A Thesis about the Characteristics and the Economic Benefit of the Electronic Distribution
——Development of the Communication Karaoke——

<div align="right">Hiroshi Okada</div>

1．Introduction

Karaoke, as a peculiar culture invented by Japanese, has captured the hearts of many people. With the changes of times, Karaoke is in continuous Development. New record media is developed accompanied by technological innovation. On the basis of the uninterrupted improvement, the manufacturers awake the new consumption demand of customers and thus open up the markets. This thesis mainly focuses on the characteristics and the economic benefit of the newly born the communication Karaoke. The appearance of the communication Karaoke arouses several new tasks.

Firstly, study about the electronic distribution. Traditional Karaoke employs CD or LD disks, which are popular commodities, to store the music of Karaoke. However, the musical signals of the communication Karaoke is transmitted through electronic communication, is compared with the conventional material distribution, it achieves the communication of electronic information through the electronic communication lines.

The greatest advantage the electronic distribution brings about is that manufactures provide products directly for consumers. The complicated traditional distribution process is simplified to a large extent. In addition, up to now the traditional Karaoke market is monopolized by few producers. Having used the infrastructure of the electronic communication in the communication Karaoke, manufactures are easy to enter this market and thus intensify the competition.

Secondly, for uses. Both the communication Karaoke and the traditional one are singing apparatus, though they have different inner working structure, to put it another way, they could be substituted by each other.

Thirdly, the hardware and software of the communication Karaoke are unified and are

in mutually complemented existence, which is another worth mentioning feature of its technique. What the communication Karaoke differs from the traditional one lies in their inner structure. Traditional Laser disk Karaoke is required to have two instruments, namely the machine and the musical disk. While for the communication Karaoke the relationship between the hardware and the software is complemented mutually, similar to the relationship between the copper, the zinc, and the bronze, or that between the desk or the table and learning sets, as Cournot has explained.

Finally, the tone generation principle of the communication Karaoke is quite different from the laser disk Karaoke. The inner computer in the former one controls many sound sources to form tunes, which signifies the machine and the software should be produced by one manufacturer. On the contrary, those instruments of the traditional one are made by different producers.

The second point and the third one, are the relationship of "completely substituted" and "mutual complement" reflect Cournot's view of relativity. Here these two aspects would be analyzed in a micro economics analysis.

2. Social Benefit Brought about by the Simplified Distribution of Karaoke.

Electronic distribution is a means to transmit information, goods, etc. through electronic communication lines. It is distinct from the traditional methods where the commodity and service are provided by the traditional distribution organization.

What is the most important is the simplified distribution process. The software and other products are directly offered to retail traders or consumers without any media distribution. It has a low price compared with the traditional goods for it does not need the complicated media distribution. Lower price and the freedom of participating in the market bring advantages for consumers. Next is a simple study about this process.

⟨The Reasons for the Media Distribution Dealers to Hinder the Electronic Distribution from Participating in the Market⟩

Firstly, in the aspect of the distribution cost, the electronic distribution and the traditional one are different. Suppose two kinds of monopolized goods exist at the same time in the market, their competition can be illustrated through the changes of a commodity reaction curve.

Since these two kinds of goods are in competition and can be mutually substituted, their

relationship in the market in which both of them participate can be analyzed in the following passage.

For convenience, we suppose the function needed in this market as a linear function.

The price-sales quantity function of participant 1 and participant 2 is p_1, x_1 and p_2, x_2. The constants are s_1, s_2, m_1, m_2, n_1, n_2 and the price-sales quantity function of participant 1 and participant 2 is as follows:

$$x_1 = s_1 - m_1 p_1 + n_1 p_2 \quad (s_1, m_1, n_1 > 0 \; ; \; x_1 \geqq 0 \; ; \; p_1, p_2 \geqq 0) \tag{1}$$

$$x_2 = s_2 + m_2 p_1 - n_2 p_2 \quad (s_2, m_2, n_1 > 0 \; ; \; x_2 \geqq 0 \; ; \; p_1, p_2 \geqq 0) \tag{2}$$

For the sake of analysis, we assume the production costs of the two participants are zero, and their profits can be indicated by Π_1, Π_2.

$$\begin{aligned} \Pi_1 &= p_1 \times x_1 \\ &= p_1(s_1 - m_1 p_1 + n_1 p_2) \\ &= s_1 p_1 - m_1 p_1{}^2 + n_1 p_1 p_2 \end{aligned} \tag{3}$$

$$\begin{aligned} \Pi_2 &= p_2 \times x_2 \\ &= p_2(s_2 + m_2 p_1 - n_2 p_2) \\ &= s_2 p_2 + m_2 p_1 p_2 - n_2 p_2{}^2 \end{aligned} \tag{4}$$

