

Natural monopoly and solutions to be implemented – why do we prefer to regulate electric utilities?

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25.02.2005

Working paper version 0.001

Abstract

This paper presents some arguments for the practice of regulation in electricity industry. In the first part we will remind some basics of the natural theory monopoly and explain the reasons why it constitutes a problem and remind existing solutions. Next, we briefly explain the franchise bidding as an alternative solution to the natural monopoly. Finally, we illustrate the case of electricity sector and show why franchise bidding cannot resolve problems in this sector and regulation is preferable.

Natural monopoly problem

One of the most important market failures is the natural monopoly. An industry is a natural monopoly if the production of a particular good or service by a single firm minimises costs. It is an extreme case opposed to perfect competition (fig. 1), when the single firm has total control over the sector (it is the unique producing firm and there is no other sector supplying a close substitute). Generally, these monopolies are rare; they exist under the form of a governmental protection. Legal restrictions imposed by the government (licences, quotas, etc), high entry costs (MS Word largely diffused) and product differentiation and publicity (market of cereals for breakfast, Pepsi and Cola) are barriers on entry to the market that favour monopoly. We will focus on the case of public service concession and in particular on the electricity sector.

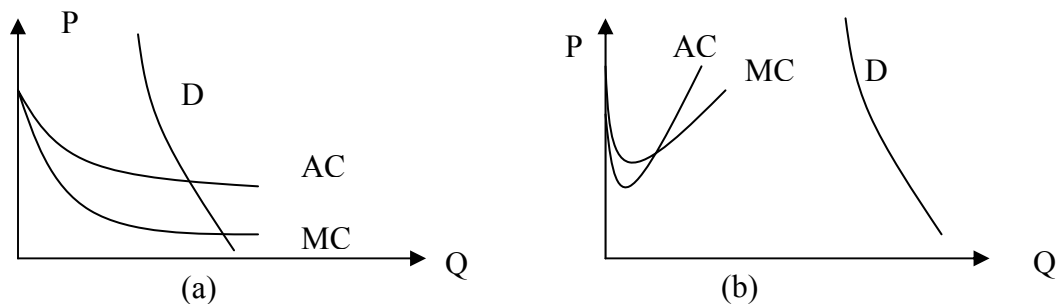


Fig. 1 (a) natural monopoly case; (b) perfect competition case

The problem is to find how society can benefit from this least-cost production without suffering from monopoly pricing. Figure 2 is an illustration of welfare losses resulting from monopoly pricing.

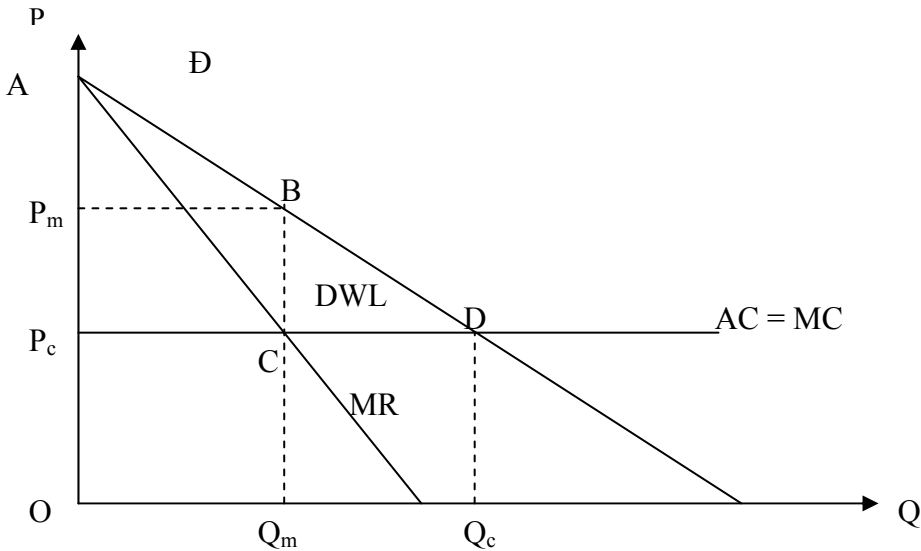


Fig.2 - deadweight loss

For simplicity we assume that average cost equals marginal cost ($AC = MC$) and we take the first case one where the monopolist sets prices where AC meets marginal revenue (MR). This means sold quantity is Q_m and monopoly price is P_m (price that meets market demand D), monopoly (producer) surplus is P_mBCP_c and consumer surplus is AP_mB . In the case of competition, when the price is set at MC , consumer surplus becomes AP_cD , there is no producer surplus and BCD (the deadweight loss triangle) is avoided. The approach usually followed in public utility regulation is to force the monopolist to price so as to earn a “fair” rate of return on investment.

