INTERCONNECT/ACCESS PRICING: A SUMMARY AND CRITIQUE[1]

1. OVERVIEW OF THE PRICING PROBLEM

The traditional telephone monopolies are quickly disappearing, although their market power is not diminishing as quickly. New regulatory tools of incentive regulation and competitive entry are replacing the traditional rate-base, rate-of-return regulation and rate structure setting methodologies.

The pricing of intermediate services is a thorny, but extremely important, issue in this context. This paper will focus on this issue; however, the reader is reminded that this is only a partial analysis, other issues interact with this one and it cannot be considered in isolation.

Intermediate or interconnect pricing represents the price of the intermediate good or service needed by a firm to provide its service. In the telecommunications industry, this price is also known as the "access price" and would be the price charged by one service provider, usually the incumbent, for connection to its network in order for the other provider to complete the service for its end-user customers. For example, in the United States, it would represent the price that long-distance carriers must pay to exchange carriers to complete a call on the public switched telecommunications network (PSTN). Another example would be the connection of a mobile provider to the PSTN.

The pricing becomes more complex when the company charging the interconnection price also competes with the company to which it supplies the intermediate service. The company charging for interconnection has an obvious incentive to overcharge the competing company — not only to enhance its own revenue, but also to make the competing company's cost, and hence its price, higher.

Section 2 focuses on one of the most discussed "solutions" to the intermediate pricing problem — the efficient-component pricing rule (ECPR). We argue that the ECPR is not appropriate, although it is accepted by many policy makers. This erroneous acceptance of a pricing rule leads to poor and inappropriate prices and policies.

In Section 3 we review various models and their results. The models are used to characterize how the regulators in some countries have implemented access charges.

In Section 4 we review the application of ECPR to the telecommunications industry.

Our discussion is summarized in Section 5.

1.1. Definition of the Problem

The problem of intermediate pricing has three major characteristics.

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[1] This review has benefited from discussions with Drs. Mark Schankerman and Alain de Fontenay. Ms. Barbara Miller offered excellent editorial assistance. The usual disclaimer applies. Partial support was provided by Hagler Bailly.

The good or service that is needed is an essential facility that is usually provided by a monopoly, natural or de jure. The product is an input to a competitive good or service. That is, the intermediate product is provided by the incumbent but needed by the rivals.

This, in itself, would be a serious problem, but it is compounded by the fact that the supplier of the intermediate product competes with its customers in the final or downstream market. Thus, the monopoly firm has an incentive to keep the price of the intermediate product higher than its (economic) cost, however defined, in order to increase its revenues. But more important in this context, it increases its rivals' costs and, hence, their price to the end users. The incumbent can place the rival at a competitive disadvantage. Thus, the interconnection price is critical to the establishment of viable and fair competition.

In the U.S. telecommunications industry, the price to the inter-exchange carrier (IXC) is critical because the local exchange carrier (LEC) competes with the IXC in the intraLATA (Local Area Transport and Access) toll market and, with the recent passage of the Telecommunications Law of 1996, in the interLATA market.[2] Similarly, with the pricing of the cellular mobile connection to the PSTN, the telephone company is a competitor and a provider of the connection for its rival to the PSTN, although this has received less attention.

1.2. Intermediate Price Goals

Before addressing the issue directly, we propose a framework around which to evaluate the issue. Whatever the pricing methodology, it should be judged on whether or not it will encourage efficient entry, and avoid inefficient bypass and network duplication. In addition, it should not discourage the incumbent from developing and maintaining the current network. Finally, it should promote a transition to a competitive market.[3]

1.2.1. Encourage Entry

The rationale for the encouragement of entry has been spelled out in many discussions (Nuttall and Vickers, 1996). Competitive entry promotes the desirable behavior in the firms. With competition, firms have incentive to be more efficient and least-cost providers. Competition will drive prices toward costs and provide dynamic efficiency by promoting cost savings innovations, and, over time, more efficiency.