Suppose the price of participant 1 (or participant 2) is changing and participant 2 (or participant 1) is an invariant, the maximum profit of each participant can be expressed as follows according to the partial differential

$$\partial \Pi_1 / \partial p_1 = s_1 - 2m_1 p_1 + n_1 p_2 = 0 \tag{5}$$

$$\partial \Pi_2 / \partial p_2 = s_2 - m_2 p_1 - 2n_2 p_2 = 0 \tag{6}$$

According to formula (5), the function of commodity 1 of participant 1 is as follows:

$$p_1 = s_1 / 2m_1 + (n_1 / 2m_1) p_2 \tag{7}$$

In the same way, according to formula (6), the function of commodity 2 of participant 2 is as follows:

$$p_2 = s_2 / 2m_2 + (m_2 / 2m_2) p_1 \tag{8}$$

In the figure 1, the reaction curve of commodity 1 and commodity 2 are R_1, R_2, in which the horizontal axis indicates the retail price p_1 of commodity 1 and the vertical axis indicates the retail price p_2 of commodity 2. The intersection of curve R_1 and R_2, that is E_1, represents the equilibrium price of p_1 and p_2.

The curves R_1 and R_2 corresponding to formula (7), formula (8) are showed in figure 1. Hence one can see that the decision-making of an enterprise is a complementary relationship in strategy.

Figure 1. The Reaction Curve of the Substitute Product.

$$p_2 \quad R_1 \quad R_2 \quad E_1 \quad p_2 \quad S_2/2n_2 \quad S_1/2m_1 \quad p_1 \quad p_1$$
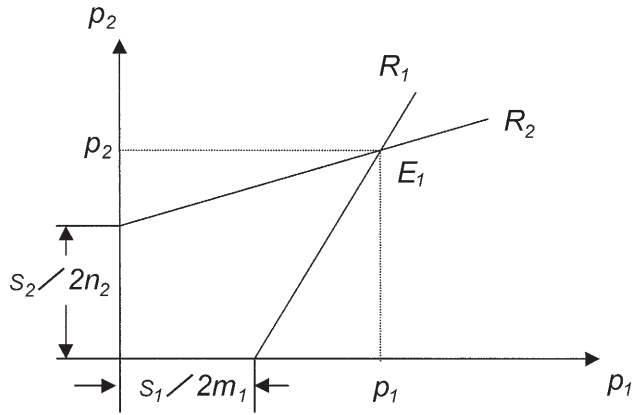
As the figure shows, with the decreasing of the retail price of the opposite side, the corresponding selling price that retailers choose will also be reduced with the curve. That is to say, when the retail price of the opposite side is lower and lower, that of one's own is also dropped.

Since both sides of the sales agents fix their own price independently, point E means the equilibrium price. Both sides choose the price that they prefer depending on the price of the opposite side.

The following figure 2 explains the process how customers benefit from the electronic distribution.

The figure 2 demonstrates the respective dynamic states of each side after the simplification of the distribution process.

The products of traditional sellers are regarded as commodity 1, those of the electronic distribution are regarded as commodity 2, and the respective reaction curves are R_1 and R_2.

The more the distribution cost of the sellers is economized, the less the cost of the commodity from the producer to consumers is, and the retail price made according to the price of the opposite side is lower. Reflected on the curve in the figure 2, the more excellent the seller is, the more the saving is, and the curve is closer to the origin of coordinates.

Figure 2. Economic Profits Brought by the Participant
of the Electronic Distribution

p_2　　　　　　　　R'_1　R_1
　　　　　　　　　　　　E_1　R_2
　　　　　　　　　　　　　　　R'_2
p''_2　　　　　E_3　　E_2

O　　　　p''_1　　　　　　　p_1
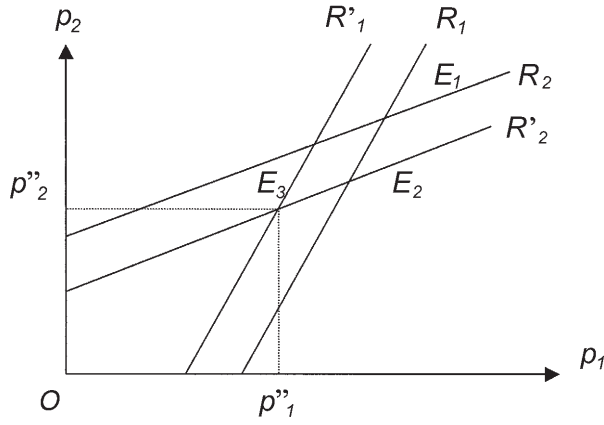
The electronic distribution 2, through the employing of communication lines, the distribution cost is economized. It is reflected in the figure as the changing of curve R_2 to curve R'_2. If sellers of commodity 1 acknowledge the change, the equilibrium price of the retail prices is to drop from E_1 to E_2, and thus the profits of both sides are reduced, which means the benefits of consumers are increased.

In the market competition seller 1 tries by some means to cut down the distribution cost to the level of that of Electronic Distribution 2, reflected as the change from R_1 to R'_1 in the figure 2. In this way the equilibrium price of both sides further drops to E_3 (p''_1, p''_2), from which consumers benefit more.