Some characteristics of a natural monopoly are (eventually) permanence, subadditivity and sustainability, and scale economies.

Permanent (Fig.3) means that average cost continuously falls as output increases so a single firm can cover all the demand, no matter how large it is. On the contrary, when $LRAC$ falls until an output Q^* and becomes constant thereafter, it means that as demand grows over time, the market can become competitive since other firms can enter at the same $LRAC$. This could happen with the development of new technologies like in the case of telephone services. So, technical change can shift cost functions and make competition workable.

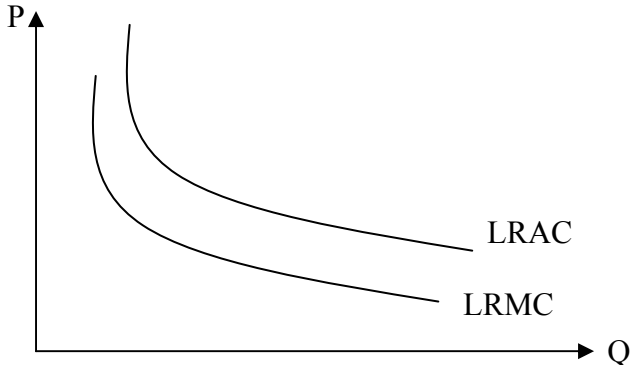


Fig.3 “ideal” permanent monopoly

Subadditivity refers to whether it is cheaper or not for a single firm to produce all demanded output in the market or additional firms would achieve lower total cost. The cost function of a natural monopoly has the subadditivity as defining property, meaning that the production of all combinations of outputs is done at least cost by a single firm.

Sustainability is a relevant concept when a regulatory agency must decide whether to allow entry of a multiple-product natural monopoly in a particular market (Baumol, 1977).

A very important characteristic of a natural monopoly are scale economies. For illustration, we take an example (which is an extreme case) of most cheaply production carried out by a single firm (Fig.4): LRAC curve reaches its minimum at an output level that is very large relative to market demand. The monopolist will set price P_m and output Q_m where it will maximize its profit. Suppose there are a number of firms able to produce only output q and that they are sufficient to obtain competition. As we see LRAC of q would be high and would result in a competitive price P_c which exceeds monopoly price. This example shows how economies of scale can make monopoly the preferred market organisation.

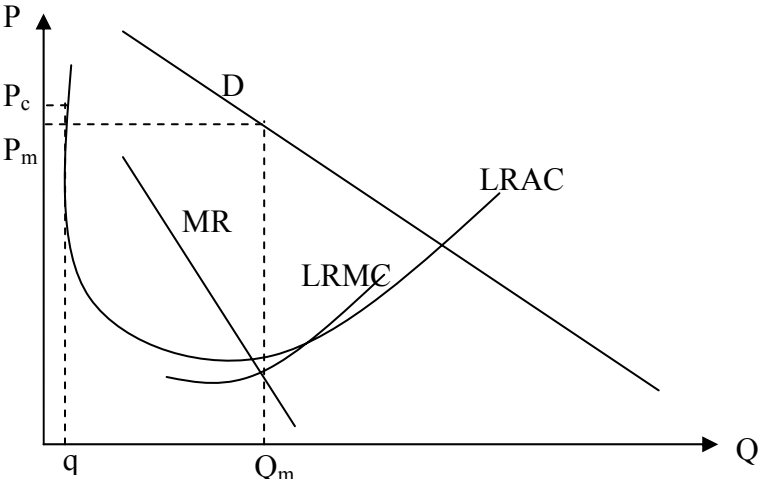


Fig.4 – scale economies

In those cases the policy problem becomes one of controlling the natural monopolist by regulating it or by franchise bidding process.