1.2.2. Inefficient Bypass and Network Duplication Avoided

Although competition should be encouraged, it should not lead to bypassing of the incumbent's network if the cost of doing so would be greater than the incumbent's cost. Nor should the pricing policy encourage firms to build their own networks if the cost of doing so would be greater than that of the incumbent's. Both would mean the unnecessary utilization of resources and would be inefficient allocations of resources.

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[2] This is provided that certain conditions are met. The issue is actually more difficult because of the institutionalized subsidies that flow to the access market and, in this reviewer's opinion, the services are incorrectly defined and priced. See Alleman (1994).
[3] This follows Laffont and Tirole, 1995.

1.2.3. Promote Competitive Market Transition

The pricing policy should lead to a smooth transition to the competitive market solution, if such a solution is feasible.

1.2.4. Incentive for Incumbent to Develop and Maintain Network

From the point of view of the incumbent, the policy should encourage, or at least not discourage, the development and maintenance of the traditional public switched telecommunications network. That is, the incumbent firm should be able to cover its costs and earn a reasonable return on its investment such that it is able to maintain the network and not be reluctant to continue investing where and when appropriate.[4]

2. EFFICIENT-COMPONENT PRICING RULE: A CRITIQUE

A solution to this complex pricing problem has been suggested (and, in some cases, adapted). It is known by a variety of names: the efficient-component pricing rule (ECPR), the Baumol/Willig rule (after its authors), and the parity principle.

The ECPR prescription for pricing intermediate services provided by the incumbent but needed by its rivals requires that the intermediate service be priced on the basis of the average incremental cost of the intermediate product ***plus*** the opportunity cost of lost market share.

2.1. Overview

The Baumol/Willig rule indicates that the intermediate service should be sold at its average-incremental cost (AIC), the contestability equivalent to the marginal cost, including the opportunity cost.[5] [6] With the "efficient-component pricing rule," the idea is that the firm that sells an intermediate product to its rivals must receive the sum of all the marginal cost required to produce the product, the definition of AIC, plus any foregone revenue as a result of the loss of market share to the rival which is the opportunity cost associated with the service. The rival is assumed to offer **exactly** the same end-product, but requires the intermediate product from the incumbent for some part of the service.

This is a controversial prescription. At its limit, all of the contribution lost by the incumbent must be paid by the rival under the ECPR. This makes many uncomfortable, but the logic is impeccable with the assumptions used in their model. However, the assumptions do not hold, and with them, the conclusions do not hold. The model does not decay gradually as the assumptions are slightly modified, as is the case with most models, but it **collapses**.

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[4] This is in no manner an endorsement of rate-of-return regulation; it is simply indicating a requirement of the pricing policy.

[5] See Chapter Seven of Baumol and Sidak (1994a). An expanded version of this chapter by the authors (1994b) appeared in the *Yale Journal on Regulation*. In the same volume Tye and Kahn, 1994; and Taylor, 1994, respectively, take issue with the application of the methodology.

[6] From this point forward, we refer to both the Baumol and Sidak book and article (1994a and 1994b) by only the authors' names, we do not use the dates unless they are unique to one of the sources.

The ECPR requires two critical assumptions:

1. The incumbent firm is pricing efficiently initially. Alternatively, the opportunity cost does not include any monopoly rents associated with the service.
2. The intermediate products sold are substituted one-for-one for the incumbent's intermediate products.

Note that in the above formulation, prices and quality are constant, the payment to the incumbent is only on lost traffic not new traffic, and monopoly profits are assumed away. No restriction on entry into the intermediate service is suggested.

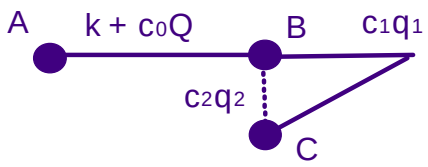
These are stringent assumptions that do not hold, particularly considering that in actual practice the opportunity cost is calculated as a residual (see below).