Therefore in the Karaoke industry it is not easy for a new product to struggle into the market. Generally speaking, the new product is not superior to the traditional one so far as participating in the market competition is concerned. However, due to the applying of high communication technology, the appearing on the market of the communication Karaoke, as many researches show, brings lots of benefits for consumers.

3. The Structure of the Communication Karaoke

In the following passage is a simple introduction of the communication Karaoke which has appeared on the market in 1992.[1]

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1) The communication Karaoke is a new product combined personal computer soft vender and the technology of electronic music in which I myself has been being combined all along.

The communication Karaoke is a type of new Karaoke product employed the net communication technology. The computer starts the inner sound source through the data recorded in the memory unit, and sends out a tune. Its constitution is shown in the figure 3.

The main engine is made up of two parts, the so-called commander JS-2 and the amplifier JA-1. Other devices, include television monitor, speaker, microphone and the accounting installation, etc. In addition, laser disk apparatus is necessary if cartoon is to be projected.

The commander JS-2 is composed of central processor CPU, communication modem, memory unit and sound source, etc. CPU controls the whole system of Karaoke, such as starting the sound source according to the music in corded in the memory unit, choosing memory unit, broadcasting the pictures prepared in the laser disk, or collecting fees, like coins, notes or magnetic cards by the accounting installation.

Compared with the traditional Karaoke, the communication Karaoke has no auto-changer, and occupied little space since having been compacted. It is warmly received in snack bars and restaurants with high rent located in the heart of the city. Its two-way function of communication is helpful to marketing statistics and the intelligence-collecting of the popular songs. It can be flexibly managed by the communication Karaoke users.

Moreover, the best feature of the communication Karaoke lies in its self-examining function. It can judge its hitch and inform the host computer as soon as possible.[2]

Although the communication Karaoke has more advantages than the traditional one. Whether it is the package type or the communication type, their basic function is to play Karaoke and there is no difference in its final function offered to consumers. These supplementary functions resulting from the communication technology and microcomputer do not differ from any other innovation in the electronic machine field. Thus the communication Karaoke and other package types of Karaoke can be completely substituted.

4. The Objective Analysis of the Karaoke Goods

The appearing of the communication Karaoke, which adopts the electronic communication technology, breaks through the market originally monopolized by one enterprise. This article is to analyze the changed Karaoke market. Firstly, Karaoke is analyzed as a kind

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2) It is applied the self-examining function of the personal computer soft vender belonging to the basic technology of the communication Karaoke.

Figure 3. The Function Composition of the Communication Karaoke
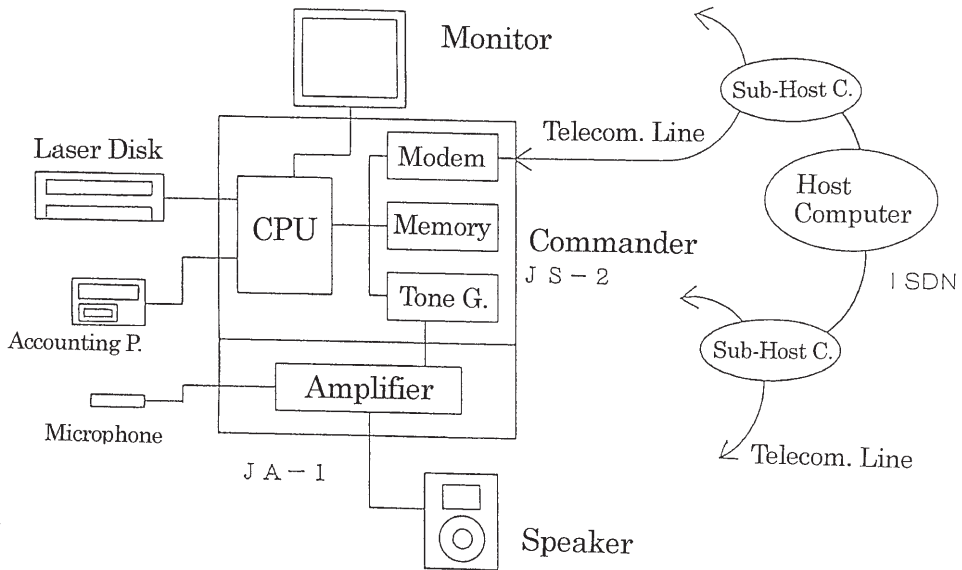
of goods, about which two points are to mention here.

In the first place, the communication Karaoke and the traditional one are of the same kind, and thus in theory they could be substituted by each other. As is shown before, compared with the traditional Karaoke,[3] the communicational Karaoke has several new advantages in its function, structure, etc. However, all these aspects are measured from the angle of the producers and the distribution agents, instead, as a kind of goods, they mean little difference for consumers. That is to say, both the communication Karaoke and the package type are used for the instrument of singing, and they belong to the same goods.

Secondly, the complete supplementary goods and the combined goods. Up to now the package Karaoke is made up of two parts, the hardware Karaoke Machine (the first goods) and the musical software LD (disk, the second goods), which are complemented by each other.