After seeing the characteristics of a natural monopoly, we will now briefly examine various solutions that have been proposed to correct its inefficiency. They include theoretic “ideal” solutions as marginal cost pricing (assuming that the firm acts for the public interest and that fixes prices so as to produce economic efficiency), Ramsey pricing, Loeb-Magat solution, franchise bidding solution and regulation. Ideal solutions are highly theoretical and cannot be truly applied in a real market; this is why we will leave them aside of this paper. We will focus on the franchise bidding and make a short analysis of this solution and we will show the reasons for which it cannot be implemented in the case of electricity industry.

Franchise bidding solution

In this section we will consider alternative policy solutions to the natural monopoly problem, which, in contrast to the ideal pricing solutions have actually been implemented. We will briefly examine the franchise bidding solution and, in the third part, we explain why, in the case of electricity sector, regulation will be preferred.

Franchise bidding contracts are passed between a public authority conceding a service to a private operator (through a bidding process) which, at its turn, supplies the contracted service directly to consumers (not to the franchiser itself) (Huet 2004).

The failures of regulation during the 1960 brought H. Demsetz to propose an alternative solution. He argues that “the theory of natural monopoly is deficient for it fails to reveal the logical steps that carry it from scale economies in production to monopoly price in the market place” (Demsetz 1968). Even if scale economies impose a single supplier ex-post, concurrence is possible at the initial stage of the offer between many candidates. Moreover it might be possible to have bidding for a franchise giving to one firm the right to supply the whole demand of the market. This way, competition for this right would give a price which will be an improvement over the natural monopoly price, due to the initial selection of the most efficient candidate. This most efficient candidate designates the one who proposes the smallest price. When the number of candidates is high and collusion is impossible, the price will be close to marginal cost. The general idea of this paper is that competing for the market can replace an ex-post regulation (if we see regulation as a form of contract). Demsetz illustrates it with an example from automobile industry and, for simplicity eliminates uncertainty, durability of the distribution systems and irrational behaviour (Demsetz 1968) considering them as “complications with no importance” (in the natural monopoly theory) in the justification of the choice between a regulatory commission and a franchise bidding process.

In 1976, O. Williamson demonstrates the lack of pertinence of Demsetz solution (F. Huet 2004). His paper shows the limits of franchise bidding in the case of uncertainty and specific investments (also taking into account the duration of the contract) and the difficulties a competition for the market could bring. He analyses three types of contracts. Conventional analysis (Williamson 1976) has great difficulty to distinguish between ex-ante offers and ex-post supply conditions.

Once for all contracts are not applicable in practice, because the changes of prices, technologies, and demand function or consumer preferences will shift long run average cost curve and all initial conditions of the contract with it. The incertitude is too high in this kind of contract and it is impossible to specify all changes in cost and demand in order to allow prices to adjust in the future.

Recurrent, short-term contracts are simple and they can be incomplete since the auction will be put up periodically for a new award and a new contract. This is one way to handle cost and demand changes. This contract also provides incentives for the current franchise owner to honour its contract (concerning the quality of service for example) otherwise he will be penalized through disadvantages in the next bid by the franchiser. Though, for the threat to be effective, the government agency must have good credibility.

At the renewal time, however, a real parity among bidders is needed. If the previous winner (incumbent) has an advantage and wins again, the new contract will be inefficient for being set in non-competitive terms.

The first advantage an incumbent can typically have consists in investments made in plants or equipment that have already been counted as depreciation and he will bid at his average variable cost. This way new competitors' bid will be higher than incumbent's bid, even if they might be more efficient at long-term. (Fig. 13.6 - needed?).

The solution to this problem is a transfer of capital from the current franchiser to the new winner. However this would be a compulsory transfer of assets and this puts a problem for a fair and efficient transfer when the new winner should buy the assets from the former one because requiring the incumbent to sell at (original cost – depreciation) gives him room to inflate the true value of assets. Moreover, not only the physical capital is to be transferred, but also human capital. Incumbent's employees did benefit of a learning process while working during the contracted period and they should be transferred to the new winner, otherwise they will make another advantage for the incumbent. Finally, capital transfer can be seen as a bargaining problem to be resolved in the best interest of both firms. (Hmmm ... *explication?*)

The second advantage can rise from the fact that governmental bureaucracy would prefer maintaining the status quo (stability) rather than make changes, because changes mean additional work plus, if things turn out badly, they are the blamed ones (Viscusi, Vernon, Harrington 1992). If, on the contrary they maintain the "stability" their loss is very little. This hypothesis has not been empirically verified yet, but seems interesting developing it when we want to compare franchise bidding to regulation process.

