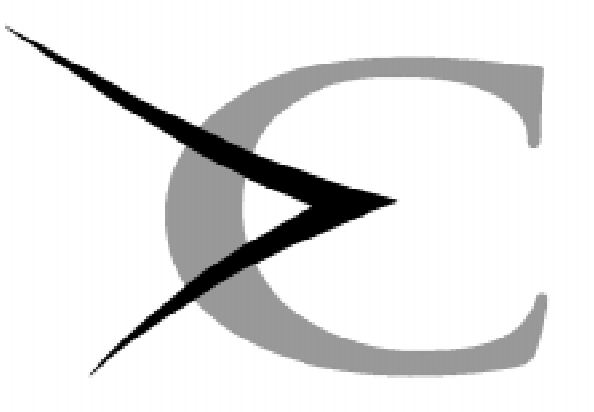

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Competition and Access in Telecoms: ECPR, Global Price Cap, and Auctions

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Competition and Access in Telecoms: ECPR, Global Price Cap, and Auctions*

Marcel Boyer†

Résumé / Abstract

Les industries-réseaux (télécommunications, électricité, gaz naturel, services postaux, services d'aqueduc et d'égouts, etc.) font face à de sérieux problèmes dans leur transition vers la concurrence. Dans cet article, je rappelle d'abord quelques faits et principes avant de discuter des procédures par lesquelles la concurrence peut être introduite, à savoir les règles et conditions d'accès aux réseaux. Je compare la règle de tarification efficace des composantes, la règle de Ramsey et la règle du plafonnement global des prix et je montre que cette dernière peut être la réponse à plusieurs des questions soulevées dans la recherche d'une approche efficace à la transition vers la concurrence. Je poursuis avec la présentation d'un mécanisme d'enchère qui pourrait aussi permettre le développement ordonné de la concurrence. En conclusion, je rappelle divers facteurs généralement négligés mais néanmoins importants.

Many network industries (telecommunications, electricity, natural gas, postal services, water and sewage services, etc.) are confronted with significant logistic and behavioral problems in their transition towards competition. In this article, I first recall some general principles and fundamental facts and issues before proceeding with the basic procedures through which competition can be introduced in telecommunications markets, that is the access pricing rules. I compare the efficient component pricing rule, the Ramsey pricing rule, the global price cap rule, and show how the latter could in fact be an answer to many of the concerns and questions raised in the search for an efficient way to introduce competition in telecommunications markets. I then continue by presenting some recent research on network access auctions, a possible approach to increasing competition with soft or light-handed regulation. I then conclude by raising some neglected albeit important issues.

Mots Clés : Réglementation, concurrence, télécommunications

Keywords : Regulation, Competition, Telecommunications

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This is a revised version of a presentation made at the "Telecommunications ans Antitrust Symposium" organized by the Bureau of Competition Policy of Industry Canada (Ottawa, November 1995). I would like to thank the symposium participants for their comments. The usual caveat applies.

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1 Introduction

Coming back from Japan, China and Hong-Kong last November, I was surprised by a magazine article claiming that 60 per cent of the adult population in the world today has never made a phone call and that for another 15 to 20 per cent, making a phone call remained a difficult enterprise. Given the tremendous interest that the revolution in telecommunications is generating among and around us and given the significant potential in productivity gains that it promises, it may be useful to keep in mind that this revolution, its characteristics and its consequences are still unknown for a very strong majority of the human population. There is clearly a large part of the world which is still in need of some very basic communication systems. Indeed, one of the main challenges confronting the telecommunications industries is and will be for some time to link a vast majority of human population to the international telecommunications network. It is therefore extremely important that we find new and more efficient ways to develop and implement telecommunications networks in order to achieve the global village which has been announced as a virtual fact. It is clearly not yet the case. And this symposium is not unrelated to the more global objective of achieving complete interconnection in the near future. How can this be done ? At what cost ? Through what kind of institutional and organizational structure ?

Many network industries (telecommunications, electricity, natural gas, postal services, water and sewage services, etc.) are confronted with significant logistic and behavioral problems in their transition towards competition. In some of those industries, this transition is already more or less achieved while in others, it is still a project rather than a reality even if pressures to achieve such a state of reasonable competition are mounting. It is believed that a competitive structure is the only way to credibly incite firms to provide efforts in minimizing costs and to offer to their clients and customers the best adapted products to their needs. On the other hand, when different providers of goods and services are intensively engaged in a competitive process, it becomes difficult to ensure that an adequate level of coordination is taking place in order for the industry to benefit from economies of scale which are external to the firms but internal to the industry. In the network industries, these economies of scale may be very important on specific well-identified essential links of the network. Those are subject to monopolization: they are essential inputs and would be inefficiently provided if more than one producer was involved. If there ever existed natural monopoly sectors, these essential network links are thought to be the perfect examples.

Increasing competition in such network industries, of which the tele-

communications industry is the front runner, raises important questions: what are the reasonable and workable competition structures ? What are the characteristics of the appropriate coordination mechanisms which would ensure that the potential scale economies are realized ? Given the reality of essential facilities subject to important scale economies, how can we achieve the proper competition among networks through the determination of conditions of access to the essential links ? What are the characteristics of efficient transition policies, that is, policies which are capable of counteracting the tendencies of the regulated monopolies to overestimate the difficulties of creating a manageable competitive framework ? Should the transition be gradual or brutal ? Should it be done through a stage of flexible and incentive regulation ? Can we dispense with the regulatory framework in favor of a more general competition policy and antitrust framework ? These are questions which are confronting the telecoms industry and the telecoms observers today.