On the other hand, the communication Karaoke controls the sound source through computer and can freely compose music, so it omits the second goods, disks. The two parts of the package Karaoke are combined as one goods, and indicates the new product of the same effect is produced.

A new research subject is aroused from the stand of the producers. the appearing of the

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3） The traditional Karaoke needs laser disk or other disks, so it is called the package Karaoke, compared with the communication one.

communication Karaoke implies the enterprise making the Karaoke machine also has qualifications for producing musical software. For example, it does not resemble the package Karaoke, the two parts of which are produced by two separate companies, that is, the machine is made by Pioneer, while the software and disk are those of Victor in Japan.

Goods 1, the Karaoke machine and Goods 2, the musical disk, are complementary, yet the appearing of the communication Karaoke enables these two goods to be made by one company, and brings a certain economical effect. In addition, the package Karaoke and the communication Karaoke have the same retail price and consumers.

In this background, these two important subjects are studied in the micro economics theory and then it comes to the third subject : the maximum profits of these two goods.

4-1. The Analysis of Substitutional Goods in a Duopoly

To study the Karaoke market by using the duopoly model of Cournot. Karaoke is to distribute at a high speed through the national nets, and thus Enterprise D, which possesses the national distribution network, gradually monopolizes the markets. Since the communication Karaoke which adopted the intelligence communication technology enters into the market, the duopoly situation occurs with the package Karaoke Enterprise D and the communication Karaoke at the center of the market.

In order to vividly explain the duopoly model theory, next comes the analysis of the market held by Enterprise D (Enterprise 1) and the communication Karaoke (Enterprise 2).[4]

As shown in the figure 4, x is the product (the Karaoke system) and p is its unit price. The two product are Enterprise 1 (the package Karaoke) and Enterprise 2 (the communica-

Figure 4. The Duopoly Model of Cournot

Name	Unite price	Offering quantity	General offering quantity	Unit price
Enterprise 1 (the traditional Karaoke)	p_1	x_1		
Enterprise 2 (the communication Karaoke)	p_2	x_2	x	p

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4) Brother Industry corpration is the first one which successfully develops the communication Karaoke. Here the communication Karaoke is viewed as an enterprise entity. Actually the communication Karaoke is further developed by Xing Corporation.

tion Karaoke).

Enterprise 1 produced x_1 whose unite price is p_1 and Enterprise 2 produced x_2 with p_2 as its unit price. The production cost is supposed to be zero for the sake of analysis.

To begin with the first model, that is, x_1 and x_2 are goods that can be completely substituted by each other. In other words, both enterprise produce products of the same quality, x_1 and x_2 can be absolutely replaced. By each other, and these two goods can be regarded as the same goods. And the whole offering quantity in the market x is equal to the sum of those of x_1 and x_2. The formula is as follows.

$$x = x_1 + x_2 \tag{9}$$

since all the money comes from consumers, the price on the figure 2 is the same in this completely substituted case. That is :

$$p = p_1 = p_2 \tag{10}$$

And the inverse demand function of the said market is :

$$P = G(x) \tag{11}$$

Function $G(x)$ is a general monotone decreasing function. Suppose the profits of the Enterprise 1 as Π_1, according to formulas (9) and (10), profit Π can be gotten in the following formula. Presume the production cost as zero.

$$\Pi_1 = p_1 \times x_1$$
$$= x_1 G(x_1 + x_2) \tag{12}$$

Taking the output quantity of the opposite company into consideration, Enterprise 1 strives for the maximum of the output quantity x_1. First and second premises can be illustrated as follows :

$$\partial \Pi_1 / \partial x_1 = G(x_1 + x_2) + x_1 G'(x_1 + x_2) = 0 \tag{13}$$
$$\partial^2 \Pi_1 / \partial x_1^2 = 2G'(x_1 + x_1) + x_1 G''(x_1 + x_2) < 0 \tag{14}$$

The profits of Enterprise 2 (the communication Karaoke) is as follows :

$$\Pi_2 = p_2 \times x_2$$
$$= x_2 G(x_1 + x_2) \tag{15}$$

For the pursuit of the maximum profits, first and second premises are expressed as

$$\partial \Pi_2 / \partial x_2 = G(x_1 + x_2) + x_2 G'(x_1 + x_2) = 0 \tag{16}$$
$$\partial^2 \Pi_2 / \partial x_2^2 = 2G'(x_1 + x_2) + x_2 G''(x_1 + x_2) < 0 \tag{17}$$

Here G is a monotone decreasing function. From formula (13) take x_1 as the function of x_2, formula (18) is obtained.

$$x_1 = \Psi_1(x_2) \tag{18}$$

This is the reaction function of Enterprise 1. Under the same conditions, x_2 is performed

according to the formula (16) as

$$x_2 = \Psi_2(x_1) \tag{19}$$

This is the reaction function of Enterprise 2. Both of these two reaction functions (18) and (19) hold water under the condition of the market equilibrium.

