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Service Cooperation Policy in a Dual-Channel Supply Chain under Service Differentiation

Jun Chen*, Ying Yang

School of Management, Chongqing Jiaotong University, Chongqing, China
Email: *jingmu139@163.com

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Abstract

A service collaboration decision problem in a dual-channel supply chain is studied with the service level and the customer's acceptance of the Internet channel is taken into consideration. Then the Stackelberg decentralized decision model and the centralized decision model are developed for two settings that the retailer provides the same service level in both channels or not. The conclusion implies that the system profits, the manufacturer's optimal profit and retailer's optimal profit are always higher when different services are provided than the same service, and the optimal service level for the direct channel is a little lower than that for the traditional channel under decentralized mode.

Keywords

Supply Chain, Dual-Channel, Service Differentiation, Incentive Mechanism

1. Introduction

In 2000, Lenovo started a large-scale transformation of channel for the first time and turned its strategic direction from product to service. Recent years, the problems of channel structure arrangement and channel conflict in a multi-channel supply chain derived from strong growth of B2C electronic commerce have put forward new challenges for supply chain management. With the increasingly mature of e-commerce market, the competition between enterprises gradually focuses on services rather than products. Therefore, better logistic delivery service and more convenient return, replacement and maintenance service are chosen to increase competitiveness. In the new economic environment, service is not only a core competitiveness of enterprises, but also another important

*Corresponding author.

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measure to maintain market share when facing fierce marketing competition. In a dual-channel supply chain, the difference between online direct channel and traditional retail channel gives rise to differentiation of customer's service experience in each channel, which may alter customers' purchasing behaviors and lead to changes of market demand structure. In order to maximize profit, it has become a focus of concern for service providers to provide differentiated service experience. According to the difference of customers' service experience in different channel, providing differential service to maximize profits has been a focus of the attention paid to by service provider.

Early literatures pay more attention to pricing strategies, and have demonstrated that a direct online channel can effectively reduce the double marginalization in a retailer market and increase the manufacturers' bargaining power [1]. By formulating Bertrand and Stackelberg pricing game models of a dual-channel supply chain, Yao *et al.* obtained the manufacturers' appropriate entry strategies for opening online direct channel [2]. Ahn *et al.* (2002) study the pricing decisions of a manufacturer's direct and retail channel, when the two have spatially separated markets [3]. Cattani *et al*. found that uniform pricing would alleviate channel conflict only when online channel is not convenient enough or costs are higher [4]. Related literatures just focused on differential pricing that can optimize system efficiency [5] and did not consider the influence of service in a dual-channel supply chain. But customers' sensitivity to service quality is more complicated than that to be priced, which might greatly influence the balance of supply chain system [6]. Yao *et al.* argued that opening online channel will force retailers to improve its service level [7]. Based on the difference of service providers, current researches on problems of channel service can be divided into two aspects: supply chain members who provide service independently and one of the members who provides service centrally. As regards the independent service, Yan formulated Stackelberg master-slave game model under the condition of price-service sensitive demand [8]. Xu studied the decision problems of Stackelberg and Nash game when suppliers and retailers provide service independently [9]. Considering the network fitness of product, Yan *et al.* studied the performances of supply chain when retailers provide different level of services [10]. Chen *et al.* established customer channel selection model under the situation that level of services will have effects on demands [10]. Chen *et al*. studied the optimal competitive decisions for chain members when services in different channel are differentiated. They found that service competition makes supply chain with dual-channel superior than that with one channel [11]. Dan *et al.* studied the optimal strategies of service and pricing for retailers in dual-channel supply chain [12]. Various decision schemes under the service competition are conducive to improving supply chain performance, but the loss of system efficiency is still large. Therefore, some scholars turn to study service cooperation in dual-channel supply chain. For example, Xiao studied the pricing strategy in a dual-channel supply chain under service cooperation. The study found that in an electronic channel, the marginal cost of service of the manufacturer and retailer significantly influences the channel price [13]. Luo *et al*. build a mechanism for coordinating supply chain, which is based on the suppliers and retailers to share the service cost [14].

Viewing from the above literatures, the researches related to manufacturers and retailers who provide service independently are rich, but that service cooperation is limited. Different with literature [13], by assuming that the retailers accept the service delegation from the manufacturers and provide differentiated services for customers in different channels rather than the same service, we study the service cooperation strategy and its impact on profits of chain members and supply chain system from the perspective of channel service cooperation, which is based on the difference of customer's service experience.

