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REGULATION OF ACCESS AND INTERCONNECTION PRICES IN TELECOMMUNICATION

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PRELIMINARIES, AIMS AND METHODOLOGY

In network industries (telecommunication, electricity and gas distribution, transportation…) the access of networks essentially determines market mechanisms. Conditions of access and interconnection significantly influence the characteristics of market structure and market power and hereupon the welfare performance of the industry. Not surprising that regulation of access and interconnection prices has become one of the most important issues of the evolution of network markets and market regulation. Access of essential facilities by rivals is one of the basic problems of telecommunication, as well as other network industries. Incumbent is interested in presenting its costs of access services as higher, because this way it is able to devolve a part of retail costs and hereby to achieve a competitive advantage in retail level (in competition of services provided in the network). Thus as owner of a network (essential facilities) the incumbent has the potential of predatory practice (or at least to handicap entrants), that is unregulated access prices will be "too high": the incumbent charges a higher price than the marginal cost of access. Incumbent will provide less access services on higher price in order to raise competitors' retail prices.

Price regulation, including the regulation of interconnection charges, is based on the principle of "cost-based pricing", though this regulation policy sets many problems. One important aim of this dissertation is to analyse and present systematically what regulation rules lead to bigger welfare under different conditions: cost-based pricing, *ECPR* based pricing or Ramsey pricing. We could separate different regulatory situations based on different combination of regulatory conditions, aims and instruments, and deduce optimal access and interconnection charges (or, at a more general level, the rule of regulation) of each case in respective models. The other basic aim of the dissertation is to present information problems of this regulatory situation that significantly worsen the efficiency of regulation, and to build a feasible model— based on principal–agent theory—of incentives regulation that takes account of asymmetric information between regulator and firm, and that provides proper incentives for participants. In this model first we presented the benchmark case of regulation with perfect information and cost-based pricing, then we described a model of incentive regulation that is able to deal with problems of adverse selection and moral hazard. It follows from these that the dissertation methodologically builds on theoretical modelling: I present the optimal regulatory rules in models described under different regulatory conditions.

KEY POINTS OF THE THESIS

1. Optimal regulatory policy of access basically depends, on the one hand, on regulatory conditions (what aims the access charges have to accomplish and what additional instruments the regulator has) and, on the other hand, on that important condition whether entrants have the opportunity to bypass the access (network) of incumbent or not. We can see in the models described for different cases that regulation has to optimize in force field of different aims and available instruments. Maximizing welfare in each case requires that the regulation ensures:

   (a) Productive efficiency, effective usage of resources. It means that every unit of good is produced what can be sold on the market at a price equal to marginal cost, that is, without/not having deadweight loss. This requires prices be equal to marginal cost.

   (b) Allocative efficiency, efficient entries into market segments. It means that the more efficient firm should provide services, which requires the proper signals for entries. We showed that in case firms are forced to offer retails tariffs that depart from their underlying costs, inefficient entries will occur. Correction of entry signals requires a departure of access price from its cost.

   (c) The correct "make-or-buy" signals to entrants. That is, entrants' decision whether they should prefer access to incumbent's network or bypass it and construct their own network, should not be distorted.

   (d) Control of prices if competition is not efficient. Access charge affects retail prices since it builds into the other service provider's costs. This requirement pushes charges downward.

As we showed there could be a conflict between these aims, and how and how much could regulation of access charge achieve these aims depends, on the one hand, on what additional instruments regulator has and, on the other hand, on whether bypass is a possibility for entrants.

There are four problems that bottleneck cost-based regulation (which is so popular in regulatory practice): (i) asymmetric information, (ii) problem of distribution of fix and common costs (a requirement that call charges be used partly to cover non-traffic sensitive network costs), (iii) prices that are departed from marginal cost (e.g. by reason of geographically uniform tariffs) and finally (iv) unregulated retail tariffs. The first three are common problems which render cost-based regulation more difficult in every situation departing access charges from their marginal cost, while the fourth problem of access charge regulation arises in a special case: if regulator controls only the access charge but retail tariffs are unregulated, then instrument of access charge has to take over more tasks and, as we claimed, a conflict could emerge between these regulatory tasks.