If take the combination the required equilibrium quantity as (x_1^D, x_2^D), the formula is deduced as,

$$x_1^D = \Psi_1(x_2^D), \quad x_2^D = \Psi_2(x_1^D) \tag{20}$$

It means formulas (13) and (16), formulas (14) and (17) are identical under the equilibrium condition.

Sum the two sides of the respective formulas, next formulas are performed :

$$2G(x^D) + x^D G'(x^D) = 0 \tag{21}$$
$$4G'(x^D) + x^D G''(x^D) < 0 \tag{22}$$
$$(x^D = x_1^D + x_2^D)$$

Formulas (21) and (22) are the requirements of the equilibrium point that both enterprises get the maximum profits in the market of duopoly by Enterprise D and the communication Karaoke.

4-2. The Presuming Market Analysis after the Communication Karaoke is Annexed by the Gulliver.

In the preceding text is analyzed the two separately-producing enterprising, of which the offering quantity can be substituted by each other. Next we are to deal with the effect to the market if one enterprise exits the market competition and the other comes in the completely independent production.

Karaoke market is solely monopolized by Enterprise D all alone. With the gradual development and maturity of the market, the market originally monopolized by one enterprise changes into duopoly situation after the appearing of the communication Karaoke adopted IT technology. Consequently, in order to continue its original monopolization, the Gulliver Enterprise adopts many measures.

Finally Gulliver market strategy succeeds and the newly-joint communication Karaoke withdraws from the market competition. We will analyze what kind of economic subject emerges since the communication Karaoke is annex by Gulliver. We assume that the previously mentioned Enterprise 1 annexes Enterprise 2.

Profits Π_M after the annexation is shown as :

$$\Pi_M = p_x = xG(x) \tag{23}$$

During its process of pursuing the maximum monopolized profits, as in the proceeding formulas (13), (14), (16), (17), its condition 1

$$G(x^M) + x^M G'(x^M) = 0 \tag{24}$$

$$2G'(x^M) + x^M G''(x^M) < 0 \tag{25}$$

Among them x^M indicates the best production quantity bringing about the greatest monopolized profits. What should be noticed here is the effect to its price and the trade quantity under there-realization of the sole monopolization after the annexation of these two enterprises. Let us see the relationship between x^D, p^D in the market of duopoly and x^M, p^M in the market of monopoly.

The following function is taken for the convenience of analysis.

$$K(x) = G(x) + xG'(x) \tag{26}$$

Differential analysis of it is to get :

$$K'(x) = 2G'(x) + xG''(x) \tag{27}$$

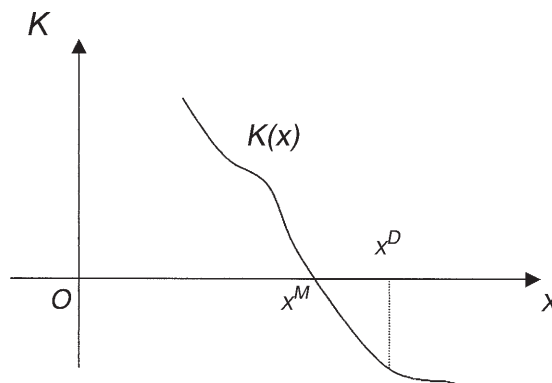Referring to formulas (24) and (25) obtains

$$K(x^M) = 0 \tag{28}$$

$$K'(x^M) < 0 \tag{29}$$

If a certain price is determined judging by x^M, and then the following relationship is tenable :

$$
\begin{aligned}
K(x) > 0 &\longleftrightarrow x^D < x^M \\
K(x) = 0 &\longleftrightarrow x^D = x^M \\
K(x) < 0 &\longleftrightarrow x^D > x^M
\end{aligned}
\tag{30}
$$

Formula (30) can be comprehended on the basis of the figure 5.

Figure 5. The Comparison of the Equilibrium Points.

From formulas (26) and (21), we obtain

$$K(x^D)+G(x^D)=2G(x^D)+x^D G'(x^D)=0$$
$$K(x^D)=-G(x^D)<0$$

(31)

And then on the basis of formula (30) we can get

$$x^D > x^M$$

At the same time $G(x)$ appears to be an inverse demand curve decreasing to the right direction.

The following relationship is acquired.

$$x^D > x^M, \quad p^D < p^M$$

Proposition 1 is obtained according to the above formula.

Proposition 1: If the two replaceable goods market changes form the duopoly market into the monopolized one, the results is as follows:

(a) $x^D > x^M$

(b) $p^D < p^M$

⟨The Implication of This Proposition⟩

First of all, x^M is less than x^D, thus the quantity of the goods in the market is lessening after the amalgamation of Enterprise 1 and Enterprise 2.

Secondly, suppose the market demand curve appears to be a creasing curve to be right direction, the market price p^M after the amalgamation is higher than that before the consolidation.

In brief, after the realization of the sole monopolization, the market price rises with the sales quantity cut down. The amalgamation of the enterprise brings about the negative effect. To speaking in another way, the appearing of the communication Karaoke in the market is favorable to the low-price for consumers, if it can effectively avoid the monopolization of the Gulliver Enterprise.