The problem of designing an optimal or efficient set of institutions for developing a proper competition level over time among service providers and between networks is a difficult task. Up till now, the drastically simplifying assumptions under which its analysis has been done make the results difficult to implement and therefore its messages remain rather poorly understood by the regulators and many telecoms observers. Although the existing systems of regulation was designed in a theoretical context which by now is in disrepute and significantly challenged by the new theorists, it is still very much pervasive in the regular discourse of practitioners. It is very important to explicit the underlying assumptions under which the design of institutions and the characterization of the mechanisms by which the transition towards competition will be implemented. In that sense, there is still a need for basic and theoretical research into both the new regulation of telecommunications and the potential effects of relying more and more on the application of the competition and antitrust laws. Moreover, translating the results of theoretical research into a workable set of institutions and procedures which can be well understood by the different parties is both demanding and challenging. Few institutions are designed to tackle such a task which requires a fine equilibrium between managers, researchers and political analysts. This may be one reason why it is so difficult to reduce the time lag between research findings and their implementation: first, the researchers may not value that much the implementation of their ideas and results and second, the practitioners may be too preoccupied to maintain the well known and mastered institutions and procedures by which the regulation of network industries is achieved now. We then end up with a set of procedures and institutions (organizations, firms and

markets) which may be tractable and manageable but which are not capable of generating the level of static and dynamic efficiency which more adequate procedures and institutions could generate.

Let us recall what are the characteristics which a proper competition-generating institution design should eventually discuss and tackle [Laffont and Tirole (1994), Economides and White (1995), Armstrong, Doyle and Vickers (1995)]: the determination of the final consumer prices; the nature and modes of competition in product and services markets; the level of market power (and mode of competition) over different links in the network; the level of differentiation among the products being sold to consumers over the networks; the potential and real extent of bypass, that is, competition among the networks; the possibility of offering fixed or common conditions of access combined with variable or discriminatory conditions for different network users; the possibility of variable entry and exit by service providers over time; the incomplete (different and private) information structures and the specific incentive system that regulators, network operators and service providers are respectively facing; the dynamic factors and forces present in the industry and generating or dependent on learning-by-doing and innovations. A demanding research program by any standards.

My paper is divided in four parts. In part I, I cover some general principles and fundamental facts and issues which have in part been already mentioned by others in different contexts. Then I will proceed with the basic procedures through which competition can be introduced in telecommunications markets, that is the access pricing rules. I will compare the efficient component pricing rule with the Ramsey pricing rule. Then I will discuss the global price cap, what it is and how it could in fact be an answer to many of the concerns and questions which have been raised for some time in the search for an efficient way to introduce competition in telecommunications markets without losing the benefits of important economies of scale and scope. I will continue by presenting some recent research on network access auctions which is a relatively new idea put forward by two of my colleagues and myself as a possible approach to increasing competition with soft or light-handed regulation. I will then conclude by raising some issues which have been relatively neglected but remain nevertheless important issues.

2 Basic principles and fundamental issues

Let me just recall what the general principles and fundamental facts, issues and concerns are. It is important to restate those here so that

we can better define and understand the basic problems which bring us together to analyze the telecommunications sector.

First, *institutional and organizational design (coordination and incentives) is a major problem of human societies.* The observed movement of reform towards market-based system economies, outsourcing and downsizing in business and governments, and deregulation and incentives-based regulation, are all parts of a recent realization and increasing consensus that those coordination and incentives mechanisms are a major determinant, factor and driver of social efficiency and social well being in human organizations and more generally in human societies.

Second, *inefficiencies in organizations may creep up, even if all members are honest, hard working and law-abiding citizens.* This is well illustrated by the costs of telecommunications before price caps were introduced or competition introduced. Saying that organizations are inefficient or that costs are too high does not mean that this is done deliberately. It may be done in a very honest way. People do not know how far they can go in reducing costs, unless they are forced to do it, and this is something which is forgotten in many discussions about the role of regulation or deregulation.

Third, given the difficulty to go after the true cost of an activity, *the role of government and regulators is basically to set up a proper environment for decision making* rather than to intervene into what may be called micro management. Basically the role is to set up an environment in which decision making can be made efficient.

Fourth, *the development of the regulatory framework, in telecommunications in particular, was done in a period where there was a huge need for stability.* Demand was in formation. People were learning how to use telecommunications. There were lots of network externalities to be mined and technology didn't offer as much possibilities for introducing competition. This have clearly changed now.

Fifth, *technology and industry seems to be abreast and ahead of what academics and regulators are thinking.* In a sense, current academic research becomes more or less obsolete before it is finished because of the fact that practice and technology have changed by the time the research is completed. This occurs in particular when we want to pinpoint and be too specific about regulatory actions. Therefore, our research efforts should be more in terms of framing or characterizing the proper environment in which decision-making in those industries would be made.

Sixth, *it seems there is no other way to build an efficient telecommunications system today than to bring in competition.* It is not clear how you could do it otherwise. So how can that be done? Well, the first step is to allow access by competitors to some essential facilities. This is the

basic problem. Access pricing and conditions to essential facilities are the major procedure or the major problem we should tackle.

One cannot simply put in place organizations or rules without first considering and understanding their implications in terms of coordination patterns and procedures and of incentives for social and economic performance, both static and dynamic. Many of the problems we are facing are basically linked with those coordination and incentives problems, and it is important just to restate again and again what these problems are, where they come from and how they play a crucial role in institutional and organizational design.

Before looking more precisely at the telecommunications business, it may be useful to stress at the outset that these problems and issues are not peculiar to the telecommunications business. Indeed, the analysis of coordination and incentive mechanisms, both from a normative point of view and a positive one, may be the unifying paradigm underlying microeconomics and the economics of growth, if not of all social sciences. Let me mention two other problems currently facing all modern societies, the social security and welfare reform and the fundamental dynamic problem of economic growth.

