# 불완전 정보하에서 접속료의 최적규제에 관한 연구

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# An Incentive Regulation of Access Charges under Incomplete Information

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요 약

이 논문은 통신서비스의 소매가격과 접속료에 대한 유인적 규제제도를 제안한다. 이러한 유인적 규제제도는 병목설비를 가지고 있는 독점적 사업자로 하여금 자발적으로 사회적으로 최적인 접속과 소매서비스를 제공하게 한다. 중간투입 설비를 가진 상류기업은 이부제 요금을 통해, 전체 통합이윤을 실현할 수 있다는 것은 잘 알려진 사실이다. 이 논문은 첫째, 규제기업의 수지보전(budget balancing)과 관련하여 접속료와 소매요금 등을 규제하는 규제프레임워크를 제시한다. 둘째, 접속(상류)과 소매서비스(하류) 모두에서 이부제 요금제도가 어떻게 적용될 수 있는가를 소개하고, 비용함수에 대해 규제자가 불완전한 정보를 가지고 있는 경우, 유인적 규제제도의 적용가능성과 그 효과를 분석하고 있다. 셋째, 자기선택 제도를 사용하여, 접속과 소매부문에서 어떻게 사회적 최적인 상태가 도달되는지를 보여준다.

**Key Words :** Incentive regulation, Access charge, Incomplete information

ABSTRACT

This paper considers an incentive regulation in the telecommunications industry with respect to the sale of retail and access services. This regulation scheme induces the monopoly carrier who owns bottleneck facilities to adopt socially optimal outcomes when providing access and retail services. It is well known that upstream carriers can realize an integrated level of profit, without integration, by means of a two-part tariff. First, this paper introduces a framework for regulating an access and retail price combined with budget balancing. Second, this paper introduces two-part tariff (price discrimination) scheme for both access (upstream) and retail (downstream) services and discusses the resulting implications for incentive regulation when the regulator has incomplete information about cost functions. By imposing a self-selection mechanism, the regulator can induce firms to adopt socially optimal prices in both access and retail markets.

## Ⅰ. Introduction

Access charges have been a hot topic among telecommunications operators because they relate tocompetition in retail markets where providers use access to complete their services. In addition, as the interconnection among carriers has become more complex, there have been many disputes over which elements should be included in net-work costs for the purposes of calculating access

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charges. The regulator requires much information about the cost structure of regulated firms, if it is to simultaneously recover the investment cost and avoid giving excess profits to the firm. Therefore, an incentive regulation scheme that requires less information about cost and demand functions and gives more flexibility to the firm would be desirable.

There are two types of interconnection that have been modeled: one-way interconnection and two-way interconnection. One-way interconnection means interconnection between networks possessing subscribers (i.e., local networks) and networks possessing no subscribers (i.e., long distance networks). On the other hand, two-way interconnection means interconnection between networks with subscribers (i.e., between local and mobile networks).This paper deals with one-way interconnection. Armstrong, Dole, and Vickers (1996) providesgood insight into one-way interconnection by explaining the long-run increment cost (LRIC) condition and the ECPR (Efficient Component Pricing Rule). ECPR means that the access charge is equal to the opportunity cost of the retail service, plus the marginal cost of providing the access service. The ADV model suggests that the retail service price and access charge that maximize social welfare are equal to the long-run increment cost (LRIC) of each service. In addition, this model suggests that the optimal access charge for maximizing social welfare follows the ECPR, when the retail service price is externally given. The former, LRIC, results when the regulator sets both the retail service price and the access charge, and knows the cost of the carrier and the demand function of the consumers. The latter, ECPR, results when the regulator determines only the access charge (this assumes that the retail service price is already given). However, if the retail service price differs from the cost of the carrier, either because the regulator incorrectly estimates this cost, or because of the presence of political influences on the regulation of the telecommunications industry (i.e., universal service), then the ECPR may be a weak solution, in that it may guarantee excess profits to the monopoly carrier.