2. Departure of retail prices from marginal cost results in bad entry signals. If firms are forced to offer geographically uniform tariffs, that is, retails tariffs that depart from their underlying costs, there will tend to be "too much" entry into artificially profitable segments and "too little" in the loss-making market segments. In addition, distorted entries induce funding problems: if entries eliminate profits in the previously profitable market segments, then incumbent may be unable to continue to fund its operation in loss making market segments (e.g. to fund loss making universal service obligation). As we showed in applied models, to ensure proper incentives for entry—if retail tariffs depart from their underlying costs—access charge has to be departed from its marginal cost. This result leads to the so-called ECPR principle (*efficient component pricing rule*), that says the following:

access charge = marginal cost of providing access + incumbent's lost profit in retail markets caused by providing access

Here the idea is not the overall compensation of incumbents for lost profits, but rather that departures from cost-based access pricing are the result of second-best correction, which intends to account for incumbent's distorted retail tariffs. (Compensating lost profits due to uniform tariffs derived universal service obligation, which would imply that entry would also be profitable if the entrant has a higher retail cost than the incumbent and/or

provides an inferior service). Thus, this ECPR plus in charges is the instrument of correction of entry signals.

3. When bypassing the incumbent's network is a possibility, the cost-based access pricing policy is the only one that gives the correct "make-or-buy" signals to entrants. For example, if the price is charged for use of network elements is above its cost, it could result that an entrant would prefer to bypass the incumbent's network and construct its own network, even though it would be more efficient to use the incumbent's network. Consequently, bypass reduces the excess in the ECPR formula: bypass constrains the magnitude of deflection of access price from its cost (entrant will bypass the incumbent's network if the access price is too high).

4. We showed if regulator has another regulatory instrument, e.g. an output tax levied on retail services (which can be accomplished by payments into a well-designed universal service fund), that can implement the second-best correction of entries, then access charges need not perform this additional task (there is no need to corrupt productive efficiency in the interest of correct "make-or-buy" signals), thus cost-based access price is expedient.

5. We demonstrated in models that cost-based pricing policy is sufficient if access charge needs not perform additional regulatory tasks. There were three such cases:

   – When incumbent's retail tariffs reflect its underlying costs. In this case access charge does not have to correct entry-distorting signals, its only task is to perform allocative efficiency (that is, each provider should produce on Pareto efficient level). However this is rather extraordinary because of uniform telecommunication tariffs (requirement of non-discriminative prices).

   – When regulator has another regulatory instruments (e.g. an output tax levied on retail services) that can perform the second-best correction of entries. In this case, again, access charge needs not correct incentives for entries, therefore the optimal access charge equals its marginal cost. This is the reason why many supporters argue for a well-designed universal service fund in economic literature. Application of this fund allows access charge to be equal to marginal cost but, at the same time,

inefficient entries should not take place and non-discriminatory financing (which is not anti-competitive) of the loss of universal service obligation should be achieved.

– When retail tariffs are unregulated, but competition on downstream markets (on retail level provided on the network) is efficient, then optimal access charge could get closer to its marginal cost. If access charge (a) needs to perform to control the incumbent's retail price (P), then this task reduces the efficient access charge: cutting back a will decrease P, which is beneficial from a welfare point of view. Therefore in the case of efficiently competitive downstream market incumbent has no significant opportunity cost, therefore access charge should reflect its costs.

But if these conditions are not satisfied, then cost-based access price cannot be optimal, thus other regulatory policies yield higher welfare.

6. When retail prices do not reflect their costs, because prices have to be charged above costs to cover high fix costs and loss of universal services, then optimization of incumbent's retail and access prices simultaneously yields higher welfare, since in this case the trade-off between consumer surplus and productive efficiency could be taken into consideration during optimization. This leads to the so-called Ramsey pricing approach. This regulatory policy is more efficient from the point of view of welfare, because it enables to take into account how incumbent's retail price (P) and the access charge (a) affect welfare surplus. If we increase a, then income from access could cover greater part of fix costs and deficit of universal services from loss-making market segments, and hereupon incumbent's retail price could be decreased. Since confrontation of effects of a and P to welfare is imported into optimization, this regulatory model yields higher welfare than the separate optimization of P (independent of the access charge).

