공학석사 학위논문

Impact of package price elasticity and distribution channel structures in a product-service complementary goods market

제품-서비스 보완재 시장에서의

패키지 가격 탄력성과 유통 채널 구조의 효과

2014 년 2 월

서울대학교 대학원

산업공학과

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Abstract

This paper analyzes the impact of retail channel and direct channel on pricing, total profit and consumer benefit in a product-service complementary goods market, where a product and a service are used as a package.

Direct channel is where manufacturers and service providers sell their products or services independently. Retail channel is where service providers bundle their service with a product supplied by manufacturers and sell them as a package.

The analysis shows that the retail channel is always unfavorable for consumers. When retail channel is an equilibrium choice for firms, the price of package is always higher in retail channel than in a direct channel.

In contrast, firms can take the advantage of the retail channel under some conditions. Sometimes, additional revenue-sharing contract between manufacturers and service providers is required to have the retail channel as equilibrium. Package price elasticity decides such conditions along with the effect of price buffer in retail channel.

The findings and implications from this study can apply to telecommunications markets, e-Book markets and other product-service markets having the similar characteristics.

Keyword: Co-opetition, Complementary goods, Package, Price elasticity, Channel structure, Bundling

Student number : 2012-21047

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1. Introduction

Smartphone and telecommunication service are perhaps the best-known pair of complementary goods. Another example is e-Book, comprised of an electronic device and book contents. Such complementary goods of nowadays are distinguished from the traditional complementary goods for the following three characteristics.

First, they are perfect complements; they are only consumed as a package and cannot be used alone. Second, they are comprised of product and service. Smartphone is a product and telecommunication is a service. e-Book device is a product and contents are service (or software). Combination of different types of goods creates a unique profit structure for each complement providers. While product purchase offers one-time profit for product manufacturers, service purchase offers long-term profit for service providers. Third, their providers are independent. Product manufacturers and service providers are usually independent and complementary firms. An increasing number of industries have evolved away from vertical integrated structures to more horizontal structures (Casadesus-Masanell and Yoffie, 2007). Such a horizontal structure creates co-opetive (cooperative and competitive at the same time) interactions between independent and complementary firms.

Most widely used channel structures in the sales of such complementary goods described above are retail channel and direct channel. Retail channel is where manufacturers supply products to service providers and service providers resell products in addition to their service. Hence, in retail channel, consumers buy a complete package comprised of product and service packaged by service providers. In contrast, direct channel is where manufacturers and service providers independently sell their product or service to their consumers. The main characteristics of retail channel in comparison with direct channel are as follows: (1) integration of price, (2) product supply chain.

(1) Integration of price and price elasticity

In direct channel, consumers make two independent purchase decisions for product and service. They take into account both product price and service price independently. Consumers may have different value on product and service. Hence, different price elasticity of demand for product and service are applied in purchase decision-making process.

In contrast, in retail channel, consumers buy only one package through service providers. Thus, total sum of product and service price (package price) is considered in purchase decision. Only the package price elasticity matters in retail channel.

(2) Product supply chain

In retail channel, manufacturers and service providers are involved in a product supply chain. Manufacturers are suppliers of products and service providers are retailers of products. Service providers earn margins from retailing of products in addition to service sales. However, in direct channel, manufacturers and service providers do not have such a relationship.

This paper analyzes the impact of retail channel structure in comparison with direct channel, in light of pricing, profit and consumer surplus in a hybrid duopoly model of complementary goods market.

The remainder of this paper is organized as follows. Section 2 introduces the existing related literature on this issue. Section 3 introduces dynamic hybrid duopoly model analyzing the two channel structures of complementary firms by use of game theory. Section 4 provides results and analysis of pricing game. Section 5 concludes by discussing managerial implications of the analysis and giving directions for future research.

2. Literature

2.1. Co-opetition between complementary firms

Co-opetition is a compound word of cooperation and competition, and was pioneered by Brandenburger and Nalebuff (1996). Handset manufacturers and carriers are cooperative in that they produce complementary goods; a manufacturer's effort to make products innovative can increase the sales of complementary services. However, they are also competitive; a carrier's decision to increase service price can decrease the sales of complementary products.

Many research have been published in the area of co-opetition among complementary firms. Their focus was the natural conflicts emerging over pricing, revenue sharing, and, others. This paper also deals with the same issue. Nevertheless, there was little research regarding the problem arising from the different profit system between product manufacturers and service providers.