In Canada as well as elsewhere in the developed world, the reform in the social security system is basically a coordination problem and an incentive problem. The social security and welfare systems of the recent past and present have become over time less and less efficient because of organizational malfunctions both internal and external. Social security and welfare personnels in large enough numbers have developed routines and habits which may have been desirable in the past but are now ill-adapted to the current working and needs of the labor markets and of society as a whole. Social security and welfare recipients in large enough numbers have learned to use the system in distorted ways by modifying their behaviors in order to privately profit from the system, not as a security and insurance system but as a regular and predictable source of income and benefits. Although at the beginning of the current reform effort such perceptions and objectives were present in some official documents and public interventions, the emphasis was quickly put on different issues, namely the need to reduce government deficits and the 'vested rights' of people to the traditional comprehensive social protection system. The former is clearly an unrelated problem while the latter is a lack of flexibility (incentives) problem: the tragedy of public deficits is not that they exists but rather that they are incurred for the wrong reasons, namely because of consumption habits, political inflexibility and unprofitable public investments rather than for productive investments capable of generating directly or indirectly the revenues

necessary to finance themselves. In so doing, we lost contact with the more fundamental coordination and incentives problems which the social security and welfare system had created. Nevertheless, it is through the theory of coordination and incentives that we can understand better what this whole reform is or should aim at. Both the economists (and other social scientists) and the politicians have a lot of selling effort to make in order to convince the people of such a fact. But surprisingly, those better equipped to do it seem absent from the public debate on these issues.

As for the problem of growth, it is surprising that economists have for so long looked for mechanistic models of how economies can grow in order to characterize the paths, efficient or not, through which growth occurs. The recent renewed interest in endogenous growth, with its emphasis on externalities in human capital and knowledge (technological patterns) capital, leaves aside for the most part the institutional and organizational 'capital' of a society. Growth is more a matter of this latter capital than of anything else since, as the recent histories of Eastern Europe, Asia and Africa have demonstrated, the quantity and quality of human capital and/or of technology are not sufficient factors to explain or generate growth although they may be useful, indeed necessary, factors to reach higher growth paths. Moreover, these traditional factors, human capital and technological patterns, are better understood as products of institutional and organizational capital, that is, of coordination and incentive mechanisms generally present in the society being considered. It is not clear how formal models of growth incorporating measurement of the quantity and quality of this capital and of its evolution over time could be developed but one may hope that they will be in the near future so that a better understanding of the determinants of growth can be achieved.

Incentive constraints come basically from asymmetric information on some characteristics of particular situations. Herbert Simon, the Nobel Prize winner in economic science, said that the major problem that organizations are facing today is to overcome the fact that information is proprietary. It is now common among economists to consider two basic objects of this private information, namely the private information on characteristics (for example, on technological characteristics or costs) leading to adverse selection, and the private information on actions (for example, on effort) leading to moral hazard. Both forms are major problems in organizations. For instance, it is quite difficult to observe the economic profits (not the accounting profits) and their sources in an organization. Similarly, it is quite difficult to observe the effort level and structure in generating those profits, in choosing the right investments, in

self-protection and self-insurance activities across the organization. But the efficiency of the organization depends on its capabilities to overcome these information problems possibly more than on any other factor. A society is more (or less) efficient in its use of the scarce resources it controls when its organizations are more (or less) efficient in solving the coordination and incentives problems generated by the asymmetric information structure.

Coordination is also a major issue. A proper level of coordination is necessary in particular to determine the proper level and characteristics of investments in telecommunications. Are markets sufficient for this? Most probably not, for two reasons. Those investments are very specific investments and they relate to design attributes. Therefore, there is a significant possibility that they will become stranded and that small errors in synchronization and complementary matching will generate major losses, unless an efficient form of coordination is achieved. Moreover, economies of scale and scope are an important feature of telecommunications technologies. In many cases, the market will by necessity remain an oligopolistic market in which too much duplication should be avoided. Again, important gains can be achieved by having an extended form of coordination. It is not clear how this coordination can be obtained in an efficient way without allowing or inducing the firms to collude. It is clear however that the regulatory process has been one way to more or less make these investments in some form of coordinated way. Market-based investments in developing networks may not be as successful as regulated investments have been in the past unless proper coordination is achieved.

It is useful to see the problem of regulating or reforming regulation of telecommunications as a coordination and incentive problem. Although for many years, lawyers, managers, regulators and economists have been fighting among themselves over the proper way to generate a normal rate of return in the traditional rate of return regulation structure or framework, we know now that many of the costs which were incurred by telephone companies were not necessary in spite of the fact that we have been mostly convinced for many years that they were in fact minimum costs. These were the costs on which the rates of return were computed. When price caps were introduced in Great Britain about 10 years ago, costs decreased rather rapidly. When competition was introduced in Canada in the long distance market, Bell Canada and other Stentor companies found that they were overstaffed and that at least a good chunk of their costs could be avoided. Before a firm gets into a more incentive system, it seems very difficult for it to find that out. This is the starting point for the analysis of global price caps and auctions in

the next section, as ways through which efficient decision-making could be achieved.

Unless an economy can count on a very efficient telecommunications system, firms in that economy will have problems to compete on the world markets. That may not have been the case up till about 10 years ago. Low cost communications were important but 'not vital', that is, firms could survive and prosper even if costs of communications were, say 10 or 15 per cent above what they should or could be. The telecommunications industry was maybe less vital in that sense than it is today. Therefore, the pressure to get to the lowest cost possible has increased.

Ownership structures have been advocated also as one way to reach this proper level of competition. The U.S. 1984 split between long distance and local exchange companies was an attempt to control the ownership structure in order to generate enough competition. Here in Canada more recently, Sirois and Forget (1994) advocated that we should split the network operators from the provider of services over the network. In this way, the different technologies which represent different networks could compete with each other and the service providers would compete with each other over the different technologies. By splitting the ownership structure, we make sure that a proper level of competition will likely emerge. Sirois and Forget very strongly advocate against duplicating the different technologies. So these satellite operators would not like to compete against another satellite operator (fearing a Bertrand-like destructive competition) but would not mind about competing against the other technologies. Here, the way to bring in competition would be through restricting ownership structures and opening the networks to all service providers on level playing field conditions. Again, the basic problem to overcome for the regulators is the determination of access pricing and conditions over the different networks. More fundamentally, it is our rather poor understanding of the competition forces which would be at work in such a context that constitute the major stumbling block to the adoption of such an approach.