Access charge will be above its marginal cost in the case of Ramsey pricing for two reasons:

First, distorted retail prices would cause inefficient market entries, and correction of false entry signals has to depart prices of services (including access price) from marginal cost in such a way that incumbent's opportunity cost is compensated.

Second, incumbent's fixed costs have to return, hence price of each service has to contain an additional markup. The extent of this Ramsey markup in each price depends on price-elasticities.

7. In case of two-way interconnection of networks, when these networks do not compete for subscribers, the problem of monopoly pricing appears especially sharply. We showed this problem in a model of international call termination. In this case double monopoly mark-up can take shape in unregulated market. Although regulation is able to reduce this problem, but if each national regulator optimize based only on their own national welfare, single monopoly mark-up will remain.

8. In the case of two-way interconnection with competition for subscribers interconnection (termination) charge could be the means of collusion. Higher collusive retail prices are obviously better for the firms than competitive tariffs, and proper choice of interconnection charge (based on (66) equation in model described in chapter II. 3.2.3.) helps maintaining collusive retail prices. When the interconnection charge is set in this way, firms have no incentive to deviate from the collusive prices in the retail market: if one firm undercuts the other by a small amount, the gain in retail profits from increased market share is just offset by the increased access payments, since the larger market share, the bigger number of outgoing calls to the rivals networks, that is, the more payments has to be discharged for access to the rivals.

9. We showed in the model in chapter II. 3.2.3. that the higher this collusive interconnection charge (the stronger incentive on collusion), the sharper competition without collusion, that is, (i) when each firm's services are closer substitutes, (ii) when elasticity of demand is less, (iii) when retail level profit per subscriber is higher.

   Although under the same conditions but applying two-part tariffs (nonlinear pricing) on retail level firms' profits are independent of interconnection charges, therefore firms are indifferent between different levels of interconnection charges, so these charges cannot sustain collusion. Laffont, Rey and Tirole (1998b) present this outcome is valid when network-based price discrimination is allowed. Dessein (2000) and Hahn (2000) show that in the case of heterogeneous subscribers (heterogeneous calling patterns and demand) this neutrality of equilibrium profits remains: interconnection charge has no effect on equilibrium profits. At the same time if firms' costs are not symmetric, this neutrality of profits vanishes and collusion can be sustainable again by a particular choice of interconnection charges.

10. In regulatory practice the methodology used to calculate cost also affects outcome of regulation. Historical Cost methodology, for example, does not motivate to develop inefficient network components, and it gives false entry signals: it can hold more efficient

competitors off and can attract less efficient rivals. Furthermore termination charges based on costs of past investments send false signals to entrants for "make-or-buy" decisions. This is an additional argument for using forward looking costs in regulation. Unfortunately LRIC models of each national provider and regulator contain lots of historical data. Therefore use of historical data in cost account models has to be suppressed that termination charges be able to give correct entry signals.

11. In prevalent cost account models there is a mark-up put on LRIC costs. This mark-up is added to incremental costs calculated in LRIC model to allocate fixed and common costs. Therefore price regulation based on LRIC model gets closer to average cost-based regulation: the bigger this mark-up, the farther average incremental cost gets from marginal cost, that is, the larger distortion of firms' productive and allocative decisions.

12. To decrease problems of asymmetric information that exists between regulator and regulated firm, so-called bottom-up models are developed in regulatory practice. However in most countries inputs of bottom-up models come from regulated providers, thus B-U models' ability to treat information problems is limited. This is the reason why another benchmark is used by several national regulatory authorities.