4-3. To Analyze from the Angle of the Goods Which Can be Completely Complemented──to Analyze the Price of the Communication Karaoke.

Next we regard the structure features of the communication Karaoke system as a case that can be completely complemented. There are many united things in our real life, such as a set of furniture made up sofa, armchair, and table in the drawing room, or a suite of clothes including western-style clothes, trousers and waist-coat, etc. If we focus on the communication Karaoke that this article is concerned, many interesting topics can be

revealed in the way of micro economics analysis.

The traditional Karaoke, like anther common audio products, needs music disks, such as laser disk. When the Karaoke boxes, snacks, etc. install the Karaoke system, they always purchase complete sets of equipment, such as machines and musical disks made by diffident enterprises.

The communication Karaoke differs from the traditional products. It combines into one the first goods machine and the second goods musical disk. Here centers on this point and studies its promotion of the economic profits in a micro economic theory. The two profits of Karaoke, x_1 and x_2, composed the product x in the ratio of 1 to 1. The unit price is p, which is also the sum of those two parts. Thus:

$$p = p_1 + p_2 \tag{32}$$

In addition, since x and x_1, x_2 are in the ratio of 1 to 1, they can be measured in a material unit.

$$x = x_1 + x_2 \tag{33}$$

Formula (33) is only a material formula, in which material having different qualities are laid on the two sides of the equal-sign. The function of product x is:

$$x = F(p) \tag{34}$$

Here we also suppose the production cost is zero for convenience. From formulas (32) and (34) gets the profits of Enterprise 1, the machine producer:

$$\Pi_1 = p_1 x_1 = p_1(p_1 + p_2) \tag{35}$$

In the completely complemented case, the ratio between x_1 (the Karaoke machine) and x_2 (the musical disk) is fixed.

Enterprise 1, the machine producer pursues the maximum of its unit price p_1 in contrast to the price of the opposite enterprise. Prerequisites 1 and 2 are:

$$\partial \Pi_1 / \partial p_1 = F(p_1 + p_2) + p_1 F'(p_1 + p_2) = 0 \tag{36}$$

$$\partial^2 \Pi_1 / \partial_1^2 = 2F'(p_1 + p_2) + p_1 F''(p_1 + p_2) < 0 \tag{37}$$

Prerequisites 1 and 2 for Enterprise 2, the producer of musical disks, in pursuing the maximum profits are:

$$\partial \Pi_2 / \partial p_2 = F(p_1 + p_2) + p_2 F'(p_1 + p_2) = 0 \tag{38}$$

$$\partial^2 \Pi_2 / \partial_2^2 = 2F'(p_1 + p_2) + p_2 F''(p_1 + p_2) < 0 \tag{39}$$

Since F is a monotone decreasing function, according to formulas (36) and (38), the same to the formerly concerned formulas, presume p_1 as the function of p_2, and p_2 as the function of p_1, and then the reaction function of Enterprise 1 and Enterprise 2 are:

$$p_1 = R_1(p_2) \tag{40}$$

$$p_2 = R_2(p_1) \tag{41}$$

If the two reaction functions (40) and (41) are tenable at the same time under the equilibrium condition, and the demanded combination of the equilibrium unit price are (p_1^{D*}, p_2^{D*}), and then the following formula is obtained:

$$p_1^{D*} = R_1(p_2^{D*}), \quad p_2^{D*} = R_2(p_1^{D*}) \tag{42}$$

Here, formulas (36) and (38), formulas (37) and (39) are tenable at the same time, and respectively adds the two sides of the formulas:

$$2F(p^{D*}) + p^{D*}F'(p^{D*}) = 0 \tag{43}$$

$$4F'(p^{D*}) + p^{D*}F''(p^{D*}) < 0 \tag{44}$$

$$(p^{D*} = p_1^{D*} + p_2^{D*})$$

4-4. The Economic Profits of the Communication Karaoke When the Completely Complemented Goods are Produced by One Enterprise.

After the amalgamation of Enterprise 1, the producer of Karaoke machine and Enterprise 2, the producer of musical disks,

$$\Pi = px = pF(p) \tag{45}$$

The amalgamated enterprise makes the price p in order to pursue the maximum profit Π, if the best price is p^{M*}, as in formulas (24) and (25), we can get:

$$F(p^{M*}) + p^{M*}F'(p^{M*}) = 0 \tag{46}$$

$$2F'(p^{M*}) + p^{M*}F''(p^{M*}) < 0 \tag{47}$$

What should be mentioned here is in what way the sales quantity and the market price will be changed after the amalgamation. The same to the above one, the following function is introduced to analyze the case.

$$S(p) = F(p) + pF'(p) \tag{48}$$

$$S'(p) = 2F'(p) + pF''(p) \tag{49}$$

The below formulas are acquired in referring to the above formulas (46) and (47).

$$S(p^{M*}) = 0 \tag{50}$$

$$S'(p^{M*}) < 0 \tag{51}$$

Suppose p^{M*} is definite, the following formula is tenable as shown in the figure 6.