3 Access pricing rules

The telecommunications industry is regulated because of the important economies of scale present in the network activities: it would make little sense to let two similar parallel networks exist and offer similar products and services. But if there exist important economies of scale in providing the services of the network itself, the situation may be quite different regarding the activities, goods and services offered over that network.

Hence the possibility of separating the network itself from the goods and services 'travelling' over it. Moreover, it is possible and quite likely that the network economies of scale are important over some links but not over all the links. For the latter links, market forces should lead to an efficient number of parallel links insuring that a proper level of competition will emerge. Those links over which the economies of scale are important are the essential facilities and duplication is either not feasible or not economically meaningful. Hence, access to the essential facilities must be regulated in some way to prevent the owner from exercising market power and predatory self-dealings in cases where the essential facility provider is also active on the competitive links and/or in the provision of goods and services travelling over the network. How should the access pricing and conditions to the essential facility be regulated ? The objective of regulation here is two-fold: to make sure first that the proper goods and services are produced and offered at a proper price to the consumers and second that the firms allowed to use the essential facility be those firms which are the most efficient in using it. Ideally, it should be in the best interest of the owner of the essential facility, when it is also present in the complementary competitive markets, to allow these most efficient firms to have access to the essential facility even if this means allowing the entry of more competitors in previously monopolized or oligopolized markets. Finally, the regulation rules should discourage the entry of firms which would be less efficient in using the essential facility. What are those rules ?

The efficient component pricing rule [The ECPR: Willig (1979), Baumol (1983), Baumol and Sidak (1994)] and the Ramsey pricing rule [Laffont and Tirole (1994)] are two approaches to find the proper regulation rules to attain an efficient allocation of resources and an efficient access to the essential facility in particular. They have been more or less opposed to each other in the literature. However, some authors [Armstrong, Doyle and Vickers (1995)] have advocated recently that the two approaches are in fact two sides of the same coin even if for some time, the ECPR was considered as suffering mainly from very restrictive assumptions and the Ramsey pricing rule was considered as suffering mainly from very demanding information gathering. In spite of their internal consistency and powerful theoretical propositions, the translation of either approaches into real and operational institutions has been less than satisfactory at this time. One reason may be that the suggested procedures and rules to make their results operational has been too closely related to the formal models themselves. We may need here a new approach in which the institution design stage of the research program is given more importance and follows a kind of stand alone development.

It is most likely that the institutions by which theoretically efficient allocations are achieved will have little resemblance with their theoretical representations.

Let us just recall briefly what those access pricing rules are. The objective of the Laffont-Tirole Ramsey pricing is global efficiency. It is not an entry issue. It aims at making sure that the proper goods are produced and that we would create as small distortions in production as possible from the first best allocations, which would have been characterized in the usual way. It says that the margin over marginal cost should be proportionate to the inverse of the superelasticities in the different markets or the different goods. To apply Ramsey prices, you have to know or have an evaluation of those superelasticities which is something requiring a lot of information on demand systems. The Baumol-Willig ECPR has the objective of allowing efficient entry under 'given', possibly regulated, final prices which rule out monopoly rents. If it is not the case, the rule itself would not generate a fully efficient allocation of access to the essential facility because the pricing of final products and services might be monopolistic rather than competitive or efficient. This final prices issue is an important one in practice because of the difficulty for the regulator to fix unilaterally those prices. Baumol and Sidak (1994) advocated for fixing final price ceilings according to some measure of stand alone costs, more precisely of stand alone cost of a hypothetical entrant. This may be difficult to assess in practice. To prevent predation, the incumbent would also be required to satisfy price floors determined by marginal (incremental) costs. The objective of the ECPR is to make sure that the access rules to the essential facility do not allow inefficient or less efficient firms to enter the market for goods and services using the essential link of the network as an input but at the same time do not prevent the entry of any firm which may have the capability to be more efficient than the incumbent in using the essential facility itself. It is important to control the power of the incumbent to block systematically the entry of those more efficient firms. In that sense, it is a cost based rule. But as we will see, its validity as a normative rule is limited when a budget balance constraint is imposed on the incumbent and its apparent simplicity and therefore superiority over Ramsey pricing rules can be challenged when more realistic cases are considered.

According to the ECPR, the access charge (and other conditions) should be the direct cost of access plus the incumbent's opportunity cost of giving access to competitors, that is, in the notation of Armstrong,

Doyle and Vickers (1995),

$$a = C_2 + [P - C_1],$$

where a is the cost of a unit of access, C_2 is the marginal (incremental) cost incurred by the incumbent for giving access to a firm, P is the given price of the final (homogeneous) product, and C_1 is the incumbent's marginal cost of production. This opportunity cost $P - C_1$ is basically the displacement of the incumbent's market plus possibly a contribution to the cost of the social obligations to serve, if this is considered as being a social responsibility of the incumbent firm. The displacement of the incumbent's market translates into a loss of variable profits for the incumbent. Given the final prices optimally set (by the regulator) to eliminate monopoly rents, the reduction of the incumbent's variable profits (revenues minus variable costs) implies that the incumbent's fixed costs would not be covered anymore. Hence, the new entrant should be able to cover this loss in variable profits, not as a tribute to the incumbent but as an efficiency condition. Regarding the contribution to the cost of social obligations (a form of differentiated product sold at a loss by the incumbent who has to recuperate the loss from the profitable sectors of the market) imposed on the incumbent, again the reduction in variable profits would make the incumbent unable to fully cover the cost of those obligations. Hence the requirement that the entrant contributes to those social obligations unless the contribution can be considered as part of the loss in variable profits. The rule has two important properties: first, it sends the right signal to potential entrants since only the more efficient entrants will find it profitable to enter and second, the incumbent being fully compensated does not object to the entrant's use of the essential facility (at least in the static non strategic context considered).