2.1.1. An example:

Consider the stylized network with the following characteristics (see Figure 1):

Figure 1

Stylized Network



The price received by the incumbent for one minute between A to C (through B) of traffic is $10. The incremental cost for the traffic between B and C is $4.

According to Baumol and Sidak, the ECPR works as follows:

If a potential entrant enters the market, it must pay the incumbent $6 for each minute of traffic it carries. According to the authors, the incremental cost plus the opportunity cost to the incumbent equals the lost revenue minus the incremental costs of the traffic no longer carried.

Two points to note in this example:

- The opportunity cost is calculated as a residual, namely the difference between the price (between A and C) and the incremental cost of the lost traffic (segment B and C).
- The price, not the cost, is used to determine the cost associated with the service.

The simplicity of the approach, which is stated as its advantage in practice, hides other faults as discussed below, including, the following:

- Monopoly rents may be embedded in the price.
- The total pricing methodology is undetermined.
- No allowance is made for demand expansion.
- New substitutes and complementary services are not addressed.
- Cross-subsidies may be embedded in the price.

2.2. What is Not Covered [7]

2.2.1. Monopoly Rents

The opportunity cost to the incumbent of competitive entry should not be compensation borne by the entrant. It should be only the **hypothetical** opportunity cost associated with a competitive solution, not one in which monopoly rents are embedded, inter alia, in the price/cost structure. The ex post competitive result should be the consideration, not the ex ante circumstances.

If this monopoly rent is ignored in practice, then the rent would be institutionalized into the potential entrant's cost and, perhaps, would preclude entry; certainly it would not have the desired efficiency effect.[8]

2.2.2. Demand Expansion

With the ECPR, no distinction between the incumbent's market loss to the rival and the market gained by the rival's own initiative is made. Namely, if new traffic is generated by the rival, it should not have to pay to the incumbent the opportunity cost for this additional traffic. This is not an easy undertaking; the difficulty is separating the new traffic from old traffic that is lost by the incumbent.

2.2.3. Embedded Cross-Subsidies

Any cross-subsidies that are in the incumbent's price would be included in the opportunity cost of the incumbent, just as the monopoly rents would be included. The principal subsidy that is carried by the telephone industry is the universal service obligation, which is inappropriate in this author's opinion.

2.3. An Illustration

To be more specific, if we assume constant (marginal) unit costs, c_0, c_1, and c_2 represent the costs for each unit of traffic. A fixed cost, k, can be treated as the universal service obligation or simply as a fixed cost associated with the A - B leg.[9] If the incumbent was selling service to cover its cost, the price for the segment A - C would be $p_1 = k/Q + c_0 + c_1$, or the average fixed cost plus the unit costs for the two legs of the call where Q is the total of all the traffic.

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[7] The following is based on the review of Baumol and Sidak (Alleman, 1994).
[8] Baumol and Sidak note that this monopoly rent should be detected by the regulator, but offer no prescriptions for its detection nor elimination.
[9] This follows Laffont and Tirole (1995).

This specification shows that the price to the consumer would include a proportional share of the fixed cost k. With the assumption of a contestable market, no sunk costs, and no change in total demand, the ECPR leads to the efficient price; however, when the market is not contestable — virtually all cases in the telecommunications industry — then the economic logic of the rule falls apart.

First, if sunk costs exist, the equilibrium price is the monopoly price. Conceptually, one can think of k as including the monopoly rent, which, applying the ECPR, is passed on to the consumer after the entry of competition.

Second, suppose the new entrant expands the market beyond simply replacing the incumbent's market. That is, the new demand is Q' > Q, then the incumbent earns a return larger than before the entry of competition. This additional economic rent is (Q'-Q)(k/Q). The logic of introducing competition, inter alia, is to reduce prices and squeeze out the economic rent; but in applying the ECPR, not only do we maintain the rent, but we also increase it.

