REGULATION FOR INTERCONNECTION BETWEEN NETWORK OPERATORS IN A LIBERALISED MARKET

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ABSTRACT
Interconnection between network operators in a liberalised market is essential for delivering services to end users. As the incumbent has a strong advantage compared to the new entrants, regulation is necessary for making sure that a competitive market can be established. Interconnection tariffs are used for protecting market shares by the incumbent and therefore have to be regulated by the national regulatory instance (NRI). Several cost models have been formulated for making sure that the tariffs reflect the real costs made by the operators for connecting the calls. In this paper, the legal framework formed by the EU and the Belgian government is explained, as well as the cost models that the NRIs have constructed. The most important part of this paper deals with the modelling of the market interaction between an incumbent and two new entrants, a cable operator and an alternative operator who is using the carrier select service of the incumbent, and this for situations with and without regulation. Our model allows confirming that the use of cost models leads to lower interconnection tariffs for network operators as well as lower telephony prices for the end users.

KEYWORDS
Interconnection tariffs, liberalization, regulation, cost models, telecom market

1. INTRODUCTION

Until the eighties most European telecom networks were owned by their government. The advantage of the incumbents is that they have already rolled out a complete network, covering a large area. Therefore, it is very difficult for new telecom players to enter the market. Large investments for a new network must be carried out and justified, and costs and inconveniences for the society such as breaking up the streets must be avoided. It would be easier if some of the existing infrastructure that the incumbent owns could be reused. [1]

Interconnection is the physical linking of a carrier's network with equipment or facilities not belonging to that network. This is most common between two or more carriers who want to connect their customers with customers of the other carrier(s).

2. LEGAL FRAMEWORK

To facilitate the entry of new network operators, the EU decided to introduce a framework for regulation [2] which describes a set of policies and directives the national regulatory instances (NRI) in the EU member countries should implement. In the Framework Directive, the competences and responsibilities of the NRIs, as well as the obligations of carriers with significant market power (SMP) are described. The latter are defined as: "An undertaking shall be deemed to have SMP if, either individually or jointly with others, it enjoys a position equivalent to dominance, that is to say a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers." These obligations contain transparency, non-discrimination, accounting separation, access to,
and use of, specific network facilities, price control and cost accounting obligations, further explained in the Access Directive. The Non-Discrimination Directive encloses the obligation to offer services and information to the other carriers at the same conditions as to its own partners or subsidiaries. Cost accounting obligations ensure that the incumbent cannot set its prices freely. These must be based on costs, raised with a fair investment return. This will be explained in the next section. The Authorisation Directive describes how an internal market can be established for electronic communication networks and services. This must facilitate the entrance of new players on the telecom market. The Universal Service Directive ensures a liberalised market where a minimum number of services must be offered to all end users at a reasonable price.

In Belgium, Belgacom is the incumbent and only market player with SMP in fixed lines services. Belgacom is obliged to make reference offers with tariffs the other carriers must pay for services offered by the incumbent. The BRIO reference offer [3], approved every year by the BIPT (the Belgian NRI) encloses several interconnection services offered by Belgacom. Terminating Access Services: Phone calls from carriers’ end users to Belgacom customers are handled in the access points and terminated in the Belgacom network. Collecting Access Services: Belgacom end users could make use of services of other carriers. The conversion is put through on the other carriers’ network in the closest access point and terminated in this network or put through again on the Belgacom network. Examples of this service are carrier pre-selection and carrier selection. In the first case, all conversations will be redirected automatically to the alternative operator’s network. In the latter case, the end user can choose to make a connection via the alternative operator’s network through a code. If the user does not use the code, Belgacom will terminate the call. Transit Service: Belgacom will transit a call, originating in the network of operator A, over its own core network and passes through the call to the network of operator B, e.g. termination of international calls.