The opportunity cost or displaced market for the incumbent can be evaluated in different contexts, from the relatively simple case above, which was the original case in which the ECPR was proposed, to more and more complex and realistic cases. As we go from the simple case to the more realistic case of product differentiation, bypass, uncertainty in demand, input substitution, multiproduct firms and multiaccess (entry in the network at different points or nodes), the evaluation of the incumbent's opportunity cost becomes more and more complex. Those factors will in general reduce the opportunity cost of access for the incumbent.

Consider product differentiation. If the entrant offers a new product different from the products offered by the incumbent, the displacement of the incumbent's market becomes more difficult to evaluate because the new sales of the entrant are not necessarily lost sales by the incumbent.

Hence, an entrant producing a differentiated product may increase welfare by generating diversity even if it is less efficient than the incumbent. In the extreme case of independent products, the entrant has no impact on the incumbent's market (absent income effects) and therefore, the ECPR would fix the access price at the direct cost of access only. More generally, substitution factors must be evaluated in order to determine the level of access charge, making necessary a rather detailed knowledge of demand conditions.

Armstrong, Doyle and Vickers (1995), following an approach proposed by Laffont and Tirole (1994), have shown that in such a general context, the proper evaluation of the opportunity cost for the incumbent of providing access is a rather complex issue. For instance, in a context where a competitive fringe of entrants with each one supplying a similar product but differentiated from (and substitute to) the incumbent's product, where some bypass possibilities exist and where there are input substitution possibilities, the equilibrium fringe final price will be increasing with the incumbent's final price and the cost of access. In fact, the output x and price p of the fringe and therefore its demand for access z and its impact on the incumbent's variable profits are all directly determined by the incumbent's final product price P and access price a thanks to the assumption of a purely competitive fringe (if the entrants have market power, the problem is somewhat more difficult). The incumbent's output increases with the access charge ($\hat{X}_a > 0$) and decreases with its own product price ($\hat{X}_P < 0$) while the fringe's output and demand for access decrease with the access charge ($\hat{x}_a < 0$, $\hat{z}_a < 0$) and increase with the incumbent's final product price ($\hat{x}_P > 0$, $\hat{z}_P > 0$). When the budget balance constraint of the incumbent is not binding, the optimal access charge is based on the opportunity cost obtained as the product of the incumbent's marginal profit per unit sold and of the ratio of the marginal impact of an increase in access charge on the incumbent's output and the marginal impact of this increase on the demand for access by the fringe, that is,

$$a = C_2 + \sigma[P - C_1],$$

with

$$\sigma = \frac{\hat{X}_a}{-\hat{z}_a}.$$

When the budget balance condition is binding, the optimal access charge should be increased by a third term (besides the two terms of the simple ECPR), namely the price elasticity of the fringe's expenditure on access times the multiplier factor of the budget balance condition $\theta = (\frac{\lambda}{1+\lambda})$,

that is,

$$a = C_2 + \sigma[P - C_1] + \frac{\theta \hat{z}}{-\hat{z}_a}.$$

The last term is of course due to the possibility of relaxing the budget balance constraint of the incumbent by taxing access. More generally, for the multiproduct and multiaccess case of an incumbent producing N final products and supplying M access services (or nodes), the access pricing formula for the m-th access service is, with straightforward notation,

$$a_m = \frac{\partial C}{\partial z_m} + \sum_{n=1}^{N} \sigma_{mn} \left(P_n - \frac{\partial C}{\partial q_n} \right) + \sum_{i \neq m} \rho_{mi} \left(a_i - \frac{\partial C}{\partial z_i} \right) + \frac{\theta \hat{z}_m}{-\partial \hat{z}_m / \partial a_m},$$

where the sum of the second and third terms represent the loss in variable profits by the incumbent when it supplies a marginal unit of access of type m. The last term is added because of the budget balance condition imposed by the regulatory procedure. It constitutes in a sense the difference between the Ramsey pricing (the four terms above) and the direct application of the ECPR (the first three terms above). Clearly, a proper evaluation of all these terms and formulas would require a lot of informations on demand and cost conditions.

It turns out that both the ECPR and Ramsey pricing have been proposed and sometimes used as tools aimed at obtaining in the telecommunications sector an efficient allocation of resources, efficient entry, and efficient production of the right goods for the consumers. Both of them are informationally very demanding. They are very complex in realistic cases and they are open to manipulation, to regulatory capture and to predatory behavior because of this complexity and because of the fact that there is so much uncertainty or imprecision in the estimates of the basic parameters or basic variables you have to obtain and know to apply them and because of the fact that generically, the information structure on costs and demands is incomplete. The latter factor creates an incentive problem which is sidestepped by the analysis. In fact, they may be more open to manipulation, regulatory capture and predatory behavior than we have thought before. This is a major drawback. Hence the need for a more information-efficient approach.

4 Price caps and global price caps

Such an approach may be the Laffont-Tirole global price cap (GPC) designed to consider explicitly those information requirements. As expressed by Laffont and Tirole, the two main advantages of GPC is first

to follow theoretical precepts and second to require no more information than the other schemes such as ECPR, the Ramsey pricing rule, or the long-run incremental costs of access with or without proportional markups la Allais. The global price cap considers both the final products and services prices and the access charges in one single price cap formula. Once the price cap is determined, the incumbent firm is free to choose its prices, including the access charges, as long as the global price cap is satisfied. The firm implements the Ramsey price structure if it knows its demand and cost functions. There is no need for the regulator to find and measure as before those demand and cost conditions and elasticities.