Casadesus-Masanell and Yoffie (2007) gives a good example of co-opetive firms, Intel and Microsoft. Intel and Microsoft have incentives to cooperate since they are producers of complementary goods of personal computers (PC), but the shape of their profit functions are different giving them another incentive to compete; Microsoft derives

profit from selling operating systems with each new PC and from selling applications to the installed base; Intel's profits, however, come from the sale of microprocessors in new PCs. Cai et al. (2012) evaluated how a combination of exclusive deals and revenue sharing impact suppliers and retailers in a competitive multichannel market, a similar setting to this paper, where the suppliers sell products and the retailers sell complementary goods/services simultaneously. Matutes and Regibeau (1992) presented a simple duopoly model of compatibility and bundling in a complementary goods market. They assumed a market where consumers assemble several necessary components into a system that is close to their ideal. They differed from this study in the problem setting in which every firm produced every component of complementary goods. Wang (2006) studied the production and pricing decisions of multiple manufacturers who produce and sell to a market of complementary products. They saw joint decision of production quantity and price as important factors to achieve the highest profit, and showed impact of channel structure and parameters on firms' decisions.

2.2. Bundling

Broadly speaking, bundling is the practice of marketing two or more products or services in a single package (Guiltinan 1987). Bundling

was first suggested as an effective price discrimination strategy by Stigler (1968), followed by Adams and Yellen (1976), Schmalensee (1982), Bakos and Brynjolfsson (2000). Much of the academic work on bundling was about bundling within a single firm. However, bundling arising in telecommunication markets is in horizontal structures, between independent complementary firms. Studies on bundling in horizontal structures are rare: Liao and Tauman (2002) studied price competition between complementary product manufacturers offering products separately and also as a bundle.

Bundling is closely related to the consumer perceptions of prices. Managers have tried to maximize payoffs from interrelated products by changing the consumer perceptions of prices with the bundling strategy. Under the bundling strategy, the boundary of component prices disappears and only the bundle price matters to consumers. According to Guiltinan (1987), a consumer's reservation price for the bundle is superadditive in those for the complementary components; because of search economies, the bundled sale increases customer satisfaction and improve total image of the package. Handset and telecommunication service are very interrelated, thus they are expected to give more profit when sold in bundles.

In this study, we used the concept of price elasticity of demand to denote the measure of consumers' willingness to pay for goods, instead

of reservation price. According to Parkin et al. (2002), the more necessary a good is, the lower the elasticity, as people will attempt to buy it no matter the price. High brand loyalty also results in more inelastic demand (Gillespie 2007). Hence, it seems quite logical to say that price elasticity of demand can represent consumers' willingness to pay. Consequently, Guiltinan (1987)'s argument above also can apply to our study in a very similar manner: the bundling strategy makes consumers' price elasticity of demand more inelastic, meaning that the reservation price increases for the bundle.

2.3. Channel structure

The different profit objectives of manufacturers and service providers may cause conflicts within a channel. Service providers want to achieve the long-term profit and manufacturers want to increase instant sales. The existing literature also indicates different objectives of channel members create conflicts within a channel; its members often fail to reach Pareto-optimal pricing decisions (Choi 1991; Mcguire and Staelin 1983; Jeuland and Shugan 1983; Moorthy 1987).

On the other hand, competition between service providers in retail channel can create a price buffer for manufacturers. If competition between service providers s is fierce and retail margin is low, manufactur-

ers will be able to set higher price for their handsets. Choi (1991) also says channel intermediaries reduce the intensity of direct competition between manufacturers.

Retailers in the existing research are only intermediaries, but service providers in this study also sell their services in addition to retailing products. As far as we know, there was no research regarding this type of channel structure where retailers are not only the intermediaries for suppliers but also independent sellers.

3. Model

3.1. Market model

Following Matutes and Regibeau (1988), Economides and Salop (1992), Economides (1991), and Cai et al. (2012), we adopt the notation ij to denote the package (composite good) made up of product i and service j. For simplicity, we suppose two duopoly markets: a product market with two manufacturers (i = 1, 2), and a service market with two service providers ($j = a$, b). Each manufacturer produces a single product and each service provider provides a single service (i.e., manufacturer i produces product i and service provider j provides service j).