Unfortunately, the regulator does not possess full information aboutthe cost function or the demand function of the consumers. The classic study on access charge regulation with information asymmetry between the regulator and a monopolist is that of Laffont and Tirole (1994). Under the L-T scheme, the regulator determinesa uniform retail price and a uniform access charge by means of a truth-revelation mechanism. In contrast, this paper introduces a two-part tariff on retail and access services, but allows the regulated firm to set prices on its own.

Models of access charge regulation are usually based on a uniform pricing system. However, Valletti (1998) has also introduced a two-part access pricing system. This model suggests that access charges should be set not by the monopoly carrier but by the regulator. In such a case, the regulator must have information about the cost and demand functions. However, if the monopoly carrier were allowed, instead, to determine its own price, such information would not be necessary.

This paper first surveys the earlier studies about regulation of access charge and retail price in the respect of budget balancing and regulatory options (only access charge regulation or both access charge and retail price regulation). Second, the present paper proposes an incentive regulation system that induces the monopoly carrier to adopt the socially optimal prices with respect to retail and access services, and compares this scheme with the earlier studies. Third, the some implications on the incentive regulations are discussed. Fourth, the effects of anticipation of the regulatory scheme are discussed. Finally, this paper summaries and concludes.

## Ⅱ. The literature surveys

### 2.1 The regulatory framework and basic model

We can get the regulatory framework based on two dimensions of budget balancing and regulatory options (only access charge regulation or both access charge and retail price regulation). This means that the regulator must consider the budget balancing as well as the optimality. The budget balancing means that the incumbent providing access service recovers the investment cost through the retail price in excess of the marginal cost when the incumbent has an increasing returns technology. This assumes that the incumbent will not make a loss with the access charge. However, if this access charge does result in a loss, the optimal access charge will be the lowest charge that allows the incumbent to break even. On the other hand, the regulator can handle the access charge or both access charge and the retail price. This framework can be summarized as in Table 1.

Table 1. The regulatory frame work

| | Budget Balancing | No Budget Balancing |
|---|---|---|
| Access Charge Regulation | I | II |
| Both Regulation | III | IV |

The typical study of type I is the basic model of Armstrong et al (1996). Armstrong et al (1996) examined the access pricing problem in a model where the retail price of the dominant firm is fixed by previous regulation (for example, cross subsidy guaranteeing budget balancing because of universal service). They investigated this problem with the break-even constraint of the incumbent access provider and analyzed what is meant by the incumbents' "opportunity cost of access" in more general circumstance. They found that optimal access prices can be characterized in terms of "marginal cost plus the opportunity cost" (ECPR) when the incumbent's retail price is taken as given.

The study of Armstrong and Vickers (1998) constitutes the type II. They extend the first model (type I) to introduce the retail price deregulation. This paper shows that the optimal access charge may be above, below, or equal to marginal cost when this is the only instrument of regulation.

The type III is relevant with Ramsey pricing rule. This describes the welfare-maximizing form of pricing for the incumbents products (including access), subject to a break-even constraint for the incumbent. Finally, type IV means a first best optimality. The access charge and retail price areset equal to marginal cost, respectively. However, type IV is not easy to design and operate a regulation scheme. The present paper proposes a regulation corresponding to type IV. We reuse the basic model of Armstrong et al (1996) to compare the first three models with our proposed regulatory scheme.

Suppose that there are potentially two firms in an industry that produces a single final product: an incumbent and an entrant (alternatively, a competitive fringe). The supply of a vital input, which we call access, is assumed to be fixed as a result of a natural monopoly; for instance, this input may be monopolized by the incumbent firm. Let $C(r,z)$ be the cost incurred by the incumbent firm (monopolist) when it supplies $r$ units of the final product to consumers and $z$ units of access to the entrant. Thus, $C_2$ is the monopolist's marginal cost of providing access to the entrant, and $C_1$ is the monopolist's marginal cost of providing the final product to consumers. The entrant requires one unit of access from the monopolist for each unit of the final product that it supplies itself. Suppose that, when the entrant has $q$ units of access, it incurs an additional cost $c(q)$ to supply $q$ units of the final product. Its marginal cost is denoted by $c'$. Uniform access pricing is assumed, and the access charge per unit for this input is denoted by $a$.