2. Model Descriptions

As shown in **Figure 1**, we consider a dual-channel supply chain composed of one manufacturer and one retailer, where the manufacturer simultaneously opens traditional retail channel and online direct channel to sell the same

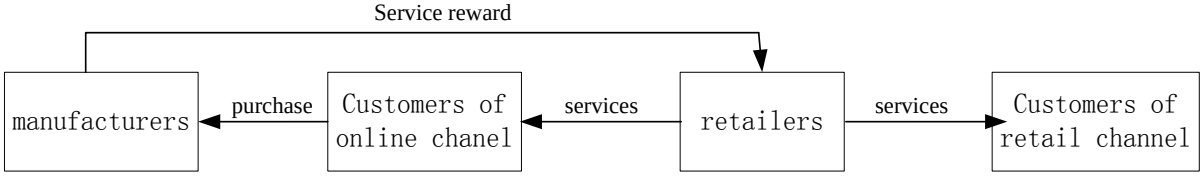

Figure 1. Service cooperation diagram in a dual-channel supply chain.

products. Due to the smaller channel service network, limited service ability and other short factors, the manufacture entrusts its online channel services (e.g., return and replacement service, advertising, mail notification) with the retailer so that customer satisfaction and efficiency of online channel can be improved by using the retailer's service network, service ability and the advantage that directly contact with customers. Thus, the retailer will provide services for the customers of whole market. Based on the different service demand (preference) of different customer groups, the retailer will provide differentiated service for customers in different channels to integrate channel resources and improve operation efficiency of supply chain system. For example, mail service that provided to customers of direct channel and product consulting service that provided to customers of retail channel.

Assuming there is no cross-buying between channels, when the information between manufacturer and retailer is completely symmetrical, the manufacturer sales product in the direct online channel at price p_d and the retailer provides service for online customers at the service level s_d. As return, the manufacturer pays service reward $c(s_d, s_r)$ to the retailer for unit product. The retailer buys products from the manufacturer at wholesale price w and then sales them in the traditional retail channel at price p_r. Meanwhile, the retailer provides services for its customers at service level s_r. The cost for proving the service is $C(s) = (\eta/2)s^2$. The parameter η represents the cost coefficient of the services. Assuming the service level $s \in [0,1]$, the value of 0 represents the retailer does not provide services and 1 represents the retailer provides perfect service.

Since various products are sold online, the degree of customer reaction will be different and there are certain differences in service requirement between different customers. Accordingly we assume that the acceptability θ of online direct channel and the sensitivity λ of customers to the channel service will affect channel demand, where $0 < \theta < 1$ [2], $0 \le \lambda \le 1$. In addition, we assume the demand market as a unit market 1, and the valuation that customers buy product from traditional channel is v $(0 \le v \le 1)$ and that buy from online channel is θv.

Drawn from Chiang's utility model [11], the utility that customers buy product from the online channel is $U_d = \theta v - p_d + \lambda s_d$. When $\theta v - p_d + \lambda s_d > 0$, namely $v > v^d = (p_d - \lambda s_d)/\theta$, the customers will buy from online channel. The utility that customers buy product from traditional channel is $U_r = v - p_r + \lambda s_r$. When $v - p_r + \lambda s_r > 0$, namely $v > v^r = p_r - \lambda s_r$, the customers will buy from retail channel. When $U_d = U_r$, namely $v = v^{dr} = [p_r - p_d + \lambda(s_d - s_r)]/(1-\theta)$, the customers will choose to buy from any of the two channels. Due to v is uniformly distributed in the interval $[0,1]$, we just consider the situation when $v^d < v^r$ to ensure the basic dual channel structure, namely $p_r > \lambda s_r + (p_d - \lambda s_d)/\theta$. The customers will buy from online channel When $v \in [v^d, v^{dr}]$ and buy from traditional retail channel when $v \in [v^{dr}, 1]$. Since the analysis results will not be affected by when the production costs is zero, production costs will not be considered.