2.4. Additional Constraints

2.4.1. Contestable Market

The ECPR presented by Baumol and Sidak is based on the theory of contestability (Baumol, Panzar, and Willig, 1982), which, with no sunk cost or other entry barriers, would lead to the competitive solution of no (economic) profits. However, this theory is not robust and has been subject to serious criticism. Stiglitz has shown that even a small amount of sunk cost changes the equilibrium from that of the competitive solution to that of the monopoly solution (Shy, 1995). Clearly, in the telephone industry, to enter the market requires the occurrence of irreversible costs. Without the foundation of the theory, the desired outcome of ECPR is also left in doubt.[10]

2.4.2. No Bypass

The more serious omission of the Baumol and Sidak model is the assumption that no bypass takes place in the industry, although casual empiricism demonstrates that the telecommunications industry can and does bypass the exchange carriers. For example, Metropolitan Fiber Systems (MFS) is one of many (and probably the best known in the United States) alternative access providers whose entire business is built on bypassing the exchange carriers.

Cellular mobile telephone service is another form of bypass of the network, although these firms must interconnect with the PSTN to be economically viable.

2.4.3. Linear Prices

Within the context of the Baumol and Sidak model, nonlinear prices are not accounted for, only linear prices. Thus, volume discounts, multipart tariffs, and declining block tariffs, which can improve economic efficiency (Brown and Sibley, 1986), are not taken into account.

[10] Technically, the fixed production coefficients assumption embedded in the Baumol and Sidak (1994a) model presents problems. See Armstrong, Doyle, and Vickers (1994).

3. MODELS

3.1. Overview

This section is designed to report the results of two groups of researchers on the interconnection issue. The first group is composed of Jean-Jacque Laffont and Jean Tirole in France. The second group is composed of Mark Armstrong, Chris Doyle, and John Vickers in the United Kingdom. These individuals have analyzed the access/interconnection issue in great detail. In this section, at the risk of presenting too simple a characterization, we will summarize their results.[11]

The French group generally assumes that the regulatory authority can determine the price structure; therefore, their analysis of the issue is based on the optimization of economic efficiency. This leads to first- and second-best approaches to the price structure, namely marginal-cost pricing and Ramsey-Boiteux pricing models. The UK group expands the models to examine interconnection prices in the context of imperfections in the pricing policy and more realistic cost and demand specification than the contestability model. That is, if the regulators set a nonoptimal retail price, what are the consequences for the optimal interconnection price? Both groups note that the ECPR demands just as much information as Ramsey pricing when the contestability assumption is relaxed.[12] But their principal contribution is to point out the deficiencies in cost-based pricing approaches such as the ECPR, and to indicate the correct approach to the access pricing.

3.2. Optimal Pricing

Before reviewing these models, we address the issue of economic efficiency.

Economic efficiency is maximized when prices are set at marginal cost.[13] However, this "first-best" pricing is not sustainable with a production function with increasing returns to scale and economies of scope, since the total cost for the firm will not be covered. Thus, the economists have turned to the notion of "second-best" pricing, where the idea is to keep the firm whole — that is, still covering all of the costs of the firm — while at the same time maximizing consumers' surplus. This can be approached as a Lagrangean multiplier problem whose solution, in general, is to mark up the price of the outputs inversely proportional to the respective demand elasticities. Thus, the inelastic products are price proportional more than its product-specific marginal cost than those outputs that are more elastic. The intuition of this approach is that by overpricing the more inelastic products, less of the consumers' surplus is lost.

If demands are independent,

$$[p_i - (\partial c_i / \partial q_i)]/p_i = [(1 + \lambda)/\lambda]\ (1/\eta_i)$$

[11] The series of works by the authors includes Laffont and Tirole (1994 and 1995), Armstrong and Doyle (1995), Armstrong and Vickers (1993 and 1995), Vickers and Armstrong, and Doyle and Vickers (1996). The latter work summarizes much of their previous work on this issue.