### 2.2 Access charge regulation with budget balancing (type I)

Under the basic model of Armstrong et al. (1996), the entrant is assumed to take the incumbent's price as given because the entrant is a competitive fringe. This assumption is not critical to drive our conclusions. Our main results are not affected even if the assumption is relaxed to introduce product differentiation. The incumbent's price for the final product is $P$ (the price of the competing service is fixed by the regulator), and the firm must supply all residual consumer demand at this price, as well as all of the entrant's demand for access. It is assumed that conditions in the industry are such that $q < X(P)$, where $X(P)$ is the consumer demand curve for the final product. Since the entrant is a price-taker, its maximum possible profit given the available margin $m = P - a$ is

$$\pi(m) = \max : mq - c(q) \qquad (1)$$

If $q(m)$ is the profit-maximizing supply of final product by the entrant, we get the following relation.

$$\pi'(m) = q(m) \qquad (2)$$

From the second-order condition $(c'' > 0)$ and (2), the entrant's supply function $q$ is increasing in the margin $m$. The incumbent's profit with the final price $P$ and margin $m$ is

$$\Pi(P, m) \equiv PX(P) - mq(m) - C(X(P) - q(m), q(m)).$$

Consumer surplus is $v(P)$, where $v'(P) = -X(P)$. Then, total welfare, unweighted sum of consumer and total industry profits is

$$W(P, m) = v(P) + \pi(m) + \Pi(P, m).$$

Since the price for the final product , $P$ is fixed by regulation, the optimal access charge is given by the following.

$$a = C_2 + (P - C_1) \qquad (3)$$

This optimal access charge is consistent with ECPR expression (direct cost of providing access + opportunity cost of providing access). Here, the opportunity cost is defined to be the reduction in dominant firm's profit caused by the provision of access, and so the access charge exceeds the direct marginal cost of access. There are many disputes over ECPR because the level of access charge depends on the retail price regulated. Irrespective of the validity about ECPR, this type of regulation does not guarantee the first-best outcome.

### 2.3 Access charge regulation without budget balancing (type II)

Armstrong and Vickers (1998) extends the analysis of Armstrong, Doyle and Vickers (1996) to the case of price deregulation. This paper shows that marginal cost pricing of access is found to be optimal in some circumstances, and more generally it is shown to be ambiguous whether access should be priced above or below marginal cost. The basic model and the notations are analogous to ADV (1996) except for the retail price deregulation. The access price is chosen to maximize social welfare subject to the facts that, with its final product price unregulated, the incumbent chooses $P$ to maximize $\Pi$ given $a$. The first-order condition for that latter choice is that

$$\Pi_P + \Pi_m = (X - q) + (P - C_1)X' - [m - (C_1 - C_2)]q' = 0 \qquad (4)$$

Equation (4) implicitly defines the incumbent's optimal price $P(a)$ as a function of $a$. Total differentiation of (4) implies that

$$P'(a) = \frac{\Pi_{mm}}{\Pi_{mm} + \Pi_{PP}} = \frac{1}{1 + \dfrac{-2X' - (P - C_1)X''}{2q' + [m - (C_1 - C_2)]q''}}.$$

Given that $\Pi_{mm} < 0$ and $\Pi_{PP} < 0$, we have $0 < P' < 1$, so while $P$ increase with $a$.

The optimal access price $a$ is given by the first order condition of the maximization of $W$

$$m - (C_1 - C_2) = \frac{(X - q)}{q'} P' > 0 \qquad (5)$$

From (3) and (4), it follows that

$$\frac{P-C_1}{P}=\frac{(X-q)}{-PX'}(1-P')>0$$
$$(a-C_2)(1-P')=(P-C_1)\left[1-\frac{(q'-X')}{q'}P'\right]. \qquad (6)$$

As the paper shows, there are two sources of efficiency. One is allocative inefficiency ($P$) for standard monopoly reasons, and the other is productive inefficiency ($m$) for rival's excess share of output. The two objectives of allocative and productive efficiency cannot both be attained by the single instrument of the access price, simultaneously.