Based on the above analysis, the demand of manufacturer and retailer respectively is

$$D_d = \frac{p_r - p_d + \lambda(s_d - s_r)}{1-\theta} - \frac{p_d - \lambda s_d}{\theta} \tag{1}$$

$$D_r = 1 - \frac{p_r - p_d + \lambda(s_d - s_r)}{1-\theta} \tag{2}$$

3. The Optimal Decision under Decentralized Model

Assuming the manufacturer in the dominant position in a supply chain, the retailer is located in the following position. According to the game order of Stackelberg, the retailer treats the manufacturer's direct sale price and the wholesale price as the information that is known and determines its own reaction function firstly, and then the manufacturer decides the optimal sale price in direct channel and the wholesale price that can maximize its profit.

3.1. The Retailer Provides the Same Service

When the retailer regards customers in the two channels as the same and provides the same service, there is $s_d = s_r = s$, namely $p_r > \lambda s + (p_d - \lambda s)/\theta$. The demand function of the manufacturer is given as:

$$D_{d1} = \frac{p_r - p_d}{1-\theta} - \frac{p_d - \lambda s}{\theta} \tag{3}$$

The retailer's demand function is given as:

$$D_{r1} = 1 - \frac{p_r - p_d}{1-\theta} \tag{4}$$

The manufacturers' profits is composed by the revenue gained from sales of the direct channel, the profits gained from sailing products to retailers and the service reward paid to retailers. So there is

$$\pi_{d1} = (p_{d1} - c) D_{d1} + \omega_1 D_{r1} \tag{5}$$

The retailers' profits is composed by the incomes gained from sales of the retail channel, the service reward received from the manufacturer, costs of purchasing and costs of service. There for the retailer's profit is determined by

$$\pi_{r1} = (p_{r1} - \omega_1 - C(s)) D_{r1} + (c - C(s)) D_{d1} \tag{6}$$

Then, the total profits of the decentralized dual-channel supply chain is

$$\pi_{s1} = \pi_{d1} + \pi_{r1} \tag{7}$$

Since manufacturer is the leader, the retailer determines its retail price based on the direct sale price, and according to the game method of Stackelberg master-slave the optimal decision results when retailer provides the same service are gained, which are shown in **Table 1**.

Submitting the optimal direct sale price $p_{d1}^* = (c + \lambda s + \theta)/2$ and the optimal retail price $p_{r1}^* = [2(\lambda s + c) + 3 - \theta]/4$ into Formula (5) and Formula (6), the optimal profits can be obtained by

$$\pi_{d1}^* = \frac{\lambda^2}{4\theta} s^2 + \frac{1}{2}\left(-\frac{\lambda c}{\theta} + \lambda\right) s + \frac{c^2}{4\theta} - \frac{c}{2} + \frac{1+\theta}{8} \tag{8}$$

$$\pi_{r1}^* = -\frac{\lambda\eta}{4\theta} s^3 + \frac{1}{4}\left(\frac{\eta c}{4} - \eta\right) s^2 + \frac{\lambda c}{2\theta} s - \frac{c^2}{2\theta} + \frac{c}{2} + \frac{1-\theta}{16} \tag{9}$$

According to the qualification that $p_r > \lambda s_r + (p_d - \lambda s_d)/\theta$, $p_r > \omega$, $p_d \geq \omega$, and $D_d > 0$, we can obtain $(1-\theta)/2 \leq c < \lambda s + \theta/2$. And as well π_{d1}^* is the quadratic function of c, the profits of manufacture π_{d1}^* will be maximal when unit costs $c = (1-\theta)/2$. At this moment, service reward paid by manufacturers for unit product is constant. This is because there is no competition in services, which means channel services have the same impact on customers of two channels when the retailer provides the same service for customers of the two channels. The indiscrimination of impact of service leads to a higher acceptance of the direct channel θ and a lower service reward. The optimal profits of supply chain system is given by

$$\pi_{s1}^* = \pi_{d1}^* + \pi_{r1}^* \tag{10}$$

3.2. The Retailer Provides Differentiated Services

The manufacturer entrust its direct channel services with the retailer who face with two kinds of customers that have different service requirements. The retailer will sufficiently integrate its resources of service and improve customer satisfaction, providing differentiated services for different customer groups, which means $s_d \neq s_r$.