[12] Ralph (1995) has developed an approach that, with the loss of some economic efficiency, shows the access charge can be set on a minimum of information.

[13] See Brown and Sibley (1986), for example.

for all *i, i* = 1,...n, where p_i is price, $\partial c_i / \partial q_i$ is the product specific marginal cost, η_i is the demand elasticity of the *i*th. Output and λ is the shadow price of the budget constraint. The λ is adjusted until the equality holds.[14]

It is on the basis of this formulation that the optimal price structure can be determined for a regulated industry. However, the Ramsey prices cannot be easily determined in a straightforward manner, even in the simple case of independent demand functions.[15] For this and other reasons, regulators turn to the fully distributed cost (FDC) methods discussed below.

3.3. Laffont and Tirole

We can gain insight into the nature of the problems by continuing the stylized model. The Laffont and Tirole (1995) benchmark model assumes no distortions, no bypass, no entry costs, and no market power on the part of the entrant.

One can define the level of traffic on the different segments as q_i for i = 0, 1, and 2 using the model characterized by Figure 1. Where:

q_0:		incumbent's bottleneck service
q_1:		incumbent's competitive services
q_2:		entrant's competitive services
Q	=	$q_0 + q_1 + q_2$.

The costs are, as before,

k	=	fixed cost (access deficit)
c_0, c_1, c_2:		average incremental costs [and product specific (constant) marginal cost].

Defining the prices as:

a:	access
p_0:	exchange
p_1:	incumbents toll
p_2:	competitive toll,

The first-best prices are equal to the respective marginal costs, namely:

$p_0 = c_0$
$p_1 = c_0 + c_1$
$p_2 = c_0 + c_2$
$a = k$,

[14] To overcome this and other difficulties, Baumol and Sidak (1994a) invoked the theory of perfectly contestable markets in their book and developed the ECPR in this context. Contestability requires only the cost side to be known, although at a great sacrifice to reality.

[15] Because of the knowledge required to calculate Ramsey prices, it has been termed informationally demanding.

where the fixed costs or access deficit is recovered via state funds. This result is consistent with classical solution, and gives a benchmark to be compared with the ECPR.

Application of the ECPR upon entry requires that $a = c_0 + (p_1 - c_0 - c_1) = (p_1 - c_1)$, the marginal cost of the bottleneck facility plus the opportunity cost of the lost competitive market.

Laffont and Tirole (1995) examine various specifications of this model and note that the access charge, a, can be above or below the ECPR when demands are different or costs differ. In particular, if the incumbent has captive customers, which allows it to have a higher price than the entrant (i.e., $p_1 > p_2$), or if the firm's cost differences are $c_1 > c_2$, then the optimal access charge is below the ECPR, $a < (p_1 - c_1)$. If the cost difference is reversed, the reverse holds.

3.4. Armstrong/Doyle/Vickers

Armstrong, Doyle, and Vickers relax the assumptions of no bypass, homogeneous products, and substitution possibilities. Using an expanded definition of opportunity cost, they show that the opportunity cost is **lower** than the benchmark case as stated above. Thus, while that the opportunity cost should be considered in the determination of access prices, this cost is not determined in the simple fashion characterized by the ECPR under contestability conditions; but it includes or is dependent on the demand and cost elasticities. Indeed, Armstrong et al. (1996) go beyond this and show that ". . . when the access charge and the retail price are chosen optimally, the access charge should . . . be greater than implied by the ECPR" but ". . . lower than the charge set by the incumbent when free to set its own access charge . . ." (p. 11).

3.5. Full Distributed Costs

Pricing decisions are the raison d'être of the regulatory community. The stylized model allows us to examine and critique these decisions.