$$S(p) > 0 \quad \longleftrightarrow \quad p < p^{M*}$$
$$S(p) = 0 \quad \longleftrightarrow \quad p = x^{M*} \tag{52}$$
$$S(p) < 0 \quad \longleftrightarrow \quad p > x^{M*}$$

According to formulas (48) and (43), the following formulas are obtained:

$$S(p^{D*})+F(p^{D*})=2F(p^{D*})+p^{D}F'(p^{D*})=0 \tag{53}$$

$$S(p^{D*})=-F(p^{D*})<0 \tag{54}$$

Also, we deduced $p^{M*}<p^{D*}$ from formula (52)

Suppose the curve $F(p)$ is an anti-demand curved decreasing, to the right direction and then :

$$p^{M*}<p^{D*}, \ x^{M*}>x^{D*}$$

Thus, proposition 2 is tenable.

> Proposition 2 : The economic profits when the Karaoke system (the completely complemented asserts) is produced by one enterprise.
>
> (a) p^{D*} (the price when the goods are produced by two enterprises)
>
> $>p^{M*}$ (the price when the goods and prduced by one)
>
> (b) x^{D*} (the sales quantity when they are produced separately)
>
> $<x^{M*}$ (the sales quantity when they are produced by one)

Next is the interpretation of proposition 2.

Figure 6. The Comparison of the Equilibrium Point(2)
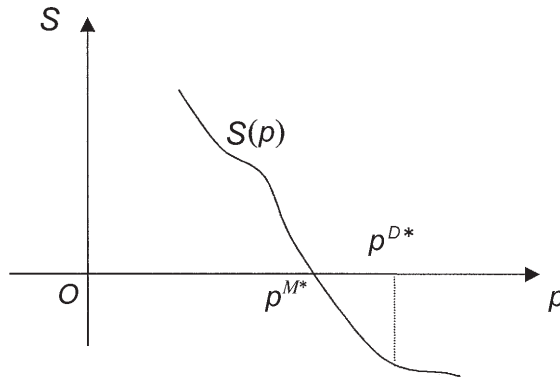
(a) : After the amalgamation, the market price of the product is cut down, from which consumer benefit a lot.

(b) : The sales quantity of the product goes up with the amalgamation.

In the completely replaceable case, with the competition failure of the communication Karaoke, Enterprise D eliminates the competition between companies by sole monopolization, and thus the rising of the production prices destroys the consumers' benefits. However, it is quite different in the completely complemented case. That is , the IT of Karaoke results in the unification between the two machine maker and the musical disk producer. The consumers received a lot of benefit from it.

I myself think that newly developed the communication Karaoke, which combines the complemented machine and the musical disks and produce them in one enterprise, is superior to the traditional Karaoke equipments so far as the consumers' benefit is concerned.

4-5. The Synthetical Analysis about the Completely Replaceable Case and the Completely Complemented One in the Duopoly Market (the Coexistence of the Package Karaoke and the Communication Karaoke).

Next is the analysis of a new situation, that is the package Karaoke and the title of this thesis : the communication Karaoke coexist in the market and both seek the maximum profit.

Package Karaoke is composed of two complemented parts. Goods 1, the Karaoke machine produced by Enterprise 1, and Goods 2, the musical disk made by Enterprise 2. On the contrary, the communication Karaoke combines Goods 1, the Karaoke machine and Goods 2, the musical disk into one and produces them in one enterprise.

Firstly, suppose the prerequisites of these two as follows : for the sake of simple, assume the package Karaoke enterprise as α, and the communication one as β.

Since they can be completely substituted by each other, and then :

The production quantity of α is x_α, and its price is p_α.

The production quantity of β is x_α, and its price is p_β.

$$\text{The total production quantity} \quad x = x_\alpha + x_\beta$$
$$\text{The reverse demand function} \quad p = G(x)$$
$$p = p_\alpha = p_\beta = G(x_\alpha + x_\beta)$$

Next comes their respective marginal cost.

In the selling system of Enterprise α, the margical cost of Goods 1 (the machine) and Goods 2 (the musical disks) are $C_I{}^\alpha$, $C_{II}{}^\alpha$. The marketing expanses for Enterprise β to sell the communication Karaoke is C^β. As has been discussed before, Goods 1 and Goods 2 can not be separately in C^β.

Proposition 2 has mentioned the relationship between these two different marginal cost. That is, the completely complemented asset-the Karaoke machine (Goods 1) and the musical disks (Goods 2)-are made by different enterprises, and thus its price is higher than that made by one enterprise. Here the one enterprise refers to the communication Karaoke.