Table 1. The optimal decisions under the same service level ($s_d = s_r = s$).

p_{d1}^*	$(c + \lambda s + \theta)/2$
ω_1^*	$(-c + \lambda s + 1)/2$
p_{r1}^*	$[2(\lambda s + c) + 3 - \theta]/4$
D_{d1}^*	$0.25 + (\lambda s - c)/2\theta$
D_{r1}^*	0.25

The manufacturer's profit will be given as:

$$\bar{\pi}_{d1} = \left(\bar{p}_{d1} - c\right)\bar{D}_{d1} + \bar{\omega}\bar{D}_{r1} \tag{11}$$

The retailer's profits composed with the sales revenue, service rewards gained from manufacturer and costs for purchasing and providing differentiated service will be changed because of the service costs generated by providing differential service. The profits of retailer is given by

$$\bar{\pi}_{r1} = \left(\bar{p}_{r1} - \bar{\omega}_1 - C\left(s_r\right)\right)\bar{D}_{r1} + \left(c - C\left(s_d\right)\right)\bar{D}_{d1} \tag{12}$$

By solving Equation (11) and (12), the optimal decisions when the retailer provides differentiated services can be obtained. The results are shown in **Table 2**.

Substituting each optimal result in **Table 2** into $\bar{\pi}_{d1}$ and $\bar{\pi}_{r1}$, the optimal profits is given as follows:

$$\begin{aligned}\bar{\pi}_{d1}^{*} = \frac{1}{2}\Bigg(& A_1 s_r^4 + A_1 s_d^4 - 2A_1 s_d^2 s_r^2 - A_2 s_r^3 - A_2 s_d^3 + A_2 s_r^2 s_d + A_2 s_d^2 s_r + A_3 s_r^2 \\ & + A_4 s_d^2 - \lambda^2 s_d s_r + \frac{(3-2\theta)\lambda}{4} s_r + A_5 s_d + A_6 \Bigg)\end{aligned} \tag{13}$$

$$\begin{aligned}\bar{\pi}_{r1}^{*} = \frac{1}{2}\Bigg(& \frac{1}{2}A_1 s_r^4 + \frac{1}{2}A_1 s_d^4 - A_1 s_d^2 s_r^2 - \frac{1}{2}A_2 s_r^3 - \left(\frac{1}{2}A_2 + \frac{\lambda\eta}{2\theta}\right)s_d^3 + \frac{1}{2}A_2 s_r^2 s_d + \frac{1}{2}A_2 s_d^2 s_r \\ & + \frac{1}{2}A_3 s_r^2 + B_1 s_d^2 - \frac{\lambda^2}{2} s_d s_r + \frac{(3-2\theta)\lambda}{8} s_r + B_2 s_d + B_3 \Bigg)\end{aligned} \tag{14}$$

where

$$A_1 = \frac{\eta^2}{16(1-\theta)},\quad A_2 = \frac{(3-2\theta)\eta\lambda}{8(1-\theta)},\quad A_3 = \frac{\lambda^2}{2} - \frac{\eta}{4},$$

$$A_4 = \frac{\eta - \eta\theta}{8(1-\theta)} + \frac{\eta}{8} + \frac{(1+\theta)}{2\theta}\lambda^2,\quad A_5 = \frac{\lambda}{4} - \frac{\lambda c}{\theta} + \frac{\theta\lambda}{2},\quad A_6 = \frac{c^2}{2\theta} - c + \frac{\theta+1}{4},$$

$$B_1 = -\frac{3\eta}{8} + \frac{\lambda^2}{4} + \frac{\eta c}{2\theta},\quad B_2 = \frac{\lambda c}{\theta} - \frac{(3-2\theta)\lambda}{8},\quad B_3 = -\frac{c^2}{\theta} + c + \frac{1-\theta}{8}$$

According to the qualification that $p_r > \lambda s_r + \left(p_d - \lambda s_d\right)/\theta$, $p_r > w$, $p_d \geq w$ and $D_d > 0$, we can obtain $\bar{c}^{*} = \left(1 - \theta + \eta s_d^2/2 - \eta s_r^2/2 + \lambda s_r - \lambda s_d\right)/2$ when π_d is the maximal. When the retailer provides differentiated services, unit service reward paid by the manufacturer to the retailer is decided by service level. The optimal profit of supply chain system is $\bar{\pi}_{s1}^{*} = \bar{\pi}_{d1}^{*} + \bar{\pi}_{r1}^{*}$.

4. The Optimal Decision under Centralized Model

4.1. Retailer Provides the Same Service

Setting the maximal supply chain system profit as the goal, the first-order derivatives of (7) are taken with

Table 2. The results of optimal decisions under differentiated services $s_d \neq s_r$.