Products and services are released at $t = 0$ and sold until T. Service purchase means subscription for at least the contract period C. After the contract period, consumers cancel subscription at the rate of δ. Even

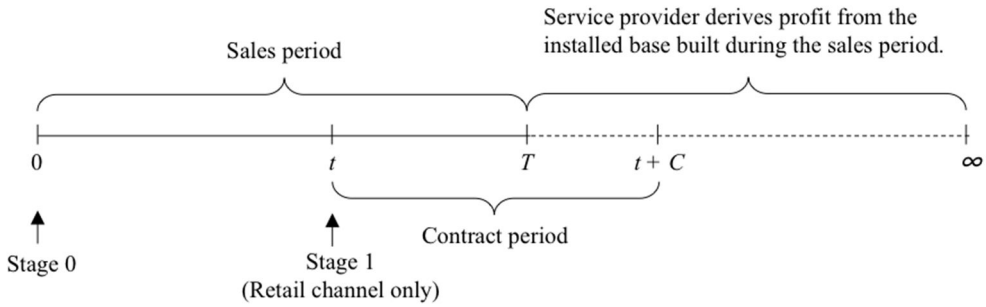

Figure 1. Model timeline

after the sales period terminates, service provider can derive profit from the installed base.

Demand for package *ij* (*ij* = 1a, 1b, 2a, 2b) at time *t* is denoted as $q_{ij}(t)$ following the basic linear duopoly function capturing package preference, price and level of package differentiation. The level of differentiation is inverse proportion to the package substitutability, τ ($0 \leq \tau < 1$). High τ indicates high similarity of packages in the market and low τ indicates heterogeneous packages in the market. Since we employ time-variant demand, $q_{ij}(t)$, demand changes as customer's preference for package *ij*, $\alpha_{ij}(t)$, and package prices, $p_{ij}(t)$, change over time *t*.

$$q_{ij}(t) = \begin{cases} \alpha_{ij}(t) - p_{ij}(t) + \tau \dfrac{\sum_{mn \neq ij} p_{mn}(t)}{3} & \text{if } t \in [0, T], \\ 0 & \text{if } t \in (T, \infty]. \end{cases} \tag{1}$$

$q_i(t)$ is demand for product *i* at time *t*, $q_j(t)$ is demand for subscription of service *j* at time *t*.

$$q_i(t) = \sum_{j=a,b} q_{ij}(t), \quad i = 1,2 \tag{2}$$

$$q_j(t) = \sum_{i=1,2} q_{ij}(t), \quad j = a,b \tag{3}$$

The number of service subscribers has the form of cumulative function of demand, $q_{ij}(t)$, considering the cancellation rate, δ, after the contract period *C*. In other words, installed base for package *ij* at *t* is denoted as $y_{ij}(t)$,

$$y_{ij}(t)=\begin{cases}\int_0^t q_{ij}(u)du & \text{if } t\in[0,C],\\ \int_0^{t-C} q_{ij}(u)e^{-\delta(t-C-u)}du+\int_{t-C}^{t} q_{ij}(u)du & \text{if } t\in(C,\infty].\end{cases} \tag{4}$$

3.2. Price, profit, and channel structures

3.2.1. Direct channel

Direct channel is where two manufacturers (M1, M2) directly sell their products (1, 2) to consumers and two service providers (SP a, SP b) directly sell their services (*a*, *b*) to consumers. Consumers independently purchase both product and service and use them as a package (1a, 1b, 2a, 2b).

In direct channel, consumers make two independent purchase decisions for product and service. They take into account both product

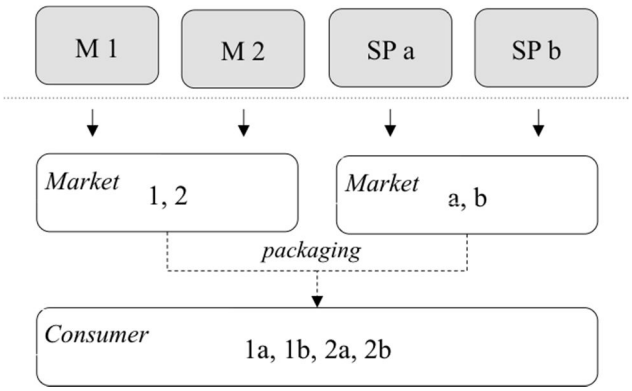

Figure 2. Direct channel

price and service price independently. Consequently, different price elasticity of demand for product (β_p) and service (β_s) are applied in purchase decision-making process. Consumers consider the expected expense during the contract period C when they subscribe to a service.

Perceived price of package *ij* in direct channel at time *t* is

$$p_{ij}(t) = \beta_p w_i + \beta_s \int_0^C p_j e^{-rt} dt \,, \tag{5}$$

where w_i is price of product *i*, p_j is price of service *j*, and *r* is discount rate. Instant profit functions of manufacturers and service providers at time *t* are denoted as,

$$\pi_i(t) = w_i \sum_{j=a,b} q_{ij}(t) \,, \tag{6}$$

$$\pi_j(t) = p_i \sum_{i=1,2} y_{ij}(t) \,. \tag{7}$$

Total profit functions are respectively,

$$\Pi_i = \int_0^T \pi_i(t) e^{-rt} dt \,, \tag{8}$$

$$\Pi_j = \int_0^\infty \pi_j(t) e^{-rt} dt \,. \tag{9}$$

3.2.2. Retail channel

Retail channel is where manufacturers (M1, M2) supply their products (1, 2) to service providers (SP1, SP2) and service providers resell products in addition to their service (*a*, *b*) to consumers. Hence, in retail

channel, consumers buy a complete package (1a, 1b, 2a, 2b) comprised of product and service packaged by service providers.