The regulatory community commonly uses a fully distributed or allocated cost standard. Although this is a common solution to cost allocation problems, economists have objected to it because of its arbitrariness (e.g., Cole, 1981, and Brown and Sibley, 1986). In the above model, one fully distributed cost is to add a markup to the long-run incremental cost. Thus, before competition, the incumbent firm, pricing to cover cost, would be:

$$p_0 = c_0 + k/Q$$
$$p_1 = c_0 + c_1 + k/Q.$$

After entry, this formula would be modified to include the access charge:

$$p_0 = c_0 + k/Q$$
$$p_1 = c_0 + c_1 + k/Q$$
$$p_2 = c_0 + (k/Q) + c_2 \quad \text{or}$$
$$p_2 = a + c_2$$
$$a = c_0 + (k/Q).$$

In this case the ECPR is satisfied.

Another FDC method is a proportional increase in prices over costs (Allais rule):

$$p_0 = c_0 (1 + \delta)$$
$$p_1 = (c_0 + c_1)(1 + \delta)$$
$$p_2 = c_0 (1 + \delta) + c_2 \quad \text{or}$$
$$p_2 = a + c_2$$
$$a = c_0 (1 + \delta),$$

where δ is set such that it satisfies the budget constraint.

Although both methods will allocate all of the costs, as indeed an infinity of allocations will, and for this reason this method is arbitrary (Cole, 1981). In addition, because of its cost-plus structure, it lacks incentives. The method does not discriminate among the different demands for the services, thus, the inelastic segments are favored in contrast to the second-best approach of Ramsey pricing (below).

Laffont and Tirole (1995) show that under certain conditions inefficient entry may occur with these methods.

3.6. Redemption of the ECPR?

Laffont and Tirole (1995), after showing that the ECPR has severe problems in application and is wrong in many cases, nevertheless feel that the rule may be a good approximate solution because it is easier to set weights correctly based only on total demand for competitive services. Also, the potential for predatory pricing is reduced since p_1 and a are linked. Only with an increase in p_1 can predation occur, but this can be controlled with the regulation of the level of p_1.

3.7. Regulatory Implementations/Applications

3.7.1. Australia

With this structure, the implementation of interconnection prices can be examined. In Australia, long-run incremental costs (LRIC) of the exchange service are used, namely, $a = c_0$. None of the overhead or fixed charges are covered.

3.7.2. California and New Zealand

In California and New Zealand, the efficient-component pricing rule is applied unequivocally — with little or no regard to the retail price of the incumbent's service, p_1. Thus, the access charge is equal to the incremental cost plus opportunity costs, i.e.,

$$a = (p_1 - c_1) = c_0 + (p_1 - c_0 - c_1).$$

Even if one could determine the incremental cost, it is clear that the access price, a, depends on p_1, but, how is p_1 set? For example, does it exclude monopoly rents? In the case of New Zealand, no regard to the retail price of the incumbent's service is considered. In California, there is a partial price cap for the control of the retail price, p_1. Laffont and Tirole (1995), have shown that this can distort both the retail and access price as discussed below.

3.7.3. United Kingdom

In the UK, the regulatory authority, the Office of Telecommunications (OFTEL), follows markup of the service's (economic) profits to determine the access charge under a (partial) price cap regulation.

The "tax" or markup on profits in each segment is (using the previous notation):

$$\pi_0 = (p_0 - c_0)q_0$$
$$\pi_1 = (p_1 - c_0 - c_1)q_1$$
$$\pi_2 = (a - c_0)q_2, \qquad \text{(profit from entrant)}$$

$$a = p_1 - c_0 - c_1$$
$$a = c_0 + (k/q_1)(\pi_1/(\pi_0+\pi_1+\pi_2)) = c_0 + (k/(\pi_0+\pi_1+\pi_2))(p_1 - c_0 - c_1).$$

Thus, the access charge is proportional to the fixed charge, k (or access deficit), and, as in the previous cases, on the retail price of the incumbent's competitive service. If the incumbent satisfies the zero profit constraint, the practice is equivalent to the ECPR, since $k/(\pi_0+\pi_1+\pi_2)$ would equal one.