### 2.4 Both access charge and final price regulation with budget balancing (type III)

The model of Type III corresponds to a standard Ramey optimality. This is a welfare-maximizing form a pricing for the incumbent's products (including access), subject to a break-even constraint for the incumbent. If we write $\lambda \geq 0$ as the multiplier for the constraint $\Pi \geq 0$, then the first order conditions for optimal retail price $P$ and margin $m$ respectively are

$$\frac{P-C_1}{P}=\frac{\lambda}{1+\lambda}\frac{1}{\varepsilon_X} \qquad (7)$$
$$\frac{m-(C_1-C_2)}{m}=-\frac{\lambda}{1+\lambda}\frac{1}{\varepsilon_q} \qquad (8)$$

Where $\varepsilon_X=-(P/X)(dX/dP)>0$ is the elasticity of demand for the final product, and $\varepsilon_q=(m/q)(dq/dm)>0$ is the entrant's elasticity of supply with respect to the margin $m$. This is not the first-best access pricing policy because if the incumbent has an increasing returns technology then the incumbent's break-even constraint will bind at the social optimum. In such cases, $\lambda>0$ and the Lerner index for each product is positive. In particular

$$a>C_2$$
$$P>C_1 \qquad (9)$$

Now, we have a following Proposition from (3), (6), and (9).

**Proposition 1.**

a) *The first-best outcome is not attained by the single instrument of access price irrespective of budget balancing requirement. (type I and type II)*
b) *The first-best outcome is not attained by both instrument access and retail price when the incumbent has an increasing returns technology and needs the budget balancing. (type III)*
c) *The second-best outcome will not be reached when the regulator has no information about cost conditions.(type I, II and III)*

The proof is straightforward and omitted. The regulation of type I, II and III assumes that the regulator has a complete information about cost and demand function. However, this is not realistic. If it is not the case, it is not possible to reach a even second-best outcome. The present paper proposes type IV regulatory model. This model can induce the first-best outcome without budget balancing and with incomplete information by both access and retail price regulation.

## Ⅲ. Optimal incentive regulation (type IV)

So far, we have discussed the regulatory framework with four types of model. From now on, we will introduce an incentive regulatory scheme that induces the monopoly carrier to adopt socially optimal prices and leave some surplus to both the competitor and the user. Consider the following regulation system for dealing with this situation.

The regulator announces his intention at the beginning of Period 1 and imposes a regulatory scheme on the incumbent. When regulating the incumbent, the regulator suffers from incomplete information: he has no information about the incumbent's cost conditions. It is assumed that the incumbent collects the information about the consumers easily through the consumers' behaviors survey.However, we assume that the regulator can observe total expenditures of the incumbent and the menu offered for consumers and the competitor (with a lag of one period). Also, it is assumed that the incumbent has knowledge of the demand functions of the consumers and cost structure of the entrant. At the moment, we will assume that the menu offered by the incumbent in period 0 is the one found in the ordinary pricing before this regulation is introduced.

Now, consider the following multi-period regulatory scheme. First, in period 1, the regulator allows the incumbent to practice price discrimination for both the competitor and the consumer by means of a two-part tariff. That is, the incumbent offers the menu $(P^t, T_i^{t,2})$ to the consumer and $(a^t, T^{t,1})$ to the competitor, which he determines completely at will in period $t$. At the same time, the regulator forces the incumbent to continue to offer an uniform price to the competitor and the consumer. Namely, it is mandatory for the incumbent to offer the uniform pricing menu $(P^{t-1}, 0)$ to the consumer and the uniform pricing menu $(a^{t-1}, 0)$ to the competitor. Second, the regulator levies a tax of $\Pi^{t-1}$ that he earned in the previous period. The total amount of the lump-sum fee charged by the competitor will be in proportion to the quantity that it provides since users are assumed to have identical demand functions. The lump-sum revenue $T_{-q}^{t,2}$ gained by the monopolist from basic charges is as follows:

$$T_{-q}^{t,2} = (1 - \frac{q^t}{X^t}) \sum T_i^{t,2} .$$

Letting $\beta$ be the discount factor, the incumbent's profit maximization problem over an infinite horizon under the regulation is written as:

$$Max \sum_{t=1}^{\infty} \beta^{t-1} \left\{ \Pi^t + T^{t,1} + (1 - \frac{q^t}{X^t}) - \Pi^{t-1} \right\} \quad (10)$$

$s.t.$

$$\frac{q^t}{X^t} \sum T_i^{t,2} + (P^t - a^t) q(P^t, a^t) - c(q(P^t, a^t)) - T^{t,1} \geq 0$$
$$\frac{q^t}{X^t} \sum T_i^{t,2} + (P^t - a^t) q(P^t, a^t) - c(q(P^t, a^t)) - T^{t,1} \geq \pi^{t-1}$$
$$v_i(P^t) - T_i^{t,2} \geq 0$$
$$v_i(P^t) - T_i^{t,2} \geq v_i(P^{t-1})$$

where $\Pi^t, \pi^t$ is the profit that the incumbent and competitor earn through the uniform pricing, respectively. That is,

$$\Pi^t = P^t X(P^t) - (P^t - a^t) q^t (P^t, a^t) - C(X^t(P^t) - q^t(P^t, a^t), q^t(P^t, a^t))$$
$$\pi^t = (P^t - a^t) q^t (P^t, a^t) - c(q^t)$$
$$\pi^{t-1} = (P^{t-1} - a^{t-1}) q^{t-1} (P^{t-1}, a^{t-1}) - c(q^{t-1}).$$

The first and third constraints are the usual individual rationality (IR) constraints of the competitor and the consumer, respectively. Similarly, the second andfourth constraints are, also IR constraints of the competitor and the consumer which are newly introduced by regulation. We have the following proposition.

**Proposition 2.** *The present regulatory scheme will:*

(a) *induce the incumbent to provide the socially optimal access charge and retail price in every period (* $P^t = C_1$, $a^t = C_2$ $t = 1, ..., \infty$*);*

(b) *allow consumers and the competitor a positive net surplus*

$$\begin{pmatrix} T^{t,1} = (P^t - a^t) q^t (P^t, a^t) - c(q^t(P^t, a^t)) + \frac{q^t}{X^t} \sum T_i^{t,2} - \pi^{t-1} \\ T_i^{t,2} = v_i(P^t) - v_i(P^{t-1}) \end{pmatrix}$$

(c) *award the incumbent the positive net revenue in period 1.*

**Proof.**

It can be seen that the second and fourth constraints are binding since $\pi^{t-1} \geq 0,\ v_i(P^{t-1}) \geq 0$. We assume $\pi^{t-1} \geq 0,\ v_i(P^{t-1}) \geq 0$ since the competitor and consumer get a nonnegative surplus in initial period. Therefore, we get the following solutions:

$$T^{t,1} = (P^t - a^t)q^t(P^t, a^t) - c(q^t(P^t, a^t)) + \frac{q^t}{X^t}\sum T_i^{t,2} - \pi^{t-1}$$
$$T_i^{t,2} = v_i(P^t) - v_i(P^{t-1})$$

After substituting the binding equations into the problem of the monopoly carrier, equation (10) can be reformulated as follows:

$$\underset{P^t, a^t}{Max}$$
$$\sum_{t=1}^{\infty} \beta^{t-1}\left\{[v(P^t) + \Pi^t(P^t, a^t) + \pi^t(P^t, a^t)] - [v(P^{t-1}) + \Pi^{t-1}(P^{t-1}, a^{t-1}) + \pi^{t-1}(P^{t-1}, a^{t-1})]\right\}$$

where, $v(P^t) = \sum_i v_i(P^t)$.