In retail channel, consumers buy only one package through service providers. Thus, total sum of product and service price (package price) is considered in purchase decision. Only the package price elasticity (β) matters in retail channel.

Perceived price of package *ij* in retail channel at time *t* is

$$p_{ij}(t) = \beta(m_{ij}(t) + w_i) + \beta\int_0^C p_j e^{-rt} dt \,, \tag{10}$$

where $m_{ij}(t)$, is service provider *j*'s retail margin on product *i* at time *t*. Instant profits of manufacturers and service providers at time *t* are denoted as,

$$\pi_i(t) = w_i \sum_{j=a,b} q_{ij}(t) \,, \tag{11}$$

$$\pi_j(t) = \sum_{i=1,2} m_{ij}(t) q_{ij}(t) + p_i \sum_{i=1,2} y_{ij}(t) \,. \tag{12}$$

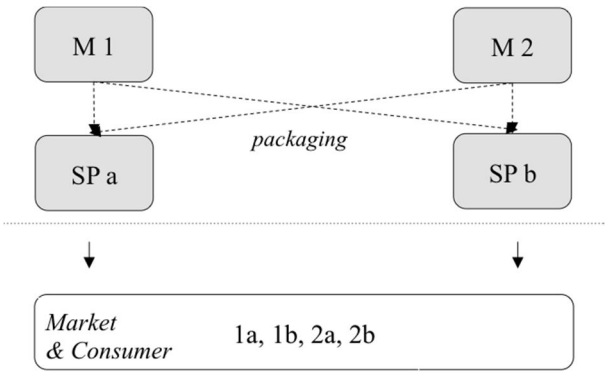

Figure 3. Retail channel

Here in retail channel, service providers not only profit from the sales of service but also gain retail margins from selling products.

3.3. Pricing game

Pricing game in this paper is non-cooperative game where the players choose strategies simultaneously and are thereafter committed to their chosen strategies. The solution concept for this game was formally introduced by John Nash (Cachon and Netessine, 2003).

Each player maximizes its own profit in a Nash game. This game setting has been widely adopted in the related literature (Cai et al. 2012; Economides and Salop 1992). The solution to the two-stage game is a subgame-perfect equilibrium and is solved by backward induction.

In direct channel, manufacturers choose w_i to maximize (8) and service providers choose p_j to maximize (9) at time 0. There is no retail margin, hence no additional pricing game. The players' reaction functions are derived from the first-order conditions of (8), (9):

$$\frac{d\Pi_1}{dw_1} = \frac{d\Pi_2}{dw_2} = \frac{d\Pi_a}{dp_a} = \frac{d\Pi_b}{dp_b} = 0 \quad , \tag{13}$$

for which the second-order derivatives

$$\frac{d^2\Pi_1}{dw^2_1} < 0, \frac{d^2\Pi_2}{dw^2_2} < 0, \frac{d^2\Pi_a}{dp^2_a} < 0, \frac{d^2\Pi_b}{dp^2_b} < 0 \quad , \tag{14}$$

satisfying the second-order condition for a maximum.

In retail channel, there are two game stages. In stage 0, manufacturers choose w_i to maximize (8) and service providers choose p_j to maximize (9) at time 0, and this stage is similar to that of direct channel. In stage 1, service providers choose retail margin $m_{ij}(t)$ at every time t ($0 \le t \le T$) to maximize instant profit at time t, (12). The players' reaction functions are derived from the first-order conditions of (12):

$$\frac{\partial \pi_a(t)}{\partial m_{1a}(t)} = \frac{\partial \pi_a(t)}{\partial m_{2a}(t)} = \frac{\partial \pi_b(t)}{\partial m_{1b}(t)} = \frac{\partial \pi_b(t)}{\partial m_{2b}(t)} = 0 \quad , \tag{15}$$

