NTT's Rate Rebalancing from the Viewpoint of Efficiency Prices

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Introduction

In recent years, telephone rates have been decreasing continuously in long-distance call market and increasing in pay phone, and revision of basic rate is also planned. These are due to the occurence of competition in long-distance call market and NTT providing several telephone services. The aim of this article is to examine such rate revision in view of the efficiency. The reason is that, in the arguments of NTT's rate rebalancing, the notion of efficiency is slighted and misused or proper priority is not paid to efficiency.

Most efficient (first-best) rate is equal to its marginal cost, and Kahn [1984] clarified the problems of telephone rates in the United States based on this pricing, and indicated the way to improve it. However, telephone industry necessitates enormous investment in equipment, so marginal cost pricing causes a loss to the telephone company. Then, we take up Ramsey (second-best) prices which require of each telephone company to equate its income and expenditure. The application of Ramsey pricing is usually argued on the assumption that goods (services) are mutually independent, but we remove this assumption and pay attention to more general properties of Ramsey prices.

I. NTT's rate rebalancing

NTT's financial profits and losses show that NTT has constantly made a profit in long-distance call section and losses in pay phone and directory assistance (DA) sections. The operating profit in local call section was red before 1993 fiscal year. NTT rates, then, have been criticized that they brought about cross subsidy from local call section to long-distance call section. Though the profits of long-distance call section (689.6 billion yen in 1992 fiscal year) and the losses of basic rate section and DA section (148.5 billion yen, 173.4 billion yen, respectively) are large, they have a tendency to shrink, and the local call section is in the black of 24.8 billion yen in 1992 fiscal year. The reason of the change in long-distance call section is that after

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NTT's Telephone Service Profits and Losses

(unit: a hundred million yen)

Specifications of services	1989 fiscal year				1990 fiscal year				1991 fiscal year				1992 fiscal year			
	operating revenue	operating cost	operating profit	current profit	operating revenue	operating cost	operating profit	current profit	operating revenue	operating cost	operating profit	current profit	operating revenue	operating cost	operating profit	current profit
telephone station	43,068	34,417	8,651	7,146	43,183	35,753	7,430	6,064	42,473	35,789	6,684	5,285	41,827	36,207	5,620	4,451
basic rate	10,087	11,702	-1,615	-2,159	10,527	12,426	-1,899	-2,383	10,945	12,499	-1,554	-2,031	11,283	12,768	-1,485	-1,901
local call	14,467	14,606	-139	-944	15,075	15,107	-32	-806	15,692	15,489	203	-557	16,097	15,849	248	-408
long-distance call	15,299	4,810	10,489	10,341	14,501	4,957	9,544	9,436	12,898	4,769	8,129	7,975	11,365	4,469	6,896	6,798
others	3,215	3,299	-84	-92	3,080	3,263	-183	-182	2,938	3,032	-94	-102	3,082	3,121	-39	-38
pay phone	2,621	3,036	-415	-510	3,004	3,219	-215	-300	3,149	3,297	-148	-234	3,164	3,391	-227	-297
automobile telephone	1,213	870	343	317	1,769	1,243	526	499	2,191	1,848	343	291	672	691	-19	-31
other mobile telephone	134	163	-29	-34	146	189	-43	-48	162	190	-28	-34	60	63	-3	-5
others	2,012	4,479	-2,467	-2,474	2,370	4,618	-2,248	-2,244	2,867	4,673	-1,806	-1,801	3,260	4,956	-1,696	-1,685
directory assistance	—	2,494	-2,494	-2,500	58	2,325	-2,267	-2,273	220	2,063	-1,843	-1,842	236	1,970	-1,734	-1,732
total	49,048	42,965	6,083	4,445	50,472	45,023	5,449	3,972	50,842	45,797	5,045	3,507	48,983	45,308	3,675	2,433

September 1987, NTT has been in rate competition with new common carriers (NCC), and NTT's communication rate between Tokyo and Osaka, for example, decreased from 400 yen (per 3 minutes) to 200 yen in June 1992. The reason of the change in DA section is that the rate had become 30 yen per 1 DA in December 1992, though it was free until then. NTT is further planning of rate revision (increase) of basic rate and DA.

Why NTT performs such a rate revision? In Japan, telephone rates are regulated from the view of fair rate of return, but the regulation is not always applied strictly. Competition in the long-distance call market made it necessary for NTT to reduce losses in other markets. However, that relates to NTT's profits and losses as a whole, and not necessarily requires breakevens in every market. And, as we shall see, cross subsidy doesn't mean uneffectiveness per se.

II. Efficiency prices (Ramsey prices)

In this section, to consider the direction of NTT's rate rebalancing from the view of efficiency prices, we deduce general properties of Ramsey prices and explain that we can apply the viewpoint of Ramsey prices to the current two-part tariff (rate).

