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Tariff regulation of telecommunication network interconnection. Controlling incremental cost with a Price Cap

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Tariff regulation of telecommunication interconnection often encounters difficulties related to the calculation of the long term incremental cost. Tariff control may lead to network effects profitable to all operators, but these effects evolve in the same direction as the incremental cost. This article shows that a productivity standard (periodic Price Cap) based, if necessary, on a Yardstick Regulation may help reduce the incremental cost equation.

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Abstract

Tariff regulation of telecommunication interconnection often encounters difficulties related to the calculation of the long term incremental cost. Tariff control may lead to network effects profitable to all operators, but these effects evolve in the same direction as the incremental cost. This article shows that a productivity standard (periodic Price Cap) based, if necessary, on a Yardstick Regulation may help reduce the incremental cost equation.

KEYWORDS: Telecommunications, regulation, Incremental Cost, Price Cap, network effects.

Code JEL: D4: market structure and price formation, L0: industrial organization generalities.

Introduction

Telecommunication sector is liberalized almost everywhere in the world and the involvement of private operators has been beneficial in terms of technical progress and control. It has therefore become a relevant topic of study of the institutional changes needed to accompany the rapid evolution of technologies of information and communication. Social media require more and more regulation as they are multiplying and interconnecting. Therefore, one of the main objectives of the regulator should be the restructuring of tariff in line with costs, so that resource allocation and new entries be conducted efficiently (Gönenç, Maher and Nicoletti, 2001). Laffont and Tirole initiated a new branch of literature by showing how price distortions could be avoided if the regulator was able to use accounting measurements of operators' costs.

This article stems out of the idea that it is possible to adapt telecommunication tariff regulation to the measurement of network effects resulting from tariff control. Fair pricing reinforces the social surplus, promotes marginal access and provides operators with additional margins for economies of scale. It is therefore intended to guide regulation in this context of multiplicity of networks driven by digital technologies. The emergence of new applications using telephony infrastructures, such as WhatsApp and Messenger, has pushed operators to call on regulators regarding the incremental cost of these new types of access. The first section discusses the issue of incremental cost[1]. The second section models the inclusion of network effects. The third and last section introduces the Price Cap proposal.

1. The interconnection regulation: the incremental cost equation

Coordination in the form of interconnection regulation will facilitate the collective action of private operators which cannot be achieved through an all commercially-oriented coordination (Hugon, 2014). It is essential for a regulator to know the type of regulation to be implemented. Should operators be always allowed to set freely or should indices be set? The regulator should find out how to determine tariff guidelines in favor of the consumer's surplus without penalizing operators' profitability. However, regulators are often inexperienced and exposed to constraints related to asymmetric information which create risks of cheating on costs or even corruption. Laffont (1996, 2000) considers that in a regime characterized by the risk of corruption and a lack of qualification, the best way for the regulator to reduce the impact of asymmetric information is to resort to strict tariff control.

In telecommunications, operators usually set different prices and retain customers on the basis of promotional tariffs. If companies have different costs, they can set different prices in a Bertrand-style competitive process (1983)[2]. Moreover, the Laffont, Rey and Tirole model (1998) shows that to the extent that termination costs are paid by customers of the other network, each network benefits from a unilateral increase in its tariff above the incremental cost. Customers will tend to join the network which sets the lowest tariff; the costs of switching network operator being almost zero in telecommunications. But in this case, the less

[1] That is the cost generated in the use of other operators' network.

[2] In Bertrand's rationale, competition leads to a balance price equal to unit cost.

efficient company may increase its interconnection costs to raise the tariff of its competitor. In such a competitive dynamic, the consumer is the loser, which requires action on the part of the regulator in setting and regulating tariffs.

Incremental cost represents the cost on the operator routing a call via another operator's network. This is the first component of the interconnection costs. The other component is the fixed cost charge to cover infrastructure renewal. The charge or cost of an interconnection is written: $c_a = q_2 c_{in} + q_2(\frac{F}{q_1})$, where,

(q_1) is the production of company 1

(q_2) is the production company 2 is offering via the network of company 1.

(c_{in}) is the incremental cost on a network portion

(F) expresses spending intended for fixed costs

Baumol and Sidak (1994) have integrated the opportunity cost that is the operator's revenue loss resulting from the diversion of part of demand by a competitor using the network. However, this approach is more adapted to the case of asymmetric interconnection (one-way non-reciprocal access). It is a symmetrical interconnection situation where each company pays back interconnection costs for reverse communications. This case is referred to as bilateral access by Laffont, Rey and Tirole (1998).