for which the Hessian matrix is,

$$\begin{bmatrix} \frac{\partial^2 \pi_a(t)}{\partial m^2_{1a}(t)} & \frac{\partial^2 \pi_a(t)}{\partial m_{1a}(t) m_{2a}(t)} & \frac{\partial^2 \pi_a(t)}{\partial m_{1a}(t) m_{1b}(t)} & \frac{\partial^2 \pi_a(t)}{\partial m_{1a}(t) m_{2b}(t)} \\ \frac{\partial^2 \pi_a(t)}{\partial m_{1a}(t) m_{2a}(t)} & \frac{\partial^2 \pi_a(t)}{\partial m^2_{2a}(t)} & \frac{\partial^2 \pi_a(t)}{\partial m_{2a}(t) m_{1b}(t)} & \frac{\partial^2 \pi_a(t)}{\partial m_{2a}(t) m_{2b}(t)} \\ \frac{\partial^2 \pi_b(t)}{\partial m_{1a}(t) m_{1b}(t)} & \frac{\partial^2 \pi_b(t)}{\partial m_{2a}(t) m_{1b}(t)} & \frac{\partial^2 \pi_b(t)}{\partial m^2_{1b}(t)} & \frac{\partial^2 \pi_b(t)}{\partial m_{1b}(t) m_{2b}(t)} \\ \frac{\partial^2 \pi_b(t)}{\partial m_{1a}(t) m_{2b}(t)} & \frac{\partial^2 \pi_b(t)}{\partial m_{2a}(t) m_{2b}(t)} & \frac{\partial^2 \pi_b(t)}{\partial m_{1b}(t) m_{2b}(t)} & \frac{\partial^2 \pi_b(t)}{\partial m^2_{2b}(t)} \end{bmatrix}, \tag{16}$$

$$= \begin{bmatrix} -2\beta & \frac{1}{3}\beta & \frac{1}{6}\beta & \frac{1}{6}\beta \\ \frac{1}{3}\beta & -2\beta & \frac{1}{6}\beta & \frac{1}{6}\beta \\ \frac{1}{6}\beta & \frac{1}{6}\beta & -2\beta & \frac{1}{3}\beta \\ \frac{1}{6}\beta & \frac{1}{6}\beta & \frac{1}{3}\beta & -2\beta \end{bmatrix}$$

which is negative definite since $\beta > 0$, satisfying the second-order condition for a maximum.

4. Numerical example

4.1. Input

In this section, we use numerical input data representing the real product-service complementary market and apply them to the model we built in the previous section. The smartphone and telecommunication market is the best-known product-service complementary market worldwide, so we made input data considering the real market environments in this market. In this way, we show how our model works in the real world and give implications from the analysis.

Smartphone and telecommunication service are innovative complementary goods whose innovativeness fades away as time goes by. Such kinds of products or services have decreasing consumer preference, $\alpha_{ij}(t)=e^{-0.1t}$ (ij = 1a, 1b, 2a, 2b), compared to the durable products with steady consumer preference. Symmetric preference is assumed for every package for simplicity of the analysis.

New packages in this market have short sales period, often around one year. Hence, we assume products and services are sold for T = 12 months. Service contract period is usually 24 months and cancellation charge is imposed on the early cancellation before the contract period. Thus, we set the contract period C = 24 months. However, we do not

consider the possibility of the early cancellation, since the early cancellation is often followed by the additional charge to offset the loss of carriers. Forbidding the early cancelation would have the same result with the case allowing the early cancellation at the additional charge.

Considering the reality where service subscribers start to cancel the subscription after the contract period, we assume the subscribers fade away at the rate of $\delta = 0.5$ after C. Package substitutability is $\tau = 0.5$. Discount rate per month is $r = 0.005$.

Price elasticity of product and service are set using the estimates of Gette, Lopez, Noual (2005). Price elasticity of product is $\beta_p = 0.625$, and price elasticity of service is $\beta_s = 0.99$. Such values of price elasticity are the estimates in the ICT (Information and Communication Technology) market covering the period 1979-2001. Package price elasticity is denoted as β.

4.2. Retail margin, price, profit, and demand

In retail channel, service providers set retail margins $m_{ij}(t)$ at every sales period and manufacturers set wholesale prices w_i. Best response functions of service providers' retail margins are

$$m_{1a}(t)=\frac{0.75+e^{-0.1t}}{\beta}-0.4375w_1-10.8368p_a+0.0625w_2+2.3558p_b,$$

$$m_{2a}(t)=\frac{0.75+e^{-0.1t}}{\beta}-0.4375w_2-10.8368p_a+0.0625w_1+2.3558p_b,$$

$$m_{1b}(t)=\frac{0.75+e^{-0.1t}}{\beta}-0.4375w_1-10.8368p_b+0.0625w_2+2.3558p_a, \tag{17}$$

$$m_{2b}(t)=\frac{0.75+e^{-0.1t}}{\beta}-0.4375w_2-10.8368p_b+0.0625w_1+2.3558p_a,$$

As the goods attractiveness decreases as time goes by, retail margin also decreases over time. As service providers set higher service fee, their retail margin goes down. Also, retail margin is in inverse proportion to the wholesale price. Details of prices and total profit in direct and retail channel are given in Table 1.