The role of 'regular' price caps has been basically to introduce high powered incentive mechanisms in regulation. A price cap rule allows the regulated firm to vary its prices as long as some index of those prices is satisfied, that is, is not higher than some benchmark. Given that the regulator controls only an index of prices, it is believed that the benefits of letting the firm choose an adequate price structure and adequate cost reduction activities would then remain with the firm itself, at least in the short or medium run. Hence, the firm is incited to adopt efficient production technologies and to provide the efficient effort levels to reduce costs and increase efficiency.

The notion of global price caps brings access in the basket of goods sold by the firm. So selling access on the market would be one of the goods in the basket on which the regulator would define the price cap. The firm is then free to determine the price of access and the price of the other goods and services it sells, as long as the index of those prices is below the cap which is imposed by the benchmark. One of the interesting characteristics of these global price caps is that they would implement Ramsey pricing in a decentralized fashion. The profit maximizing prices chosen by the regulated incumbent within the global price cap constraint are the Ramsey prices. The argument goes as follows [Laffont and Tirole (1995)]. Let $\pi(\mathbf{p})$ and $S^n(\mathbf{p})$ denote the firm's profit and the consumers' net welfare for price vector $\mathbf{p}$. A social welfare maximizing firm subject to a budget constraint would maximize $\pi(\mathbf{p}) + S^n(\mathbf{p})$ subject to the constraint $\pi(\mathbf{p}) \geq 0$. That is, it would maximize $\pi(\mathbf{p}) + \alpha S^n(\mathbf{p})$ for some $\alpha \in (0, 1]$. When increasing price p_i by one unit, a profit maximizing firm ignores the impact $(-q_i)$ on the net consumer surplus, where q_i is the demand for good i. On the other hand, a profit maximizing firm subject to price cap $\sum w_i p_i = \mathbf{w} \cdot \mathbf{p} \leq \overline{p}$ maximizes $\pi(\mathbf{p}) + \beta(\overline{p} - \mathbf{w} \cdot \mathbf{p}$ and therefore chooses the proper relative prices if the weights are exogenous and proportional to the realized outputs. So the regulator does not have to find those prices. The firm does it and it indeed will find in its

best interest to apply Ramsey pricing to its different products including access. The simple but important condition for the procedure to achieve this remarkable result is that the weights on this global price cap be properly selected by the regulator, that is, be set equal or proportional to the expected amount or quantity sold of those different goods and services, including access, sold by the firm. In a dynamic setting, the proper weights may be achieved by using the previous period observed quantities. The procedure would then converge to the optimal weights and the global price cap would achieve its objective.

Therefore, the regulatory scheme would let the incumbent owner of the essential facility compete also in the competitive markets or sectors and select the prices as long as the price cap is satisfied. The firm would have the incentive to be efficient in terms of cost reduction and to price the different goods at their Ramsey level and, therefore, assure minimum distortions from the first best rule. This is a characteristic which is quite interesting. We now have a little bit of experience with price caps so this would just extend somewhat the role of those price caps in creating the right environment, particularly in telecommunications. The problems with implementing this procedure are the usual price cap problems: first, the valuation of the X factor and the regular revision of price caps, and second, the possibility of predatory behavior by the incumbent or the owner of the essential facility.

The solution to these problems could be to define and base the global price cap on an index of prices in the telecommunications business outside the area of the firm itself. For Canada, for instance, you would need some kind of index of deregulated prices in other countries, prices over which the Canadian telecommunications sector or the Canadian incumbents have no power. These outside prices would be used basically to reflect the X factor. Global price caps could allow the firm to exert predatory behavior by raising the cost of access and lowering the cost of final goods to satisfy the price cap and at the same time to prevent entry. There is here a clear role for the Competition and antitrust laws and the Competition Bureau. Their specific role would be in fact to prevent this predatory behavior through the usual tools.

5 Auctioning network access

Let us now turn to another approach to determine access conditions, the allocation of access through auctions of parcels of capacity of the essential facility. One possible way to do it would be to run an auction to sell access and possibly rerun this auction regularly so that new firms can

come in while the already established firms have to compete for access as they have to compete for any other primary or secondary factor or input for production of their goods and services. The best known auction in telecommunications is the recently held auction of spectrum rights for Personal Communication Systems (PCS) by the Federal Communications Commission in the U.S. This was a relatively complex auctions of a non standard product. Executives of telecommunications firms and regulators learned to play this complex auction game and according to most participants and observers, it turned out to be a real success. This is likely to raise or revive the interest in regulation through auctions.

The following discussion borrows heavily from a paper by Jacques Robert, Bernard Sinclair-Desgagné and myself [Boyer, Robert and Sinclair-Desgagné (1995)]. The basic approach calls for the characterization of optimal access allocations given constraints imposed by the unavoidable existence of private information on cost and other characteristics, by capacity concerns and by revenue concerns. So the first step is to design and characterize the conditions of efficient allocations. To achieve this, we considered an environment where firms in an oligopolistic downstream market must have access to a primary upstream input in order to market differentiated products sold directly to consumers. The primary input, here interpreted as access to a network and more precisely to the essential link or facility, is produced by a 'regulated' natural monopoly. The essential facility or network link may be a local exchange network in telecommunications industry, a transmission network in electric power industry, a pipeline network in natural gas industry, a local network of pipes in the water distribution and sewage collection industry, a local routing network in mail and messages delivery industry, etc. Let us assume the existence of a regulator whose somewhat non-standard role will be to determine the characteristics of network access allocation rules and also design the environment inducing the firms and other institutions to realize such an allocation.

For the purpose of clarity and simplicity, we considered a specific access problem giving rise to the problem of deriving characteristics which an efficient access formula, procedure or rule must satisfy in this particular context. The problem of access conditions is a mechanism design problem and ultimately the access conditions should emerge as the outcome of a system composed of firms and institutions and of their designed interactions. As the title of our paper suggests, we considered how auctions may be substitutes to the standard access pricing regulator-determined rules and procedures.