Incomplete, long-term contracts are the most common in the public services sectors. The comparative advantage of this kind of contracts on short-term contracts is that they give to the winner an incentive to invest in long-run assets. He knows it will have enough time to receive returns from these investments. As disadvantage, a long-run contract is difficult to write for it must allow prices to be changed with the variations of costs and demand. Consequently, a price formula is needed to relate (cost of inputs) to (price of supplied service). There is also need for quality monitoring and penalties must be provided in contract in case of non-respect. Long-term contract problems can be encountered in three stages: before contract signature, during the execution and at the renewal moment.

Initial award problems and solutions

One difficulty is on how to choose the winner, on which criteria? Williamson shows in his article of 1976 that the price is not sufficient for an efficient attribution of a contract for not giving enough information on the quality of the service. A solution proposed (Posner 1972) was that the franchiser (local authority) evaluates consumer preferences or the candidates provide an evaluation of the sector, but this is a rather theoretical solution and is difficult to apply.

Furthermore, other factors influence on these contracts: uncertainty (on technology, on demand curve), complexity of service (Bajari, Tadelis, McMillan 2003) or quality that can be observed but cannot be verified (Huet 2004). Consequently, even if the competition for the market ensures that initial price reflects short-term average cost, it will not reflect long-term average cost given limited rationality of the agents combined with uncertainty and complexity of service. The most important risk is to choose the candidate the most opportunistic or the most optimistic, instead of the most efficient one.

Execution problems (as ex-post opportunistic behaviour) and solutions

Williamson (1976) shows two main problems on the uncertainty during the execution phase of the contract.

The first one is the divergence between cost and prices: given evolution of the economic environment during the contracted period, the contract must allow prices to be changed with the variations of costs and demand. Consequently, a price formula is needed to relate (cost of inputs) to (price of supplied service) but it will not be enough for an appropriate adaptation. In this case, they should be reviewed, but this solution implies high renegotiation costs. If the local authority decides to apply a cost-plus formula, this problem will be solved but a new one would arise: the need to control the franchisee's costs. This problem is very close to regulation problems. Moreover, it will be necessary to specify quality of services and to define credible procedures of control and penalties. Unfortunately, quality standards will not be enough and consumers are not able to evaluate the quality of the services they are provided with. Priest (1993) shows that in the case of a good quality and high complexity of services, the franchise contracts tend to be replaced by regulation.

The second one concerns the opportunistic behaviour of the winner. The threat of breaking the contract (Huet 2004) is rather weak for the franchisee because (i) the guarantee of respect of the duration of the contract is given by his specific-asset investments; (ii) even in case of interrupting the contract the juridical procedure is long and expensive (iii) could be the "bureaucratic reason already discussed on short-term contracts and (iv) interruption of the contract means interruption of service supply to the consumers. In this case, the renegotiation power of the private operator and its opportunistic behaviour risk are enforced. A solution could be the existence of a control mechanism: stipulation in the contract of an obligation of the operator to regularly provide information to the public authority and financial monitoring. An interesting aspect for a firm operating on more than one market is the reputation effect as an inhibitor of opportunistic behaviour.

Lack of equilibrium at the moment of contract renewal

The incumbent has several advantages at the contract renewal moment. His investment on capital, better knowledge about technology through learning-by-doing process, a better information on the demand of the market and also a better knowledge of franchising process (which he already won ones). Having all these advantages, the incumbent may hold up the franchiser (notably the local authorities) and force it to change the contract in his advantage. Capital transfer problems have already been discussed above, on the short-term contracts.

The most important idea of franchise bidding solution is that uncertainty about future demands a greater implication of the government in the bidding process. In the case of incomplete, long term contracts, franchise bidding differs from regulation only in degree, but not in kind. A government agency must specify quality and monitor the performance of a franchise owner and also negotiate price changes with the franchisee. In some way, regulation can be seen as an incomplete, long-term contract in which the firm is guaranteed a fair rate of return and there is an established procedure for making changes.