We have the following first-order conditions:

$$(1-\beta)(P^t - C_1)q_1 = 0$$
$$(1-\beta)\left(a^t - C_2 - (P^t - C_1)\right)q_2 = 0.$$

From the first-order condition, the following can be obtained and the superscript $S$ denotes the socially optimal price.

$$P^t = P^s = C_1$$
$$a^t = a^s = C_2$$

This result comes from the facts that the incumbent's profit is equal to the difference between social welfare in the present period and that in the previous period. This means that the incumbent can recover his investment cost even if he has an increasing returns technology.

It can be seen that both the incumbent ($\hat{\Pi}$) and the competitor ($\hat{\pi}$) get positive profits and that consumers ($\hat{v}$) also get some surplus. The regulator ($\hat{\psi}$) also receives a tax income, $\Pi^{t-1}$ which may be positive or negative. If it is negative, the regulator gives the incumbent a subsidy. This can be shown as follows:

$$\hat{\Pi}^t = [v(P^s) + \pi(P^s, a^s) + \Pi(P^s, a^s)] - [v(P^{t-1}) + \pi^{t-1} + \Pi^{t-1}]$$
$$\hat{\pi}^t = \pi^{t-1}$$
$$\hat{v} = v(P^{t-1})$$
$$\hat{\psi} = \Pi^{t-1}$$

(Q.E.D.)

So far, we have proposed an incentive regulatory mechanism that induces the incumbent to adopt socially optimal prices in both the retail service and access markets when the regulator has incomplete information about cost. Most regulatory mechanisms concerning access charges require information about the cost of the regulated firm. However, thescheme considered here does not require such perfect information, as a result of the two-part pricing scheme employed, and guarantees some surplus to all players because of the form of the menu and tax scheme.

Nevertheless, there are two potential problems with this proposed tax scheme. First, the regulator needs information about the cost and price in previous period, though not in the present period. This might cause the monopolist to misreport its cost information. Second, the monopolist might make excessive expenditures, since it then may be compensated for these expenses via taxation. This behavior might occur if the additional net benefit from such abuse is large enough.

The first potential problem can be resolved by assuming that the regulator, in any given period, can perfectly observe the cost and price in at least the previous period. In fact, this assumption is frequently made in the incentive regulation literature such as Sappington and Sibley (1988), and Sibley (1989). Furthermore, even if theregulator cannot recover all of this information, the fact that the incumbent will nonetheless charge the optimal retail price and access charge is not influenced. The second potential problem is only likely to arise if the benefit to the monopolist from abusing the system is higher than the net loss from increased expenditures in a given period and compensation in the next period.

## Ⅳ. Anticipation of the present regulatory scheme

In this section, we will discuss the effects of anticipation of the present regulatory scheme. The menu offered by the incumbent in period 0 (when no regulation is introduced) will vary depending on whether or not the incumbent anticipates a new regulatory scheme in period 1. At the moment, we will assume that the menu offered by the incumbent in period 0 is one found in ADV (1996) model. Suppose that in period 0 the incumbent anticipates the proposed scheme is going to be implemented in the next period. Then, knowing that the prices choice in period 0 affect the profits in period 1 and further that it is in his interests to offer socially optimal prices after period 1 onward, the incumbent will choose $\widetilde{P}^0, \widetilde{a}^0$ that maximize the discounted sum of profits from period 0 to period 1. The incumbent's problem is

$$\underset{\widetilde{P}^0, \widetilde{a}^0}{Max} \left\{\Pi^0(\widetilde{P}^0,\widetilde{a}^0)+\beta\left([v(P^s)+\Pi^1(P^s,a^s)+\pi^1(P^s,a^s)]-[v(\widetilde{P}^0)+\Pi^0(\widetilde{P}^0,\widetilde{a}^0)+\pi^0(\widetilde{P}^0,\widetilde{a}^0)]\right)\right\}$$