The challenge for the regulator is to set up a mechanism by which at most $\overline{Q}$ capacity units of the network is properly allocated and by

which the fixed cost of the network C is recovered completely or as much as possible, that is, at a given or endogenously determined level. Such a regulator must care about how capacity is distributed among firms (for reasons of cost efficiency), about the prices charged by these firms to their customers (for reasons of allocation efficiency), and the total revenue generated to pay for the network (for reasons of a public budget constraint or for reasons of a social cost of public funds due to distortionary taxation). Moreover, the regulator must operate in an incomplete information structure in which lots of useful informations are private to the individual firms in the market.

An allocation rule wished and/or induced by the regulator must specify the following, given the various characteristics of the different firms (actual and potential) in the industry: the prices, the quantity produced by each firm and their respective payments for accessing the network. Because the regulator cannot control all the actions of the firms nor observe their respective characteristics, he will need to allow for some flexibility. His problem is to design an incentive system or mechanism that will induce the best outcome (in expected terms). In what follows we shall consider the optimal mechanism that the regulator can implement, under asymmetric information, through a proper design of the environment that decision makers (firms and other organizations and institutions) will be facing. The optimal regulatory mechanism is therefore the one which maximizes social welfare subject to constraints relating to demand conditions, capacity conditions, revenue requirements, and incentive compatibility.

If the social cost of public funds λ is strictly larger than 1, the regulator prefers to minimize the firms' profits and to increase their access fees to finance the cost of the network rather than doing it through direct subsidies. The regulator should leave no rent to the least efficient firm whose technology parameter is denoted by $\overline{\gamma}_i$, that is, $U_i(\overline{\gamma}_i) = 0$, and some distortions away from the efficient allocation need to be introduced. The presence of asymmetric information limits the regulator's ability to fully extract all the firms' profit because firms are expected to use their private information in a strategic way. Incentive compatibility implies that $U_i(\gamma_i) = E_{\gamma_{-i}}[\int_{\gamma_i}^{\overline{\gamma}} Q_i(\gamma_{-i}, s)ds]$: the informational rent of the more efficient is a function of the profits they would make if they were pretending that their costs were high. In order to limit these rents, the quantities allocated to the least efficient firms is reduced. Relatively to the efficient allocation, firms produce less and these distortions are greater for less efficient firms. The solution to the constrained regulator's problem must then be implemented through a proper procedure or institutional design.

A first procedure analyzed by Boyer, Robert and Sinclair-Desgagné is to determine two part access charges, a fixed one and a variable one. The per-unit access price plus a rebate proportional to total revenue will incite firms to select the optimal prices while the fixed price insure incentive compatibility (firms will reveal through the auction their technological characteristics). Firms face a menu of access charges, the fixed part increasing with revealed efficiency and the variable part decreasing with revealed efficiency.

An alternate procedure is to set up an auction for access rights. The idea is that a firm would be asked to bid for access according to a function of the amount of access it will get and the amount of access other firms are going to get on the network. Access would then be allocated by the regulator or the network owner and payments for access would be made. The firms are then free to choose their prices, but a rebate on the amount paid for access is announced on the basis of the market share a firm can achieve. In this way the firms, looking for the rebate based on market shares are induced to choose and implement the Walrasian equilibrium prices.

In a particular case with 2 firms, i and j, the implementation of the efficient allocation could be achieved using an auction which correspond to the Groves mechanism for this case. Participants must reveal a lot of information (but information they are likely to have) to the auctioneer/regulator but he, in return, needs no particular information to put the mechanism in place. The mechanism is as follows:

• Each firm submits to the auctioneer a system of preference, $R_i(Q_i, Q_j)$ which states how much it is willing to pay to have the quantities Q_i and Q_j allocated. The value $[R_i(Q_i, Q_j) - R_i(Q_i - 1, Q_j)]$ corresponds to i's willingness to pay for an extra access unit; while $[R_i(Q_i, Q_j - 1) - R_i(Q_i, Q_j)]$ measures its willingness to pay in order to reduce the access of her competitor.

• The regulator allocates access so as to maximize $[R_i(Q_i, Q_j)+R_j(Q_i, Q_j)]$ subject to the capacity constraint. If (Q_i^*, Q_j^*) are the quantities allocated, then firm i pays $[R_j(Q_i^*, Q_j^*) - R_j(0, Q_j^*)]$ to the auctioneer.

• Afterwards, the mechanism follows the following rules: firms select their prices; restrictions are imposed on firms' access only if total demand is above the total quantity allocated, in which case, access is provided according to the guarantees purchased, that is, Q_i and Q_j; finally, firms receive a rebate equal to $\int_{p_i}^{\infty} Q_i(x, \gamma_j)dx$.

Boyer, Robert and Sinclair-Desgagné show that, under the above strategic environment, firms will submit their true willingness to pay so that the final allocation will correspond to the one desired by the regula-

tor. The above mechanism can be interpreted as an auction system where bids are contingent on the access allocated to the other participant. So what we have is a use of auctions for regulating access to a network in the following context: firms in an oligopolistic (downstream) market seek access to a primary input held by a regulated natural monopoly (the upstream firm). In this context, socially optimal access conditions are determined as a function of downstream firms' privately-known characteristics and different ways to implement the optimum were looked at. They suggested that allocating and determining access through properly designed auction procedures could in many cases prove as efficient as the standard access pricing approach and in some cases more efficient.

In this context, two important classes of auctions - share auctions and multi-item auctions - may prove fruitful to study in more details. Examples of share auctions in the economic world include the sale of newly registered stock in the Paris *Bourse*, the sale of offshore oil leases in Indonesia, and occasionally the weekly auctions of U.S. government bills. Overall, however, auctions of shares remain relatively uncommon. The relative unpopularity of share auctions can be explained by at least two features that put them at a disadvantage with respect to other types of auctions [Wilson (1979)]. First, share auctions often yield sale prices that are lower than those obtained in other auctions. Second, share auctions are plagued by numerous bidding equilibria.