In an ideal environment franchise bidding appears quite superior to regulation for accomplishing the same outcome at lower cost. There is no need for regulatory agency and no incentives for the monopolist to act inefficiently. However, as we introduce product quality and uncertainty it begins to look more and more like regulation. Still, it is an interesting alternative to regulation and it has considerable potential.

Why franchise bidding cannot be applied on electricity sector

The electric industry has many technological particularities. The first characteristic is the strong need for technical coordination between the subsystems (generation, transport, power markets, distribution and supply) of the electric system. This necessity brought to vertical integration of subsystems into a single utility. In this type of organisation of the electric system, it is extremely difficult to trace and allocate costs without the control of a central authority. The second characteristic concerns heavy investments in specific assets that need constant maintenance and supervision. Third, after combining the two first reasons, technological progress or adaptation becomes very difficult to follow (it will be difficult to integrate a new technology into a chained system where any modification can have upwards and downwards consequences in the whole system without the strict supervision of a central authority).

Alfred Kahn shows that between 1882 and 1907, in the US “nonexclusive, competitive electric franchises were granted freely, often as a means of forcing down rates that cities considered too high”. During this period, the city of Chicago granted 29 franchises for small areas as “one block each way” or “a few blocks on the north-west side” etc.

A first reason for this practice was technical: the use of “direct current at low voltages made it impossible to distribute electricity over an area greater than one square mile” (Kahn1988). Second, small, local companies were unable to raise large quantities of capital necessary to serve entire areas exclusively: “electrical equipment manufacturers, competing with one another, would each set up its own generating and distributing company” (Kahn1988).

Third, competition was the general national policy and the notion that in certain industries regulated monopoly might produce a better performance was not accepted yet and regulatory agencies were themselves in an embryonic state. So, municipalities tended to grant franchises and to change suppliers when the rates being charged were considered inadequate.

But this kind of competition proved ineffective for while it lasted, it “favoured the public for a time with low rates, but invariably at the expense of a deteriorated service. Financial exhaustion of one or more of the companies eventually brought about a complete consolidation or an agreement as to rates or territory” (Behling B. 1938 “Competition and monopoly in public utilities industries”). Moreover, competitive franchises were regularly followed by collusion and combination among the franchisees despite the efforts of legislatures to prevent it. A. Kahn shows that, even more, “some promoters took out these licences merely to sell them to other companies ...in city after city, as a result, one company would emerge with almost all the franchises issued. The policy of competition, it seems generally conceded, was a failure. It was out of this experience that the concept of natural monopoly gradually emerged as an attempt ... to explain the persistent tendency of competition to produce inferior results and to disappear” (Kahn1988). In the light of these events, the next logical step was the constitution of independent regulatory commissions.

A similar case has been studied by G.L. Priest (1993). US municipalities (local authorities) put up bidding processes for public services (gas, electricity, water, postal services and tramways) to save themselves from heavy investments this kind of services demanded. First, they set up incomplete, long-term contracts that revealed to generate opportunistic behaviour and were, moreover inefficient to control monopoly power of franchised operators. For preventing this kind of problems, municipalities elaborated more complex and complete contracts, stipulating very carefully penalties and giving very detailed indications over the

activity and expected results of the private operators. Instead of resolving problems, these contracts showed themselves too rigid and brought adaptation difficulties to market changes. So, reducing opportunism meant also reducing contract flexibility (Yvrande-Billon 2004). Finally, municipalities adopted a “mixed” solution: obligations and performances were specified in general terms in the contracts, allowing flexibility; prices and more detailed performance specifications were, in exchange managed and controlled by a commission of experts of the municipal council. This solution is, in fact reduced to regulation (by having a constant controlling “agency”).

In this “stories”, we find most of the theoretical arguments for regulating electric utilities instead of making competition for the market and franchise their services.

Conclusion

A very complex system, asking heavy specific investments in human and physical capital like electric industry, needs close control and monitoring, cannot suffer significant interruptions in supplying the service. These are the main reasons making impossible the signature of a satisfying contract and demanding for a continuous control and research for incentive formulas to efficiency and to maintaining quality of service. Moreover, electricity sector tends to interfere with politics, becoming this way a more important threat of opportunism.

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