1. Ramsey prices

Ramsey prices are deduced from a viewpoint of efficiency pricing of a monopoly which produces multi goods (services) and are defined as a price set which maximize social welfare subject to monopolist's breakeven constraint. When it produces two goods, Ramsey prices become a price set (p_i, p_j), which satisfies[2]

$$
\begin{cases}
\max \ \int_{p_i} Q_i(p_i, p_j)dp_i + \int_{p_j} Q_j(p_i, p_j)dp_j \\
\quad + Q_i(p_i - c) + Q_j(p_j - c) - F \\
\text{s.t.} \quad Q_i(p_i - c_i) + Q_j(p_j - c_j) - F = 0
\end{cases}
$$

(1)

(2)

where c is marginal cost (constant), F is fixed cost, and subscripts indicate market. From (1),(2), we obtain

$$
\left\{ \frac{p_i - c_i}{p_i} \right\} \left\{ \frac{1}{\phi_i + \phi_{ji} \dfrac{p_j Q_j}{p_i Q_i}} \right\} = \left\{ \frac{p_j - c_j}{p_j} \right\} \left\{ \frac{1}{\phi_j + \phi_{ij} \dfrac{p_i Q_i}{p_j Q_j}} \right\}
$$

(3)

where ϕ_i is elasticity of p_i (Q_i, Q_j) with respect to Q_i (ϕ_j is similar), ϕ_{ji} is elasticity of p_i with respect to Q_j (ϕ_{ij} is similar), and when goods are mutually independent, namely demand for one good is not affected by the other good's price, the latter becomes zero. From (2),(3), as ϕ is inverse of price elasticity,

Property 1: Under Ramsey pricing, when goods are mutually independent, price of a goods whose price elasticity is large is set high, and vice versa. This rate setting rule is called "inverse elasticity rule."

In (3), as the relation between ϕ_i and ϕ_j can be inverse from that between the values in { } which contain that elasticity,

Property 2: When goods are not independent mutually, Ramsey prices do not always obey the inverse elasticity rule.

Priperty 3: Under Ramsey pricing, when goods are mutually independent, and $\text{sgn}(\phi_i)$ = $\text{sgn}(\phi_j)$, price of every goods necessarily exceeds its marginal cost.

In (3), even though $\text{sgn}(\phi_i) = \text{sgn}(\phi_j)$, and $\text{sgn}(\phi_{ij}) = \text{sgn}(\phi_{ji})$, signs of values in { } which contains elasticity can be inverse, then

Property 4: Under Ramsey pricing, when goods are not independent mutually, prices of some goods might be less than its marginal cost. However, it cannot occur for all goods simultaneously.

An attempt to apply Ramsey pricing to telephone industry is not new[3]. Message service market can be classified by distance zone (local, long-distance) or time zone (day, night), and it is often said that long-distance call in the former and call at night in the latter have larger own price elasticities[4]. So, some argue that when marginal costs are equal, local call should be rated higher than long-distance call, and call at day time should be rated higher than call at night. However, as noted above, it is valid only when Ramsey prices are characterized by the inverse elasticity rule. In real world, telephone services may not be independent mutually and such a premise might not be appropriate. Then, we need more general grapple to apply Ramsey pricing to telephone industry. Another point to be noted is that, as Ozawa [1994] pointed out, "When Ramsey pricing is actually applied, price may exceed or is less than the cost distributed to each service based on accounting," then aside from telephone company (NTT)'s overall breakeven, breakeven in each section is not attained. As we shall see in section III, this gives us an important viewpoint about what NTT's rate structure or the direction of rate rebalancing should be.

2. two-part tariff

Two-part tariff are deduced from a view of an efficiency pricing of a monopolist with a large equipment (fixed cost). Under this tariff, firm gets all or part of consumer surplus CS_i by charging fixed fee p_f which does not depend on consumption level and allots it to the payment for fixed cost. Variable cost is raised by usage-sensitive rate. The concept of this tariff differs from that of the rates decided in view of the cost structure—aside from the relationship between costs and rates. Under two-part tariff, only consumer i who satisfies

$$CS_i > p_f \tag{4}$$

make a consumption. However, as an increase of fixed fee decreases the number of consumers who satisfy (4), it isn't always possible that all of the fixed cost are raised by fixed fee. Taking this fixed fee to be the payment for being able to consume that goods, and regarding it as a market, we can apply the concept of Ramsey pricing to two-part tariff[5]. In this case, telephone rates are decided by the price elasticities of both access and message service demands. But, by the idea of access demand, the substitutability (or complementarity) among them may be scarce. Taylor [1980], [1983] showed that the elasticity of access demand with respect to basic rate (fixed fee) is very small. Setting a basic rate, we need to think over access externality that CS_i depends on the number of subscribers in telephone service, but in the situation where telephone sets per capita is about 0.45, it might not so matter.