If p is the price of the service, the opportunity cost for each company is $p - c_{in}$. If c_i is the unit cost, each company will consider its comparative advantage which is equal to:

$$p - (p - c_{in} - \frac{F}{q_i}) - c_i = (c_{in} + \frac{F}{q_i}) - c_i$$

As a result, interconnection margins are applicable only if the unit cost is kept to a strict minimum. Companies are then encouraged to cooperate in the setting of interconnection costs. An alignment of interconnection costs is often noted due to cooperation or reciprocity of costs. However, profits are sought on interconnection unit margin whatever the cost structures:

$$p_i - c_{in} - ci - \frac{F}{q_i}$$

If the fixed cost is integrated in the incremental cost c_{in}, the interconnection margin becomes:

$p_i - c_{in} - c_i$ with $\frac{F}{q_1} \subset c_{in}$ and $(c_{in} + c_i)$ as the total interconnection cost for each company.

The difficulty in achieving interconnection margins has resulted in operators favoring *club effects* (On-net communications) at the expense of interconnection. Network effects from marginal access allow them to catch-up on their profit expectations. To maintain an optimal pricing and promote this marginal access within interconnected networks, the regulator should focus both on cost reduction incentives and on fair calculation of long-term incremental cost taking into account depreciations.

2. Interconnection and *network effects*: why adopting the *Price Cap*?

We consider that the work of the regulator is first of all to promote marginal access and tariffs, which is a significant role on the whole. The expansion of a network is indeed based on the mechanism of positive network externalities (Curien et Gensollen, 1992). This mechanism leads to a significant potential for economies of scale that can result in tariff reductions to attract new customers and so on. Network effects will therefore be achieved whenever marginal access is ensured.

Baranes and Jeanneret (1996) have elaborated an interconnection model taking into account network effects. This modeling, as well as the one set later on by Laffont, Rey and Tirole (1998), have indicated that cooperation is more optimal for international interconnection. We will use this model locally to assess the minimum network effects required to implement tariff standards. Let us consider two competing operators in a same country and the following assumptions:

- Operators have different costs and set different tariffs
- Incremental cost (c_{in}) including depreciations, is identical and represents the cost invoiced by each operator to its competitor in the interconnection.
- The demand function, inspired by Cournot, takes into account network effects:

  $D_i(p_i, p_j, q_j) = 1 - p_i + \lambda q_j$, λ measuring network effect with $\lambda \in [0,1]$

The following reverse demand functions are obtained:

$$p_1(q_1, q_2) = 1 - q_1 + \lambda q_2$$

$$p_2(q_1, q_2) = 1 - q_2 + \lambda q_1$$

Profit functions are presented as follows:

$$\pi_1 = q_1[p_1(q_1, q_2) - (c_1 + c_{in})] + q_2(c_{in} - c_1)$$

$$\pi_2 = q_2[p_2(q_1, q_2) - (c_2 + c_{in})] + q_1(c_{in} - c_2)$$

The identical nature of the incremental cost is the result of regulation since the overall declared costs may differ from one operator to another. Operators will therefore maximize their profits according to their efforts to control technological costs. The Ramsey-Boiteux pricing rule applies here since if:

$$\frac{\partial \pi_i}{\partial q_i} = p_i(q_i, q_j) - c_i - c_{in} + q_i p_i'(q_i, q_j) = 0.$$

We can write: $\frac{p_i(q_i, q_j) - (c_i + c_{in})}{p_i(q_i, q_j)} = \frac{1}{|\varepsilon|}$, $|\varepsilon| = \frac{\partial q_i}{\partial p_i} \frac{p_i}{q_i}$ (where ε is the price elasticity of the service).

The balancing quantities of the model are the following:

$$q_1 = \frac{2}{4-\lambda^2}[1-(c_1+c_{in})] + \frac{\lambda}{4-\lambda^2}[1-(c_2+c_{in})]$$
$$q_2 = \frac{2}{4-\lambda^2}[1-(c_2+c_{in})] + \frac{\lambda}{4-\lambda^2}[1-(c_1+c_{in})]$$

We have assumed that the two companies compete with each other as in the Cournot model, so their prices will align and they will share the market. We will start from an identical cost assuming that both companies have cost reduction margins $(c_1 = c_2 = c)$.