Table 1. Price and total profit in direct channel and retail channel

	Direct channel	Retail channel
Product price	0.5112	$\frac{0.4580}{\beta}$
Service fee (per month)	0.0142	$\frac{0.0025}{\beta}$
Service price*	0.3227	$\frac{0.0569}{\beta}$

Retail margin of product	-	$\frac{-0.1931+0.75e^{-t}}{\beta}$ $\frac{0.2436}{\beta}$ (average)
Total profit of manufacturer	3.1705	$\frac{2.1892}{\beta}$
Total profit of service provider	2.1570	$\frac{1.9057}{\beta}$
Total profit of industry	5.3275	$\frac{4.0949}{\beta}$
Total demand	12.616	9.7456

*Discounted sum of service fee during the contract period C

In retail channel, the major source of service providers' profit is retail margins. Service fee is sharply decreased. Total demand in direct channel and retail channel is regardless of β, β_p, and β_s. Lower demand in retail channel shows the ineffectiveness of two-staged pricing game in retail channel in terms of expanding the market size.

4.3. Total profit and channel selection

Each player decides whether to choose retail channel comparing their expected total profits in each channel. When all members choose retail channel (RC), retail channel become the channel structure in a complementary goods market. Otherwise, all players independently sell

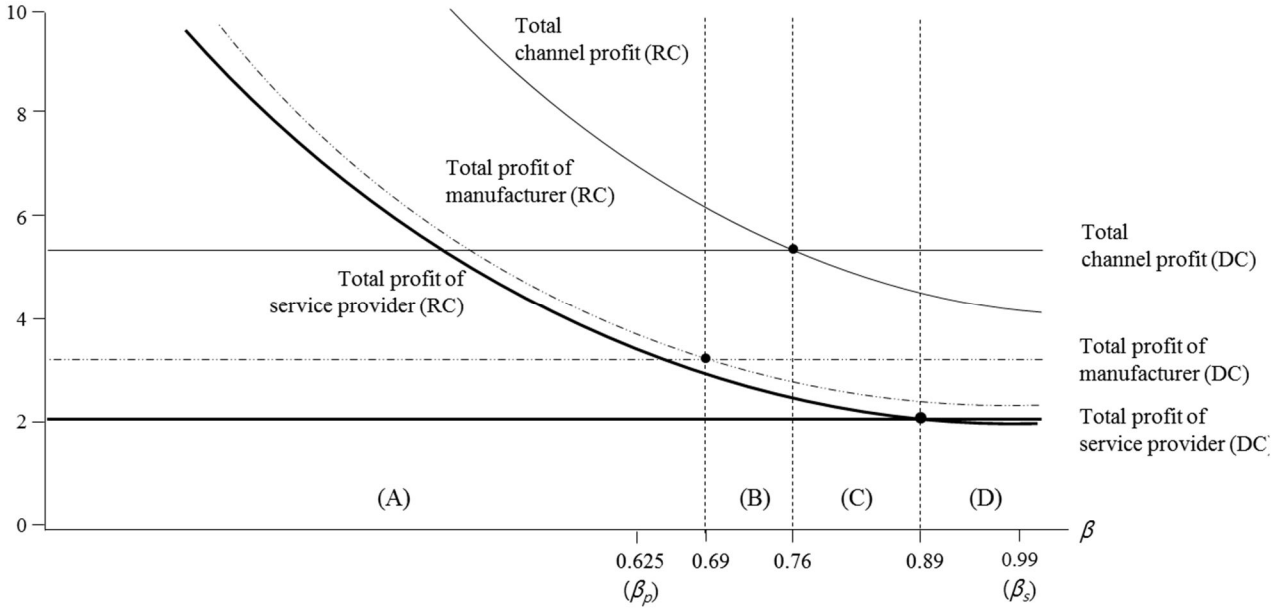

Figure 4. Total profit and β

their products or services through direct channel (DC).

According to the result of game shown in Table 1, package price elasticity, β, decides the performance of retail channel. Consequently, players in the game will decide whether to take part in retail channel considering their profit changes according to β.

Figure 4 shows total profit graphs of manufacturers, service providers, and the entire industry. Since we assumed symmetry between firms of the same kind, every player of the same kind has the same total profit. We can divide the graph into four regions (A), (B), (C), and (D) according to the expected bargaining position of each player in channel selection process.