III. About criticisms for Ramsey pricing

There are criticisms for Ramsey pricing in some viewpoint. In this section, we shall examine such criticisms.

1. universal service

Some take a view that telephone services are necessities, and we need an attention not low income group to be excluded from consumption of those services. Even if this view is right, it does not mean to set rates at low levels. Because, as they are necessities, the rate elasticity of access demand is low, and high access rate is achieved. From several investigations, Crandall [1991] concluded that in the United States, even low income group spend on telephone services much more money than basic monthly fee which enable subscriber to make a local call without additional fee. Then, it appears that there is no reason to regard the effect of adoption of Ramsey pricing on access market as so important — though it depends on the extent of rate changes. Rather, it should be noted that when we guarantee telephone services to low income group, income distribution policy is more effective than rate handlings.

2. fairness

Fairness of telephone rates are often argued with the notion of cross subsidy. Cross subsidy is said to occur when multi product firm supplements a loss in one section by profits in other sections, and there are two criteria of incremental cost and stand-alone cost[6]. As noted in Property 3, Ramsey prices do not always satisfy the incremental cost test, and all prices cannnot satisfy the stand-alone cost test simultaneously. On the other hand, averege cost price satisfies both tests. However, don't be hastened to conclude that Ramsey prices are unfair. Because subscribers, in general, make both local call and long-distance call, then for the fairness question, it is necessary to clarify what type of subscriber supplements what type of subscriber and to what extent. When subscribers' calling pattern are similar, the existence of cross subsidy has no importance. Furthermore, though overhead cost do exist in

telephone services such that long-distance call uses subscriber line and local switching system, as the expense in each section depends on the way of distribution of this overhead cost, it may not matter to inquire cross subsidies at all.

3. applicability

To deduce Ramsey prices, it is necessary to collect information of demand (especially price elasticities) and cost function in every related market. From this point, some suspect the applicability of Ramsey pricing. Matsuura [1992] refuted that "firms considering rate revision must estimate its marginal cost and price elasticities. The question is whether such information is open (at least to the regulator) or not. Even though firms cheat the regulator when revising rates at some time and increase their short run profits, if situation after that shows that the offered information were not correct, regulator ..... is to develop a game of regulation with the firms. ..... If the firms act rationally in the long run, to secure reputation from regulator, they are likely to offer reasonable information (p.205)." Though it is enough to make firms offer information with which demand and cost functions are calculated, I agree with Matsuura about such information opening[7].

IV. A viewpoint of NTT's rate rebalancing

NTT has supplemented the losses in basic rate and local call section by the profit in long-distance call section. Then, to balance income and expenditure in each section, rate increase in the section in deficit and rate decrease in the section in surplus are being considered. Most of the opinions about this topic are that, rate rebalancing which correct cross subsidies contributes to efficiency and then is favorable. But, as we saw in the previous section, the argument is groundless. The problem of NTT's current rates in view of Ramsey prices (including the idea of two-part tariff) is not that the rate of each service is estranged from its average cost, but that ① Demand sides, especially rate elasticities, of message services are not reflected in those rates, ② Fixed cost is not raised by consumer surplus in message services (two-part tariff), or ③ Demand sides of access and message services are not reflected in telephone rates. And as message services are not necessarily independent mutually, to deduce Ramsey prices, as (3) indicates, we have to take cross rate elasticities as well as own rate elasticities in account. However, if the rate elasticities of local call and long-distance call satisfy particular conditions, the direction — not the reasoning — of NTT's rate rebalancing may be approved[8]. To examine that is true or not, or to decide to what extent should the rate rebalancing move forward, it is indispensable to estimate own and cross rate elasticities. Unfortunately, arguments about NTT's rate rebalancing in view of efficiency are not so much. In deciding telephone rates, careful analysis of access demand or studies of market structure which will attain favourable performance in the long run in addition to rate efficiency may be required. However, we had better pay high priority to rate efficiency, because that maximizes social welfare as a whole.

V. The existence of NCCs and realization of efficient pricing
— with relation to market structure —

Today, several carriers called NCC, enter into long-distance call market and develop competition with NTT. But, they owe access lines to NTT and pay NTT for their usage in the same time. Then, some suspect that NTT, the monopolistic supplier in local call market, advantages in that market by setting access charge strategically[9]. This relates to "condition for fair competition" in telephone industry, but it is necessary to consider such market structure in the view of efficient pricing, too. Because, as Ozawa [1994] pointed out, "the idea of Ramsey pricing premises monopolistic utilities by nature (p.211)."