$\bar{p}_{d1}^{*}$	$\left(c + \theta + \lambda s_d\right)/2$
$\bar{\omega}_1^{*}$	$\left(-c + 1 - \eta s_r^2/2 + \eta s_d^2/2 + \lambda s_r\right)/2$
$\bar{p}_{r1}^{*}$	$\left[(3-\theta)/2 + c + \eta\left(s_r^2 - s_d^2\right)/4 - \lambda\left(s_d - 3s_r\right)/2\right]/2$
$\bar{D}_{d1}^{*}$	$\eta\left(s_r^2 - s_d^2\right)/8(1-\theta) + \left(\lambda s_d(1+\theta) - 2\theta s_r\right)/2\theta - c/2\theta + 0.25$
$\bar{D}_{r1}^{*}$	$-\eta\left(s_r^2 - s_d^2\right)/8(1-\theta) - \lambda\left(s_d - s_r\right)/2 + 0.25$

respect to p_{d2} and p_{r2}, respectively, and then one can obtain the optimal direct sale price p_{d2}^* and the optimal retail price p_{r2}^*, which are given as:

$$p_{d2}^* = \frac{1}{2}\left(\frac{\eta s^2}{2} + \lambda s + \theta\right) \tag{16}$$

$$p_{r2}^* = \frac{1}{2}\left(\frac{\eta s^2}{2} + \lambda s + 1\right) \tag{17}$$

The optimal profits of supply chain is

$$\pi_{s2}^* = \frac{\eta^2}{16\theta}s^4 - \frac{\lambda\eta}{4\theta}s^3 + \left(\frac{\lambda^2}{4\theta} - \frac{\eta}{4}\right)s^2 + \frac{\lambda}{2}s + \frac{1}{4} \tag{18}$$

4.2. Retailer Provides Differentiated Services

Under a centralized decision-making model, the profit of dual-channel supply chain composed of sales revenue in two channels and service costs is given by

$$\overline{\pi}_s = \left(\overline{p}_{d2} - C\left(s_d\right)\right)\overline{D}_{d2} + \left(\overline{p}_{r2} - C\left(s_r\right)\right)\overline{D}_{r2} \tag{19}$$

Setting the maximal system profit as the goal, the first-order derivatives of (19) are taken with respect to p_{d2} and p_{r2}, respectively, and then one can obtain the optimal direct sale price p_{d2}^* and the optimal retail price p_{r2}^*, which were given as:

$$\overline{p}_{d2}^* = \frac{1}{2}\left[\frac{\theta\eta}{2(1-\theta)}s_r^2 + \frac{(1-2\theta)\eta}{2(1-\theta)}s_d^2 + \lambda s_d + \theta\right] \tag{20}$$

$$\overline{p}_{r2}^* = \frac{1}{2}\left[\frac{(2-\theta)\eta}{2(1-\theta)}s_r^2 - \frac{\eta}{2(1-\theta)}s_d^2 + \lambda s_r + 1\right] \tag{21}$$

The optimal profit of supply chain is

$$\begin{aligned}\overline{\pi}_{s2}^* = {} & \frac{(1-2\theta)\eta^2}{16\theta(1-\theta)^2}s_d^4 - \frac{3\theta\eta^2}{16(1-\theta)^2}s_r^4 + \frac{4\theta\eta^2}{16(1-\theta)^2}s_d^2 s_r^2 - \frac{\lambda\eta}{4\theta(1-\theta)}s_d^3 \\ & + \frac{(3\theta-2)\lambda\eta}{8(1-\theta)^2}s_r^3 + \frac{\lambda\eta}{4(1-\theta)}s_d^2 s_r + \frac{(2-3\theta)\lambda\eta}{8(1-\theta)^2}s_r^2 s_d + \frac{\lambda^2}{4\theta(1-\theta)}s_d^2 \\ & + \left(\frac{\lambda^2}{4(1-\theta)} - \frac{\eta}{4}\right)s_r^2 - \frac{\lambda^2}{2(1-\theta)}s_d s_r + \frac{\lambda}{2}s_r + \frac{1}{4}\end{aligned} \tag{22}$$

5. Numerical Experiments and Analysis

Considering the overall profits cannot be observed intuitively, on the premise of corporation we study the improvements of supply chain member's profits and system profits when the retailer provides differentiated service. The following, we use numerical test to analyze the impact on profits of the manufacturer, retailer and the supply chain system when the retailer provides the same and differentiated service under the two decision-making modes. Based on a type of electronic products, we assume that the customer's acceptance of direct channel is $\theta = 0.7$ and the sensitivity of the channel service is $\lambda = 0.3$, $\eta = 0.4$. Using MatLab 7.11 to commutate, the optimal results is shown in **Figures 2-7** and **Tables 3-5**.