13. Both basic problems of asymmetric information characterise the regulatory situation: moral hazard (hidden action) and adverse selection (hidden information):

    Moral hazard refers to situations where the regulator cannot observe (or verify in front of independent court) endogenous factors. Certain actions of the firm can influence production costs or quality of service, but regulator cannot observe these efforts directly, and the outcome depends not only on these efforts but on luck (external factors) as well. Presence of moral hazard usually gives bad incentives: the company does not choose the optimal level of effort.

    Problem of *adverse selection* emerges when the regulated firm has private information about exogenous factors (for example, its own technology, costs, demand…). In this situation the firm's interest is to mimic another type of efficiency than its true one, because its utility can be higher with lying than with revealing its true efficiency level.

14. Although the requirement of incentive appeared in the economic literature of regulation, the "conventional" cost-based and price cap regulation are not able to provide a normative theoretical framework for either analysing information problems that derive from regulatory situations, or theoretical investigation of trade-offs that emerge between

increasing efficiency due to incentive and the costs of incentive. We accentuate two important critiques of "conventional" regulatory methods: (1) These regulatory methods are based on awareness of cost and demand features, and efficiency of regulation significantly decreases if regulator does not have those information. (2) "Conventional" cost-based regulatory policy is not able to give proper answers to the incentive problem: how could the firm be incited to reveal its private information and choose optimal level of effort.

15. The application of the principal-agent methodology to this situation has brought a proper normative framework. Regulatory situation is a typical delegation problem with all its symptomatic information problems, where the regulator is the principal (P) and the firm is the agent (A). Incentive regulation is design and implementation of a mechanism that gives partial freedom to the regulated firm to serve most efficiently the regulator's aims, choosing from a regulatory menu. Application of incentive regulation is worthwhile if (1) aims of regulator and regulated company diverge *and* (2) the firm has private information about exogenous (technology features, cost structures, demand information) or endogenous (cost-reducing and quality-improving efforts) economic parameters *and* (3) competition is not feasible.

16. In Chapter 3 we described an incentive model, when the regulatory situation features both mentioned information problems. Through the analysis of *incentive compatibility constraints* we could separate four different cases as a function of relative seriousness of adverse selection and moral hazard problems (compared to each other). The regulator is forced to give up an information rent to the firm in order to induce information revelation and high effort, where the extent of this rent depends on the relative degree of adverse selection and moral hazard problems. As we showed, the extent of information rent let through to the more efficient firm could be reduced by downward distortion of the output of the less efficient type. As the problem of moral hazard becomes more severe (that is, as the cost of inducing effort further increases), the downward distortion of the output level of the lower efficient types becomes smaller and smaller. Comparing all the cases, we can conclude that the service level of the different efficiency types comes increasingly closer to the Pareto-efficient level as the benefit, which the firm can acquire in return to revealing its private information, becomes smaller and smaller relative to the effort cost. Consequently, it is gradually less necessary and sensible for the regulator to offer

information rent to the firm for information revelation. As the distortion of allocative efficiency becomes smaller the interconnection charge will be lower, too.

17. Had the regulator possessed complete and perfect information she would set the interconnection charge so that the firm's total revenue would exactly cover its total costs for all efficiency types. But the "contracting power" would migrate from the regulator to the firm. It is obvious that the firm would not benefit from exerting high effort since its costs will be recovered with low effort, too. In addition, it would be in the firm's interest to hide its true type and pretend to be a low efficiency type. The benefit acquired by the high efficiency type from hiding its type would be higher (that was deduced in the model) without any effort.

18. It is shown in this study that—under fairly general conditions—cost-based pricing gives "perverse" incentives to firms not to improve their efficiency in interconnection, and that cost-based pricing results in smaller consumer welfare than incentive regulation, which can treat the problems of adverse selection and moral hazard. We can conclude that a regulatory contract that is based on the—unfounded—assumption of the regulator's perfect information results in a larger welfare loss than incentive regulation, which takes account of the imperfect nature of information. That is, cost-based pricing, which attempts to extract detailed cost data from companies regardless that information uncertainty is always present, causes larger welfare losses in public services than incentive contracts, which build on firms' voluntary information revelation.

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