The question remains as to how the retail price is set. Is this rule better than other methods?

3.8. Global Price Caps Optimal Regulation (Ramsey-Boiteux):

In the above cases, the access charge is determined from the cost-side without reference to the optimal prices — both input and output prices. Laffont and Tirole (1995) approach the problem by asking what the optimal price structure is for all of the prices, which they term a "global price cap." The difference from most regulatory regimes is that the access charge is also included in the price cap.

If the weights are set proportional to anticipated outputs, the firm will select the Ramsey optimal rate structure. Whereas, if the access charge is not included in the price cap, the incumbent will not internalize the loss of consumers' surplus resulting from the increase in the competitive price and, hence, the access charge. Laffont and Tirole note that ECPR is wrong unless the demands and costs are symmetrical, but in cases of symmetrical demands, the ECPR is redundant since the incumbent firm would choose this access charge as part of its optimization. This casts doubt on the wisdom of the OFTEL method, as well as the other regulatory practices presented here.

The global price cap is similar to other Ramsey solutions. In particular:

$$(p_0 - c_0)/p_0 = [(1 + \lambda)/\lambda](1/\eta_0)$$
$$(p_1 - c_0 - c_1)/p_1 = [(1 + \lambda)/\lambda](1/\eta_1)$$
$$(p_2 - c_0 - c_2)/p_2 = [(1 + \lambda)/\lambda](1/\eta_2).$$

Where, as before, λ is the shadow price of the budget constraint; the ηs in this case represent "superelasticities," which account for the relationship among the outputs.

$a = p_1 - c_1$, by assumption, implies
$$a = c_0 + [(1 + \lambda)/\lambda]/(p_2/\eta_2).$$

The optimal access price is dependent on usage and contributes to the access deficit, but as indicated earlier, it does not necessarily comport with the ECPR. Moreover, Laffont and Tirole have shown that the partial price cap method, such as used by OFTEL , can lead to too high of a retail price, p_1, and too low a price, p_0.

4. APPLICATION TO THE TELEPHONE INDUSTRY

There are two interpretations of the Baumol/Sidak model of the analysis.[16] Under one interpretation, the model does not comport with the stylized model of the exchange telephone service. The intermediate product that Baumol and Sidak (1994a, 1994b), and Willig (1979), address is based on the flow of traffic over the network, not on the subscriber's access to the network, i.e., it does not address the subscriber's loop (or only indirectly addresses it as a given "common cost" parameter).

Under the alternative interpretation, the model does address this loop issue. The cost of the loop is sunk, and so long as excess capacity exists, it has zero opportunity cost. Thus, It suggests that the cost to the rival of the subscriber's access is zero.

The ECPR does not address the question of what the rule would be with the addition of a new type of access for subscribers that is functionally equivalent to loop access such as cellular service. How would the addition of another subscriber line be handled? It is not clear that the answer is addressed by the Baumol/Willig pricing rule.

4.1. The Loop

In the telephone industry, most of the costs are embedded in the subscriber's loop, and only a small portion of the costs are traffic sensitive. With the appropriate definition of service, the results would be significantly different (Alleman, 1994 and 1976). If the subscriber were responsible for the entire cost of the subscriber loop, rather than it being apportioned among the services as an intermediate product, then much of the above problem would disappear.[17] Certainly, the arguments as to the magnitude of the efficient-component price rule would not be as shrill, since the efficient-component price would be significantly less and, therefore, error would not be as serious.

If the interpretation of efficient-component price rule is that the rival carriers are charged both the AIC of the exchange traffic delivered and the AIC of the subscribers loop and its associated carrying cost, then to apply the above rule in this fashion is not correct.

