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Competition and evolution of linear and two-part tariff☆

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ABSTRACT

The duopoly competition model presented in this paper tries to explain why a two-part tariff exists in the telecommunication industry. The investigation of competition and evolution between linear and two-part tariffs shows how the growth of the market and the sequence of action may affect equilibrium. The two pricing patterns are assumed to be virtual participants to constitute a tariff competition and evolution model, and by calculation, we can obtain metaphase equilibrium and evolution equilibrium. The conclusion shows that optimized Pareto equilibrium should be carried out by combining linear pricing and buffet pricing, this case being presented as a three-part tariff when many sub-markets coexist.

1. Introduction

In the telecommunication service area in 1983 AT&T first started to use a two-part tariff with a fixed fee and a price per unit purchased. Following this trend, many telecom companies such as MCI, KDD set this kind of tariff to diversify the tariff system. Today, the two-part tariff has almost replaced linear mode in every sort of telecom service. By attributing to a market subdivision strategy, a two-part tariff gives customers the authority to choose according their consumption model. Also it can stimulate consumption effectively by reducing the price per unit compared with a linear tariff.

In competitive markets firms commonly use many kinds of tariff to compete with each other including linear, two-part, three part and bound, ordering tariff. The Chinese telecom market pertains to a duopoly in which furious competition has lasted from 1999 until now. Accompanied by continuing discounts, the Chinese telecom market's successfully developed, cell phone becomes trivial with the total number of consumers with a land-line phone exceeding 420,000,000. However, Chinese companies chronically frame tariffs by intuition or by imitating foreign telecom companies due to the lack of pricing pattern related research. So, pricing pattern related research is significant not only as a means of instructing firms but also to enable government to manage the telecom industry and enhance social welfare.

There is a rich literature on two-part tariff pricing monopolists that deals mainly with optimal pricing strategies and price discrimination [1–5]. The Cournot case refers to Ireland, and the Bertrand case in Mandy and Katz constructed a model that considers monopolistic competition. A review of this literature can be found in N. Babu, Joyee Dutt comparing the profit of two-part tariff and buffet pricing under differentiation models. Solange Berstein's model tried to explain why firms may prefer a two-part tariff to a single price in a competitive market and the relationship of these prices to the existing switching costs in these industries, and addressed the effects of a two-part pricing structure on social welfare by modeling the horizontal differentiation games. On the other hand, there is vast literature about the comparison between linear and two-part tariffs but these documents do not consider the possibility of constructing a game model to explain the evolution of pricing patterns in a developing market. There are models that deal with differential services with two-part tariff pricing

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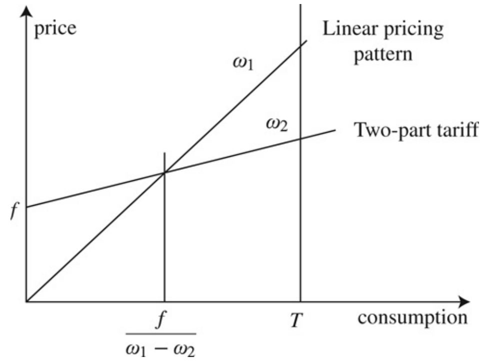

Fig. 1. Horizontal homogenization model.

under Cournot, Bertrand and monopolistic competition, nevertheless, these models do not include homogenous services under duopolistic competition.

The model presented in this paper tries to explain why a linear pricing pattern loses its power when the telecom market is developing, and what priority a two-part tariff has within tough competition. The aim is to find a way to research the optimization of pricing patterns in order to enhance social welfare.

2. The model

For simplicity this paper starts with a duopoly model with homogeneous products without consumption elasticity. The pricing structure is such that one participant uses linear and the other uses a two-part tariff. The model shows how firms compete by setting their fixed fee and price per unit [6].

It is assumed that demand is inelastic, the number of consumers is fixed and each individual demands a certain amount independent of the price. Nevertheless, different customers demand different amount of service (q), which is assumed to be uniformly distributed on interval $[0, T]$. The cost of providing the service to one more consumer is constant and equal to c. ω_1, represents the price per unit of linear tarrif while that of the two-part tariff is denoted by ω_2, Including model restriction: $\omega_1 > \omega_2 > 0, f > 0$, and customers below $\frac{f}{\omega_1-\omega_2}$, consumption use a linear pricing pattern, therefore pay $q \times \omega_1$, while customers with consumption above $\frac{f}{\omega_1-\omega_2}$ prefer two-part tariff and therefore pay $f + q \times \omega_2$. Refer to Fig. 1.

Elements of the game are as follows:

(i) Participants are linear and two-part tariff;
(ii) Linear comprises price per unit while two-part tariff comprises fixed fee along with price per unit;
(iii) Payoff of each participant: Revenue represented by R_1 and R_2.

3. Solution

3.1. Solution of static game

Stages of the game are as follows:

Stage I Nature uniformly re-distributes customers' consumption along the line segment $[0, T]$;
Stage II Two-participants decide their fixed fee and price per unit contemporarily.
Stage III Customers decide which tariff to buy.

Proposition 1. *Under competition, with the same cost of c and duopoly, firms use linear and two-part tariff, the unique symmetric Nash equilibrium of static is:*

$$\begin{cases} \omega_1^* = c + \dfrac{f}{\sqrt{2}T} \\ \omega_2^* = c - \dfrac{f}{\sqrt{2}T} \end{cases} \tag{3.1}$$

$$\begin{cases} R_1 = \dfrac{Tf}{4\sqrt{2}} \approx 0.1768Tf \\ R_2 = \left(1 - \dfrac{5}{4\sqrt{2}}\right) Tf \approx 0.1161Tf. \end{cases} \tag{3.2}$$