The marginal cost for α : $C^{\alpha}=C_I^{\alpha}+C_{II}^{\beta}$

The marginal cost for β : C^{β}

The relationship between C^{α} and C^{β} : $C^{\beta}< C_I^{\alpha}+C_{II}^{\beta}$

Hence suppose the profits of α and β are :

$$\Pi_{\alpha}=p_{\alpha}x_{\alpha}-C^{\alpha}x_{\alpha}$$
$$=G(x_{\alpha}+x_{\beta})\cdot x_{\alpha}-C_I^d+C_{II}^d\cdot x_{\alpha} \tag{55}$$
$$\Pi_{\beta}=p_{\beta}x_{\beta}-C^{\beta}x_{\beta}$$
$$=G(x_{\alpha}+x_{\beta})\cdot x_{\beta}-C^{\beta}\cdot x_{\beta} \tag{56}$$

To calculate, when the profits Π_{α}, Π_{β}, reach the highest point : to analyze formulas (55) and (56) in a partial differential calculus by using x_{α}, x_{β} and the condition for gaining the maximum profits can be acquired :

$$\partial\Pi_{\alpha}/\partial x_{\alpha}=[\partial G(x_{\alpha}+x_{\beta})/\partial x_{\alpha}]\cdot x_{\alpha}+G(x_{\alpha}+x_{\beta})-(C_I^{\alpha}+C_{II}^{\alpha})$$
$$=0 \tag{57}$$
$$\partial\Pi_{\beta}/\partial x_{\beta}=[\partial G(x_{\alpha}+x_{\beta})/\partial x_{\beta}]\cdot x_{\beta}+G(x_{\alpha}+x_{\beta})-C^{\beta} \tag{58}$$
$$=0$$

These two products can be completely substituted by each other in the market, so their demand function is :

$$p=G(x)=\gamma x+\delta$$
$$=G(x_{\alpha}+x_{\beta})=\gamma(x_{\alpha}+x_{\beta})+\delta \tag{59}$$

Then, γ and δ in formula (59) are constants. Hence, γ and δ can be calculated by analyzing formula (59) in a partial differential calculus way by using x_{α}, x_{β}. Formulas (57) and (58) are changed into the following formulas, in which x_{α}^*, x_{β}^* are the production quantity of α and β when the profits reach the highest point.

$$\gamma x^*_{\alpha}+G(x^*_{\alpha}+x^*_{\beta})-(C_I^{\alpha}+C_{II}^{\alpha})=0 \tag{60}$$
$$\gamma x^*_{\beta}+G(x^*_{\alpha}+x^*_{\beta})-C^{\beta}=0 \tag{61}$$

The following formula is obtained according to formulas (60) and (61).

$$x^*_{\alpha}/x^*_{\beta}=[G(x^*_{\alpha}+x^*_{\beta})-(C_I^{\alpha}+C_{II}^{\alpha})]/[G(x^*_{\alpha}+x^*_{\beta})-C^{\beta}] \tag{62}$$

The above formula (62) demonstrates the output quantity when enterprise α is Gulliver Enterprise and enterprise β is the communication Karaoke, coexist and reach the maximum profits.

In general, when profits reach the highest point, the ratio of the output quantity is : $x_{\alpha}^*/x_{\beta}^*<1$, and the relationship between the production cost is :

$$C_I^{\alpha}(=C_I^{\alpha}+C_{II}^{\alpha})>C^{\beta}$$

5. Conclusion (the Acknowledgement of the Market)

Karaoke industry is a peculiar culture of Japan. Actually its market has been monopolized all long by Gulliver Enterprise who has the national distribution network. It brings higher profits for clients by its quick maintenance service and its unobstructed delivering of new songs. This advanced distribution system monopolizes the market and at the same time brings pressure for the appearing of new products.

The appearing of the communication Karaoke transforms the past situation. From the view of consumers, both of them are products having the same quality, however, these new product adopted effective IT technology has advantageous economic effects in many aspects and it gains one portion of the market as quick as lighting. Henceforth the phase monopolized by Gulliver Enterprise which mainly deals with LD Karaoke is broken through and the communication Karaoke has equal shares with it in the market.

This thesis analyzes the Karaoke market in which the Gulliver Enterprise and the communication Karaoke coexist. Here this paper is to forecast the date through market, and according to (62) to predicate the respective percentage of the market occupation when these two enterprise coexist and their profits reach the highest point.

The following date are deduced from the present situation of the market, there should be not much difference from the actual date. From formula (62) is calculated :

$$G(x^*_\alpha + x^*_\beta) = 3,000 \text{ hundred million Yen}$$
$$C_I{}^\alpha + C_{II}{}^\alpha = 2,000 \text{ hundred million Yen}$$
$$C^\beta = 1,500 \text{ hundred million Yen}$$
$$x^*_\alpha / x^*_\beta = 2/3$$

It is not difficult to observe from the above prediction that the ratio of the output quantity between the Gulliver Enterprise and the communication Karaoke is 2 to 3 and it also reveals the percentage of the market occupation between the package Karaoke and the communication Karaoke. It can be predicated that in the near future the communication Karaoke is sure to be the main trend of the Karaoke market.[6]

As a matter of fact, the communication Karaoke develops by leaps and bounds recently. I myself think that although lots of enterprises develop new products continuously, manufactures like the communication Karaoke is rare to be seen, for it employs the technology innovation and pushes forward the reform of the market.

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6) The information about the market prediction comes from the interview with the Planning Department of the Xing Corporation.

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