When the objective is to maximize social welfare and the value of public funds is low, the first feature may not be too bothersome. The price is then only a transfer from downstream firms to the upstream firm. Furthermore, lower access prices may enhance participation in the downstream market, which in some industries such as telecommunications may mean increased variety in contents and consequently greater consumer welfare [Sirois and Forget (1994)]. On the other hand, lower access prices entail an accrued risk that the fixed cost of the network will not be covered.

One apparent advantage of share auctions in the context of network access regulation is that they address the Coasian criticism that fixing the access price precludes the upstream firm from learning about the shape of the demand for its capacity [Laffont and Tirole (1993)]. In a share auction, demand for capacity can easily be computed by summing up the downstream firms' submitted demand schedules. These demand schedules, however, may not be true ones. This is where the second feature of share auctions hits badly: there can be many equilibrium configurations of individual demands, besides the one involving truthful demand schedules. One way to possibly overcome this could be to invite bids from a better informed firm, for instance by allowing the upstream

firm to enter the downstream market. Intuitively, since the upstream firm internalizes the cost of access, it can adopt a bidding strategy that deters non truthful demand schedules on the part of downstream firms.

An alternative to the auction of shares in the present context is the multi-item auction. Auctions of this sort have gained much popularity and relevance lately, especially in the context of network access regulation, after one was successfully used by the U.S. Federal Communications Commission to sell spectrum licenses for personal communication services [for detailed descriptions and analysis of this auction, see McMillan (1994) and Cramton (1995)]. Multi-item auctions have also been used recently in Europe for the privatization of state-owned firms. In a multi-item auction, the network capacity would first be split into subunits of possibly uneven size and characteristics. These subunits would then be sold simultaneously to downstream firms through one of the standard auctions (i.e., the first-price sealed-bid auction or the English auction). Interesting issues here concern the design of the subunits and whether or not to allow "bundling", that is the acquisition by a downstream firm of more than one subunit [see Branco (1995) for a recent analysis of this latter issue].

Multi-item auctions present many advantages over share auctions. First, they would usually yield higher revenues to the seller. (The auction used by the FCC brought billions of dollars to the U.S. Treasury.) Second, they allow the regulator to deal directly with heterogeneous capacity (the FCC had to distinguish between different types of narrow bands) or to implement redistributive or regional policies through the discretionary design of the subunits. They are, however, less informative than share auctions about the shape of demand for capacity.

The analysis of Boyer, Robert and Sinclair-Desgagné suffers from several important limitations. First, the equivalence between a pricing system and an auction system relies on the fact that there is no uncertainty about the demand system. There exists a literature about the respective benefits of allocating resources through prices or through quantities [for example Weitzman (1974)]. This issue, an important one in practice, was side-stepped. Second, private information on the part of the natural monopoly was also assumed away. This is in sharp contrast with the literature on regulation and incentives. Taking into account the upstream firm's information would have required to consider double auctions but again this may prove to be quite fruitful. Third, the implementation of the optimal regulatory rule requires extensive knowledge by the regulator of the structure of the demand system and the distribution of types. This is of course unrealistic. Ultimately, the objective is to find simple and straightforward auctions that could induce the desired allocation

and could be put in place without presuming so much knowledge from the regulator. Finally, some of the costs intrinsic to using an auction were not made explicit here. Holding an auction presupposes that all interested parties are somewhat brought together at a given time. This imposes high coordination costs on the potential bidders and the auctioneer. Moreover, in the present context, some downstream firms are likely to be wanting to abandon their access to the network after some time whilst new firms express a concrete interest. To deal with those situations, the auction would have to be repeated relatively often. One way to decrease the frequency of repetitions could be for the regulator to sell options on the access to the network rather than real access. There is indeed much to be done.

6 Conclusion: some neglected issues

Some neglected issues should be raises in conclusion. The standard procedure of introducing competition in telecommunications markets has been to give some advantages to entrants. This has been quite often advocated to raise competition because of learning effects and brand name effects. How long should those last and how to make this duration credible ?

New competition is redefining risks and affect investments and network developments and maintenance, reliability and integrity. From my discussions with executives in telecoms, electricity and natural gas, this is something which preoccupies them very much. I am not sure if this is a proper preoccupation but they are afraid that at least the maintenance, reliability and integrity of networks might be affected by some of the new competition rules which are brought in.

Transition towards more competition seems to implies increases in game rules and litigation. Deregulation becomes synonymous with increased transaction costs. In some cases, these higher transaction costs may destroy the advantages competition was suppose to generate; the importance of those transaction costs depends very much on the way the competition rules have been introduced. The transition toward more competition has been and remains a difficult undertaking but lots of the transition costs could be avoided by a well planned course and better, sharper and more efficient announced procedures such as global price caps or auctions.

One last point deserves to be mentioned here. What is the likely effect on the Canadian telecommunications industry of globalization and/or continentalization. If we were to open the Canadian markets and let for-

eign investors own Canadian telecommunications firms or have access to the Canadian consumers directly, in exchange for Canadian firms having access to foreign customers, would Canadian firms survive ? The analysis I presume would have to be developed in terms of a small market being integrated with a large market. Let me recall that Bell Canada, the largest telecommunications company in Canada is smaller than each of the following: NTT, AT&T, MCI, Sprint, British Telecom, France Telecom, Deutsche Telekom, Telecom Italia, and each one of the Regional Bell Operating Companies. Hence on the international market, it remains a junior player. I don't know how serious this is but this was raised to me by some senior executives in different telecommunications firms; they fear such a market integration. Satisfying the Canadian market could represent a relatively small incremental cost for AT&T or other major U.S. companies. Should we let this happen or not and how much do we want or need the Canadian industry to remain Canadian ?

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