Nagai [1991] noted that "in competitive service market, price is set near marginal cost, on the other hand, in a monopolistic service market, rate regulation based on average cost is likely to realized, ... then under rate regulation that equates income and expenditure as a whole, we cannot avoid the way of thinking of Ramsey pricing (p.37)." The important notion here is not a rate elasticity of demand with which each carrier confronts but that of market demand[10]. Then, in Nagai [1991], ① market with high elasticity of market demand becomes competitive, and rate of that market decreases, and ② Ramsey prices characterized by inverse elasticity rule, are premised. But they are not so clear. Rather, it may seem that when long-distance call market becomes competitive, a range of rate which NTT can set is limited largely, and realization of Ramsey pricing become difficult.

A solution to such problem may be seen in the division of NTT into local and long-distance call company[11]. Then, by making access charge low (high) by some means, we can decrease (increase) cost of long-distance call, and induce local call rate to be high (low) and long-distance call rate low (high). In the United State, the cost of interstate call corresponding to access line is collected from both user-pay-access charge with flat rate system and interexchange carrier-pay-access charge which depends on call duration, and which is equivalent to set basic rate — a payment to be able to call — high, and, if the total amount of access charge is constant, to set long-distance call rate low. Therefore, by proper adjustment of the amount of access charge and its way of payment, rate structure close to Ramsey prices may be attainable even in a competitive market.

Conclusion

In this article, to reflect efficiency to the argument of NTT's rate rebalancing, we examined general properties of Ramsey prices, a form of efficient rates, and its application to telephone industry. It was insisted that following Ramsey prices which depend on rate elasticities (including cross elasticities), the trend to equate income and expenditure in each market lacks grounds, and it can hurt resource allocation with the rate elasticities. For Ramsey pricing, it is necessary to estimate demand functions of access, local call and long-distance call market, and development in positive analysis is indeed required.

We can see drastic changes in telephone industry such as entry of NCCs into long-distance call market, entry of carriers affiliated with electric power companies,

diffusion of mobile telephone, emergence of telephone service using CATV network, and so on. Then, our proposal which premise static and monopolistic market structure may be applicable only in a transition period. However, until and unless telephone industry secures moderate competitiveness or as long as telephone rates are objects of regulation, it is necessary to adopt a policy which reflects demand side condition to rate structure.

Notes

1) An outline and problems of fair rate of return regulation are explained concisely in Ohmura [1993]. For advanced discussion, see Train [1991].

2) When goods are not independent mutually, welfare analysis with a surplus idea has a problem in path-independence (See, Okuno and Suzumura [1985], pp.215-32). In this paper, we assume that analysis with a surplus idea is valid.

3) See, for example, Willig and Bailey [1977], Griffin [1982], Brown and Sibley [1986].

4) Own price elasticities of telephone services are serveyed by Taylor [1980], [1983].

5) This idea is provided by Zajac [1978].

6) For details, see Zajac [1978], chaper 8.

7) In the deduction of cross rate elasticities by distance zone, there are problems as followed. ① When message service market is divided into several submarket, we might not have favorable outcomes in respect to sign or significant level of estimators. ② When it is divided into only 2 or 3 submarket, as actual distance zones are included in a submarket, it is needed to make a rate index with telephone traffic. Then, variables to be explained are included in explaining variables. However, with an accumulation of relevant data, even in the case ①, we may have favorable outcomes. By the way, the number of NTT's distance zone are 9 in September 1992 (8 at night), and this number has been decreasing.

8) Griffin [1982] showed that AT&T's message service rates brought about welfare loss of 1550-1580 million dollar in 1975, but under Ramsey pricing, ① Welfare loss has been to reduce to 30-480 million dollar, ② local call rate has been to increase, and the ratio of it to long-distance call rate to decrease. Unfortunately, cross rate elasticities of services are ignored. See also Brown and Sibley [1986], chapter 7.

9) Because access charge need to be authorized by Ministry of Posts and Telecommunications, such problems seem unrealistic. On the contrary, Kojyo [1994] noted that as ① access charge does not collect the cost of access line, ② NTT has supplemented the losses in access market etc. by the profit in long-distance call market, then current access charge is against NTT.

10) See, Mitchell and Vogelsang [1991], chapter 4.

11) For the division of NTT into local call and long-distance call company, it is necessary to judge prudently the pluses and minuses including the effect on telephone rates. Oniki [1994] pointed out, though the market division based

on vertical division of labor is accompanied by the loss of economy of scope, as it distinguishes the market by the production level, it has an advantage that ① competition inside the level is promoted, and the enforcement of regulation becomes easier, ② by selecting which level should be competitive or monopolistic (regulatory), it is able to minimise the inefficiency arisen in the whole industry.

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