Currently, subscribers are not receiving the correct price signals, which equate the economic cost they generate with the prices they are charged. That is, the subscriber's loop represents a fixed cost, which one interpretation (an incorrect one in this reviewer's opinion) of the above

[16] The authors of the ECPR failed to specify the ECPR mathematically. It has been left to others to interpret the rule mathematically.
[17] Schechter (1996) has suggested that the customers purchase their own loop.

solution would address with a variable price on the rival. This has been the continuous error made in the proposed solutions to the "local" loop problem.[18]

4.2. Inefficiencies in the Incumbent/X-inefficiency

Although no recent study has examined efficiency of the telephone companies, the recent casual empiricism suggests that these companies have not been efficient, least-cost providers. However, one of the key assumptions of the ECPR is that the incumbent is a cost-efficient provider of its products or services.

In the United States we have observed the tremendous downsizing of the Regional Bell Operating Companies and GTE. In the face of potential competition, these companies have downsized their labor force by 20-25% in the last decade. AT&T has also reduced its labor force substantially since divestiture.

In the United Kingdom, British Telecom has had similar downsizing and tremendous profit improvements since it has been privatized and deregulated.

The most striking example has been the reduction in the labor force of the New Zealand Telephone company, which went from 27,000 to 9,000 employees after being privatized with no regulation — a loss of two-thirds of its labor force.

Thus, the assumption of a cost-efficient incumbent comes into serious question in the telephone industry. Considering that the ECPR is calculated as a residual, these inefficiencies become embedded in the intermediate price, which the rivals must pay.

4.3. Universal Service Obligation

The universal service obligation's inclusion in the opportunity cost in determining the "proper" interconnection price will create a large distortion in the pricing of interconnection. Stated differently, no matter how erroneous the interconnection price is methodologically, it is further distorted by the size of the subsidy that must be included. Elimination of this in the calculation of the interconnection price will reduce substantially any inefficiencies due to the incorrect interconnection price, certeris paribus.

5. SUMMARY

5.1. Ease of Implementation

For the reason already discussed, the ECPR pricing approach has a simplicity that belies the omissions or difficulties of implementing the proposal in the industry; these include the following:

- Monopoly rents are not easily eliminated from the opportunity costs in the calculation of the efficient component prices.

[18] See Alleman (1976) and Alleman, Beauvais, Cole, and Stolleman (1986) and, more recently, Mitchell and Vogelsang (1991).

- There is no easy distinction between the traffic replaced by the competitor versus new traffic developed by the competitor.

- New substitutes and complementary services are not addressed in the methodology.

- Only the pricing of traffic to the rival is addressed, not the total pricing methodology for the exchange carrier.

- Ensuring that the telephone subscribers receive the correct pricing signals is not addressed.

5.2. ECPR

We have demonstrated that the ECPR has serious problems. The simplicity of the approach, which is stated as its advantage, hides other faults, including:

- Monopoly rents may be embedded in the price.
- The total pricing methodology is undetermined.
- No allowance is made for demand expansion.
- New substitutes and complementary services are not addressed.
- Cross-subsidies may be embedded in the price.

What the work of access pricing has shown is that no simple solution to the problem exists. Cost-based pricing is incorrect and that usage must be considered in determining the interconnection charge. The ECPR is not simple to determine when the contestability assumption is relaxed. Indeed, while the ECPR is a useful benchmark according to Armstrong, Doyle, and Vickers (1996) since it can be incorporated into the analysis of the optimal price, it demands as much information as the Ramsey model.

The marginal costs, demand, and cross-elasticities are required to set the optimal price structure. The treatment of the intermediate good's price as one of the prices to optimize final goods, as in the global price-caps developed by Laffont and Tirole (1995), offers useful insights into the issues. It exhibits the distortions introduced by partial price-caps.

This is not to say that all life's problems are solved if we use global price cap. The traditional regulatory problems remain — the information asymmetries between the regulatory commission and the firm, and the danger that the commission can be "captured" by the firm it is charged with regulating. The models have not examined the dynamic aspects of the these methods.

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