output is worth the cost, i.e., whether $TB > TC$? In the example below, with the fixed cost corresponding to the shaded area, it is not worth doing the project if demand is $D1$. However, just adhering to the $p = MC$ rule and without looking at the fixed costs and some sort of average cost pricing we would never know.
- draw graph here

- A similar argument is made by Bolton. If a regulated firm has (theoretically optimal) prices set at $p = MC$ and receives a lump sum subsidy to cover fixed costs, it has no incentive to reduce its fixed cost. There is moral hazard assuming that the interest of management for reasons of prestige is to maximise output, q . Even with a higher fixed costs, $q = f(MC)$, would not change. With average cost pricing instead $p = AC$ and the quantity, $q = f(AC)$, would be reduced if the fixed costs, average costs and prices increased.