3. COST MODEL

The European Directives have dictated that the NRIs must work out cost models by which the network operator(s) with SMP must justify that the interconnection tariffs they are asking to the other operators are reflecting the true costs made for offering this service. A cost model is made up of two parts: cost modelling and cost allocation. Several approaches are followed by the different NRIs: top-down (TD) versus bottom-up (BU) cost modelling [4]. Two important cost allocation schemes are Fully Distributed Cost allocation and Incremental Cost allocation. The Fully Distributed Cost (FDC) method allocates all costs to all services. Direct costs are immediately attributed to each cost consuming service, shared/joint and common costs are attributed through the use of allocation keys. The hardest part when using this cost-base is to find the right allocation key for all costs. The tariff for a service thus includes all the incurred costs by this service [1]. The Long Run (Average) Incremental Cost (LR(A)IC) method only measures the change in total costs when a substantial and discrete increment or decrement in output is generated [6]. Long run means that capital investments or disinvestments are possible. Average means that the fixed cost is averaged over the total of all increments. This allocates the direct, shared and common costs to the various services depending on used definition of an increment. Economies of scale will be playing an important role in the allocation of shared/joint cost, resulting in a smaller part of attributed costs than in FDC. The LR(A)IC method is mainly used in the bottom-up approach (e.g. introduction of a new service or an increase in output of one service). Finally, also the manner in which the tariffs are deduced from the model is also important. Is the model developed by the incumbent and audited by the NRI or is it directly developed by the NRI.

In Belgium, the NRI develops a TD FDC model in collaboration with the incumbent as well as a BU LRAIC model. The TD model, adjusted by the results of the bottom-up model, is used to determine interconnection tariffs [8]. Another method is used in Denmark where the incumbent must develop a top-down model and the entrant a bottom-up model, both LRAIC based [6]. Although in both countries the market share of the incumbent is the same, Denmark has far lower interconnection tariffs [7].

4. GENERAL MARKET INTERACTION MODEL

In the next parts, we will aim to model the influence of regulation on market share and profit of network operators in a fictitious telecom market. Based on the described market situation, the model will be
elaborated, starting from the model described in [9]. Some assumptions had to be made for defining the fictitious market: all operators are offering only one product (telephony service over fixed lines), the market is homogeneous (only the residential market), price discrimination will not be applied by the operators, demand is inelastic, consumers will choose the operator with the lowest price, and telephone behaviour of the customer is random (no network preference). Three players are interacting in a simplified market. The incumbent (I) owns a PSTN/ISDN network and holds a position of SMP in the considered market. Two new players are entering the incumbent’s market. A cable operator (C) owns a complete cable network, which has the same functionalities, quality and range as the incumbent’s network, and can reach all end users on its own. The alternative operator (A) only possesses a core network and uses the carrier select services of the incumbent to reach its end users. Two services are offered within the model, a termination service and a carrier select service. Only the cost of the access network is taken into account. Fixed cost includes the equipment and network costs. Variable costs are a weighted average of all the recurring operational and capital costs the operator has. In our model only the termination and network costs are relevant.

I has the largest costs due to the historic (less efficient) dimensioning of the network. We assume that the access network of C is more efficient which results in lower costs. A has no fixed cost as it is using the incumbent’s access network. A is also the most efficient player resulting in the lowest network costs, but its termination costs will depend on the interconnection costs that are asked by the other operators. The total cost for an end user is the fixed cost plus (cost per minute multiplied by number of minutes) and can be viewed in (Figure 1) for the incumbent where the fixed cost equals the subscription cost, and the variable costs are related to the number of minutes called. However the cost function of the new entrants must be raised with a stickiness coefficient (z) that represents the extra costs a client must pay for switching from the incumbent to another operator (Figure 2). These contain real costs (e.g. switching subscription from I to C or A) as well as perceived costs (e.g. lack of reputation, quality). This factor will decrease when more customers have switched operator and perceived quality and trust have increased.