We find that $q_1 = q_2 = \frac{1-(c+c_{in})}{2-\lambda}$ and $p = \frac{1+(c+c_{in})(1-\lambda)}{2-\lambda}$,

Operators' sales revenues (SR) are: $SR_1 = SR_2 = \frac{1-\lambda(c+c_{in}) - (1-\lambda)(c+c_{in})^2}{(2-\lambda)^2}$

When seeking to achieve the most of network effects, companies are ready to apply long-term incremental cost that maximizes their revenues, i. e:

$c_{in} = \frac{-\lambda}{2(1-\lambda)} - c$, So $\frac{\partial c_{in}}{\partial \lambda} \prec 0$ and $\frac{\partial c_{in}}{\partial c} \prec 0$

Operators should set a negative incremental cost to maximize network effects and sales revenues. These results tend to validate the models of Baranes and Flochel (1995), Baranes and Jeanneret (1996), Laffont, Rey and Tirole (1998), which showed that the community would benefit if international interconnection costs were set within a cooperative framework between operators. But cost reduction results in network effects increasing the incremental cost. The adoption of a productivity standard will be intended to adjust costs and tariffs in response to information asymmetry.

3. Application of the *Price Cap*: indication of approach

Cooperation in interconnection can lead to collusion. It can also facilitate the fraud committed by operators on the number of call terminations in order to minimize their tax costs. Non-cooperation, on the other hand, may hide collusion as the regulator is prepared to check interconnection rates. At the end of the day, the regulator is obliged to control and supervise the overall level of costs, especially when cooperation in interconnection is possible.

The models of Barron and Myerson (1982)[3], Laffont and Tirole (1991), Martimort and Laffont (2002) have all shown the possibility of a tariff which would encourage each operator to minimize its costs and set the lowest tariff possible. If the overall surplus is not absorbed in

[3] Quoted and commented in Brousseau (1997) and Julien et Rochet (2005).

profits, the fixed price gets closer to the marginal cost than it does in the case of operator benefitting from an informational rent. The introduction of a productivity standard (Price Cap) is more relevant in persuading competitors to be willing to provide sufficient information on their costs. The regulator will then push operators to set a price lower than the price they want to set, but within a fair limit that provides operators with profit margins. The Price Cap is a strong incentive mechanism since we know that the operator can, between two rounds of negotiations, capture the productivity gains achieved beyond these objectives[4] (Brousseau, 1995). The persistent issue is that only the most efficient operators are receptive to this system. In addition, the asymmetry of information implies that the system will require periodic renegotiations of the Price cap, which will reduce the rent given to operators and the incentives to reduce their costs[5].

The *Price Cap* calculation can be based on Holmstrom's proposals (1982) making the calculation on the average productivity difference of operators in relation to the average productivity of other operators in the same business and in areas where markets are deemed relevant. Shleifer's (1985) mechanism is also possible since the regulator remains underinformed about the declared costs. It is a method based on comparative productivity or Yardstick Regulation. If M is the number of foreign operators observed, c_M the unit cost of each of them and N the number of operators in the country in question, the possible price (P) and the productivity standard (δ) will be:

$$P = (\frac{1}{N-1})\sum(C_i) - \delta \quad \text{With,} \quad \delta = \left[\frac{1}{N-1}C_i - \frac{1}{M}\sum^{M} c_M\right]$$

(C_i) is the cost declared by the operator i. It includes the incremental cost and it is assumed that the regulator has made arrangements to rely on the good will of operators.

Conclusion

The emergence of new applications, such as *WhatsApp,* has created new communication tools that require a reliable internet access. These applications have added more complexity to the regulation of network interconnection with its multiplicity and intangibility. This article proceeds with the old question of incremental cost, which has not been completely elucidated by theory. The issue of long-term funding is also an important aspect that can be incorporated into the treatment of incremental cost. This is difficult to determine and shows the need for a global approach requiring from the regulator to resort to a funding system of networks in the long-term and a universal service[6]. Our modelling shows that tariff control enables marginal access through network effects and its maximization requires the setting of a negative incremental cost. As already stated in theoretical works (Baranes, Laffont, Rey, Tirole...), cooperation between operators is practicable in the field of interconnection. The regulator is expected to prevent collusion and combat asymmetric information on costs. Finally, the adoption of a periodic Price Cap will not only enable tariff control but it will also encourage operators to disclose their real costs. The calculation of the standard can be based on the level of reported profits or on the mechanisms of comparative productivity or Yardstick Regulation.

[4] Productivity, in this case, is the difference between the regulated evolution of tariffs and the evolution of costs.

[5] Incentive regulation applied to electricity transmission in Europe indicates that the optimal duration of regulation is more than two years but less than five years in order to provide a sufficient level of incentives.

[6] For example, in the European Union, regulators have promoted the creation of funds for universal service.

However, the new regulatory dynamics should be developed within a framework of market integration that makes available a sufficient volume of information which can be used in a more harmonized regulatory framework around the word.

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