Table 3 shows that the same optimal level of service provided by retailer is 0.17 and the optimal profits of the retailer and manufacturer are respectively 0.0807 and 0.1665 in a decentralized supply chain. Due to the factor of service cost and other factors, the retailers' profits will increase earlier and then decrease with the improvement of service level, while the manufacturer's profits will always increase with the improvement of service level. The reason is the service reward paid by manufacturer is only related to consumer's acceptance of direct

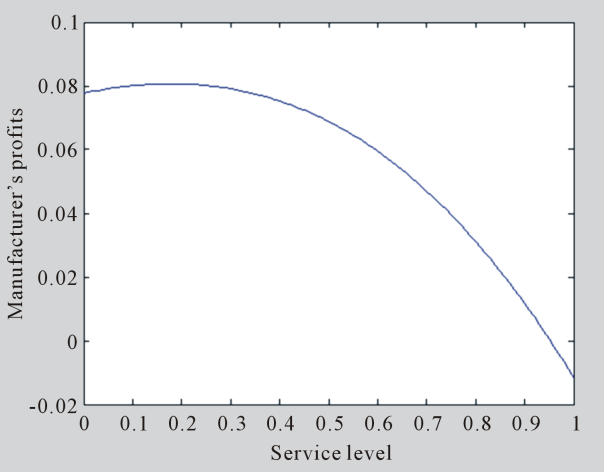

Figure 2. The retailers' profits at the same service level under decentralized decision-making.

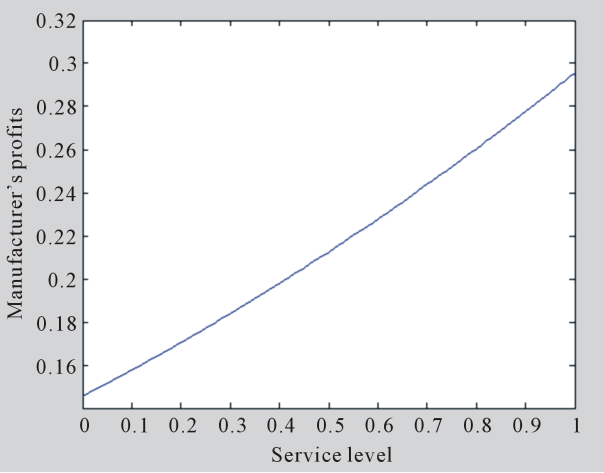

Figure 3. The manufacturers' profit at the same service level under decentralized decision-making.

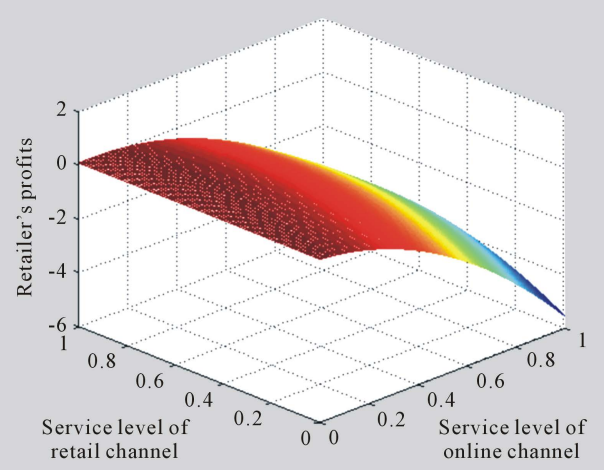

Figure 4. The retailers' profits at different service level under decentralized decision-making.