The first-order conditions are

$$\Pi_1^0(\widetilde{P}^0,\widetilde{a}^0)-\beta[v'(\widetilde{P}^0)+\pi_1(\widetilde{P}^0,\widetilde{a}^0)]=0$$
$$\Pi_2^0(\widetilde{P}^0,\widetilde{a}^0)-\beta\pi_2(\widetilde{P}^0,\widetilde{a}^0)=0 \quad .$$

From the facts that $-v'=X>q=\pi_1=-\pi_2$, we can get

$$\widetilde{P}^0 > P^0$$
$$\widetilde{a}^0 > a^0$$

This result suggests that if in period 0 the incumbent anticipates the regulatory scheme to be imposed in the next period, he raises the prices for higher profits in period 1 that compensate more than a reduction in period 1. This strategic behavior, therefore, loads to short-term welfare losses. In view of the long-term welfare gains resulting from the social optimum realized from 1 onward, the short-term welfare loss is very small. Furthermore, from the first-order conditions, we see that the net benefits from raising the prices become smaller when the discount factor becomes lower.

## Ⅴ. Conclusion

This paper investigated the regulatory framework which the optimal retail price and access charge are determined with two dimensions on budget balancing and the regulatory instruments. In addition, this paper proposed an incentive regulation system that the regulator can employ, even if he does not have complete information about the incumbent's cost function.

This regulation system functions optimally, because the incumbent is allowed to determine the retail price and access charge at will. Furthermore, under this regulation system, the socially optimal solution is obtained, and the monopoly carrier, its competitor, and consumers can all be guaranteed surplus, as a result of the structure of the menu and tax scheme employed.

The above model can also be expanded into a heterogeneous model in which consumers do not have identical preferences for the product. Under this extension of the model, the strategic behavior of consumers, which is usually addressed in scenarios involving two-part tariff pricing, can be discussed. If the incumbent acquires information about consumers'identity from their behavior in previous periods, he can discriminate the consumers. However, if he is not able to use it to force consumers to choose the option or have no information about the identity, consumers are free to choose whatever option they want to. In this case, the incumbent wants to extract the maximum surplus from high demand consumers by preventing them switching to an option intended for low-demand consumers. Therefore, it is required that the tax element of the regulatory scheme together with a new design of menu eliminate the incumbent's incentive to charge high-demand consumers a high price for large profits. Finally, the model considered deals with one-way interconnection, but it can be extended to incorporate two-way interconnection, in which each network has individual subscribers.

## 참 고 문 헌

〔1〕 Armstrong, M., Doyle, C. and Vickers, J., 1996, 'The Access Pricing Question: A Synthesis', *Journal of Industrial Economics*', 44, pp. 131-150.

〔2〕 Armstrong, M. and Vickers, J., 1998, 'The Access Pricing Problem with Deregulation: A Note, *Journal of Industrial Economics*', 66, pp. 115-121.

〔3〕 Baumol, W. and Sidak, J. G., 1994, Toward Competition in Local Telephony, Cambridge: MIT Press.

〔4〕 Economides, N. and White, L., 1995, 'Access and Interconnection Pricing: How Efficient is the ECPR?', *Antitrust Bulletin*, 40, pp.557-579.

〔5〕 Laffont, J.-J. and Tirole, J., 1994, 'Access pricing and Competition', *European Economic Review*, 38, pp. 1673-1710

〔6〕 Laffont, J.-J. and Tirole, J., 1996, 'Creating Competition through Interconnection: Theory and Practice', *Journal of Regulatory Economics*, 10, pp.227-256.

〔7〕 Sappington, D., and D. Sibley, 1988, 'Regulating without Cost information: The Incremental Surplus Subsidy Scheme', *International Economic Review* 29, 297- 306.

〔8〕 Sibley, D., 1989, 'Asymmetric information, incentive and price-cap regulation', *RAND Journal of Economics* 20, 392-404.

〔9〕 Valletti, T., 1998, 'Two- part access pricing and imperfect competition', *Information Economics and Policy*, 10, pp.305-323.

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