(A) $\beta < 0.69$: Retail channel is optimum for both manufacturers and service providers, and also in terms of the entire channel profit.

In this case, both service providers can take the advantage of low package price elasticity and gain higher profit in retail channel. Even manufacturers gain higher profit in spite of increased package elasticity, because they take advantage of the role of product supplier in retail channel. In retail channel, product retail competition between service providers buffer the increase in product wholesale price set by manufacturers. Since both service providers and manufacturers profit higher in retail channel, both will agree to choose retail channel as a channel structure. Also, the entire channel profit is higher in retail channel.

(B) $0.69 < \beta < 0.76$: Retail channel is optimum choice only for service provider and in terms of the entire channel profit.

Additional revenue-sharing contract is required to induce manufacturers to choose retail channel. Service providers take the advantage of decreased package price elasticity. This leads to higher profit of service providers in retail channel. However, manufacturers gain less due to increased package price elasticity. This means the relative advantage of price buffer offered by service providers does not offset the disadvantage of the increased package price elasticity in retail channel.

Although only service providers take the advantage of retail channel, total profit of the entire industry increases in retail channel. Thus, revenue-sharing contract is required to make both players to take part in retail channel and reach the highest total profit of the entire industry.

(C) $0.76 < \beta < 0.89$: Direct channel is optimum choice in terms of the entire channel profit and manufacturers' profit.

However, as for service providers, retail channel is optimum. This case is similar to the case of $0.69 < \beta < 0.76$, but total profit of the entire industry decreases. Service providers take the advantage of decreased package price elasticity. This leads to higher profit of service providers in retail channel. However, manufacturers gain less due to increased package price elasticity. In this case, retail channel is not an effective choice in terms of the entire channel profit.

(D) $0.89 < \beta$: Direct channel is optimum for both manufacturers and service providers, and also in terms of the entire channel profit.

If package elasticity is higher than 0.89, both manufacturers and service providers gain less profit in retail channel. In this case, manufacturers cannot take the advantage of price buffer in retail channel. As for service providers, the decreased price elasticity does not offset the disadvantage of product retail competition in retail channel.

4.4. Price and consumer benefit

According to the result of game shown in Table 1, package price elasticity, β, decides price in retail channel. Package price is closely related to consumer benefit. Package price in retail channel will decide whether consumers can be better off in retail channel or not.

Package price in retail channel is below the package price in direct channel only if $\beta > 0.91$, thus consumers can take benefit of retail channel if $\beta > 0.91$. However, in (D), where $\beta > 0.89$, manufacturers and service providers are not likely to choose retail channel structure.

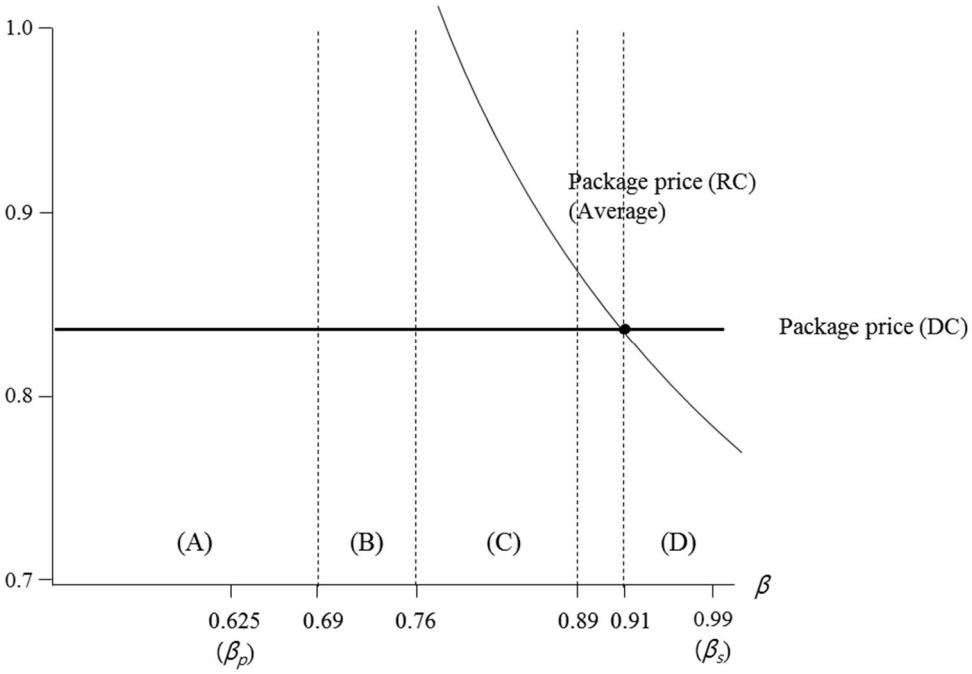

Figure 5. Price and β

Retail channel is possible only in the area of (A) and (B), in which package price in retail channel is higher than the package price in direct channel. Consequently, retail channel is always unfavorable for consumers.