![Figure 1. Cost for customer without stickiness coefficient.](image1)

![Figure 2. Total cost for customer & market shares I, A & C.](image2)

An operator’s market share is that part of the market where it can offer the lowest total price to the end user, determined by its subscription cost and cost per minute. The market share for each operator can be deduced from the intersections between the different total cost curves (Figure 2). The real profit for I, C and A consists of the profit margin on subscription, profit on the difference between the amount of people calling over the network minus the interconnection costs for calls that terminate in another operator’s network, and profit at the expense of other operators for people calling to the network in addition to which interconnection costs can be asked. For I, extra revenues are generated by A which uses its carrier select service.

5. MARKET INTERACTION WITHOUT REGULATION

Without regulation, I determines the termination and collecting tariffs. When I sets this latter tariff very high, A will not be able to gain market share because I has direct influence on the fixed cost of A (A1 to A2 in Figure 3), which results in a complete control of the market by I. For C, the variable costs will be high due to the high tariffs I imposes on the other operators for interconnection, ensuring that the market share of C will be limited (C1 to C2 in Figure 4). C can only create a customer base by adjusting its fixed cost, and this by asking no or little subscription cost to the customer and only charging per minute (C3 to C3 in Figure 4).
will have to focus on end users who are calling few minutes for enlarging its customer base, by which the stickiness coefficient will decrease and the operator will be able to lower its cost function below this of I.

6. MARKET INTERACTION WITH REGULATION

Regulation is thus necessary to ensure that a competitive market can be created. Two different scenarios will be discussed: a market where new players are entering and a more mature market where these new players have gained a reasonable market share.

In the first case, interconnection costs are calculated by I via the FDC allocation method. In this case the carrier select tariff equals the fixed cost of the incumbent. The fixed cost of C is still lower than those of I. The total interconnection cost A must pay to I and C will be higher than the revenues it receives from calls terminating on its network. This is also the case for C but due to its enlarging customer base, this gap will be decreasing whereby its cost function will lower. The best strategy A can implement is to lower its cost per minute by which it will gain market share for customers who are calling much. C will set its subscription cost equal to the cost for its fixed cost plus a profit margin. The variable costs will be lower than I’s because its network is more efficient (Figure 5). Profit for I will only be generated by its own operations, not at the expense of other operators as interconnection tariffs are based on real costs. C can make profits at the expense of other operators like I and A because it can set its own termination cost based on its real costs, which can be higher than I’s. The regulator can also impose LR(A)IC as regulatory cost allocation method. The interconnection costs will only be a fraction of the costs charged with FDC regulation. The carrier select cost will decrease, leading to a lower fixed cost for the alternative operator. The fixed cost for C remains the same. The interconnection tariff will also decrease, leading to a less steep slope in the cost functions of C and A. If both operators implement the strategies discussed for FDC, both will gain market share at the expense of I. A could also decrease the subscription cost by which its customer base will grow larger (Figure 6).

As time passes, the entrants have built up a customer base and market reputation, which results in a decline of their perceived extra costs. More market share can be acquired, which forces the incumbent to take action. Figure 7 shows the decreasing cost functions of C and A and loss in market share for I. At first I will give up its monopolistic profits and when this is not enough, it will be forced to reduce costs. This can be on three fronts. If I lowers the termination costs, C and A will benefit because they could lower their cost per
minute they charge their customers. If I lowers its fixed cost, A will benefit because a lower collecting cost will be paid. I will only gain by decreasing its network costs because this has only effect on its cost function without advantages for the other players. This will result in the preservation of its market share (Figure 8).

![Figure 7. Decrease in stickiness coefficient for C & A.](image1)

![Figure 8. I lowering profits and costs](image2)

7. CONCLUSION

In this paper, we have presented a model for studying the effects of terminating and collecting tariffs in a telecom market with three players. Most models in literature only deal with two players, e.g. [10]. Our model allows to indicate in a straightforward way that regulation is essential in the telecom market. Without regulation, an incumbent is likely to boycott any new entrant. An efficient way to regulate this sector is to control the interconnection tariffs. A cost model is imposed by the NRI’s for calculating these tariffs based on the real costs. This leads to a more competitive market with new entrants, which forces the incumbent to analyze and reduce its inefficient costs, leading to lower tariffs and lower prices for all end users.

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