5. Conclusion

This paper analyzed the impact of retail channel structure in comparison with direct channel, in light of pricing, profit and consumer surplus in a hybrid duopoly model of complementary goods market. The results show that retail channel is always unfavorable for consumers, while firms can take the benefit of retail channel under some conditions.

The key variable deciding the effectiveness of retail channel in terms of players' profit is package price elasticity. If consumer is less sensitive to package price than to the individual components of package (product and service respectively), package price elasticity is low (around β_p, or $\beta < \beta_p$), and it makes favorable condition for firms to take more profits. However, if consumer is more sensitive to package price than to individual components of package, package price elasticity is high (around β_s, or $\beta > \beta_s$), and it makes unfavorable condition for firms to be profitable.

Another key aspect of retail channel is its product supply chain. The relative impact of product supply chain decides the effectiveness of retail channel along with package price elasticity, though in opposite direction to manufacturers and service providers respectively.

As service providers retail products in addition to their services, the competition between service providers is fierce in retail channel.

Such competition between service providers' roles as a buffer to high product price set by manufacturers. In other words, product supply chain is favorable to manufacturers, while service providers suffer. This is why manufacturers can take more profits in retail channel even though $\beta > \beta_p$ in the area of (A).

This research is closely related to the reality of today's complementary goods such as smartphones and e-Books. The case of smartphone and telecommunication service is similar to the situation where β becomes close to β_p retail channel. Consumers generally put more value on smartphone than they do on telecommunication service; hence package price elasticity is formed at the point close to β_p. In this case, retail channel is effective to gain more profit. Indeed, retail channel is preferred by firms and is now a major channel in telecommunication markets. About half the smartphones worldwide are sold in bundles (Ahonen, 2010).

The case of e-Book is quite of the contrary: consumers put more value on e-Book contents. Hence, β is close to β_s, meaning that retail channel is not profitable for firms in general. Retail channel has not been effective also in reality: some e-Book providers in South Korea are selling e-Books bundled with devices, but their strategy is not successful so far. Of course, it is hard say that retail channel is not successful in e-Book markets since bundling in e-Book markets has been prac-

ticed only for one year. However, considering the fact that other famous e-Book devices like Amazon's Kindle and Barnes and Noble's Nook are generally sold alone and not in bundles, retail channel may not be an effective channel choice at least in today's e-Book market.

The limit of this study is that all kinds of costs including production cost and initial service installation cost were not considered in firms' profit functions. We assumed a very ideal profit structure where cost is zero. In the future research, we will consider different cost structures of manufacturers and service providers and see how they affect pricing game. Another next step in this research will be about how sales and contract period influence pricing and profit in retail channel. Parameter analysis will be followed changing the value of package substitutability and service cancellation rate.

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초 록

본 연구는 제품과 서비스가 보완재로서 하나의 패키지로 이용되는 시장에서 결합 판매(Retail channel)와 독립판매(direct channel)가 가격 형성, 총 수익, 소비자 이득에 미치는 영향을 분석하였다.

독립 판매란 제조사와 서비스 제공자가 각각 자신의 제품과 서비스를 독립적으로 판매하는 구조이다. 반면 결합 판매란 서비스 제공자가 자신의 서비스를 제조사로부터 공급받은 제품과 결합하여 하나의 패키지로 소비자에게 판매하는 구조이다.

본 논문의 결과에 의하면 결합 판매는 항상 소비자에게 불리하다. 기업이 결합 판매에 참여하는 경우, 패키지 가격은 항상 직접 판매보다 높게 형성되기 때문이다.

반면, 기업은 일정 조건하에서 결합 판매의 이득을 볼 수 있다. 이러한 조건은 패키지 가격 탄력성과 결합 판매의 가격 완충 효과에 의해 복합적으로 결정된다. 결합 판매를 하기 위해 제조사와 서비스 제공자 사이에 추가적인 수익 분배 계약이 필요할 경우도 존재한다.

본 연구의 결과는 이동통신시장, e-Book 시장에 적용될 수 있으며, 비슷한 특성을 가진 다른 제품-서비스 보완재 시장에도 적용이 가능하다.

주요어: Co-opetition, 보완재, 패키지, 가격 탄력성, 유통 채널 구조, 번들링

학 번: 2012-21047