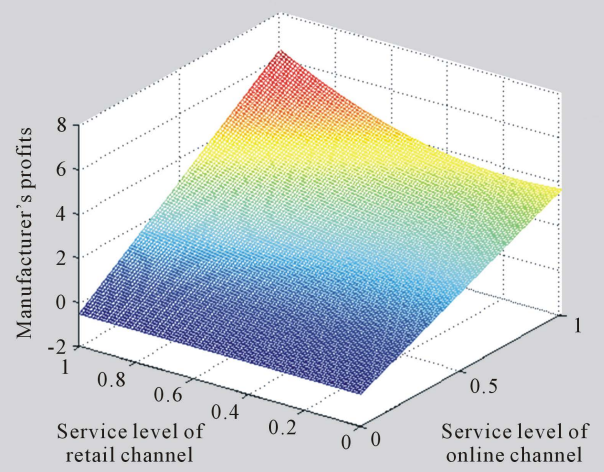

Figure 5. The manufacturers' profit at different service level under decentralized decision-making.

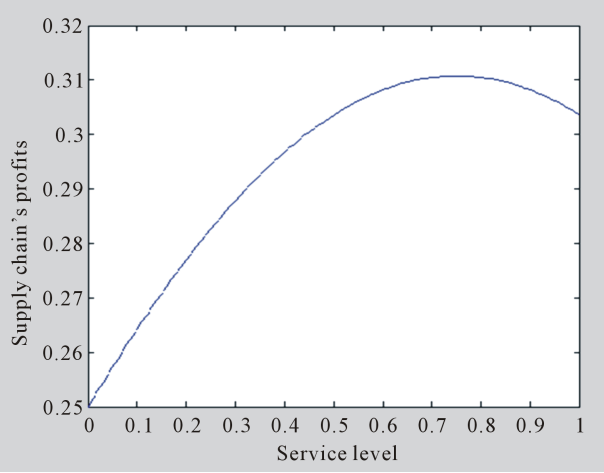

Figure 6. Supply chain profits at the same service level under centralized decision.

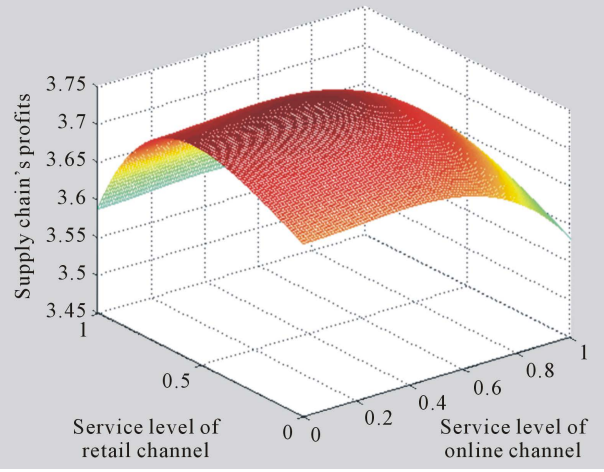

Figure 7. Supply chain profits at different service level under centralized decision.

Table 3. Profits at the same service level under Decentralized decision-making.

s	π_{r1}	π_{d1}	π_{s1}
0.05	0.0791	0.1515	0.2306
0.10	0.0801	0.1576	0.2377
0.17	0.0807	0.1665	0.2472*
0.50	0.0688	0.2125	0.2813
0.80	0.0312	0.2604	0.2916

Table 4. Profit at the different service level under decentralized decision-making.

s_d	s_r	$\overline{\pi}_{r1}$	$\overline{\pi}_{d1}$	$\overline{\pi}_{s1}$
<0.1	>0.12	>0	-	-
0.12	0.8	0.1006	0.1384	0.2390
0.14	0.74	0.1020	0.2113	0.3133*
0.15	0.72	0.0834	0.2515	0.3349
>0.22	<0.6 or >0.9	-	>0	-

Table 5. Supply chain profit under centralized decision.

The same service		The differentiated service		
s	π_{s2}	s_d	s_r	$\overline{\pi}_{s2}$
0.30	0.2879	0.20	0.50	3.738
0.50	0.3026	0.30	0.20	3.713
0.74	0.3178*	0.43	0.54	3.742*
0.80	0.3105	0.65	067	3.721
0.90	0.3082	0.77	0.54	3.689

channel and the customer demand of direct channel will increase with the improvement of service when the retailer provides the same service for the two channels.

The **Table 4** shows that the optimal level of differentiated service provided by the retailer respectively are s_d = 0.14 and s_r = 0.74 and the optimal profits of supply chain is 0.3133 in a decentralized supply chain. Despite there still have rooms for improving profits of supply chain system (e.g., 0.3349), at this moment the retailer's profits will decrease. Therefore, the retailer will not make this decision. The **Figure 4** and **Figure 5** shows that the retailer will not provide a higher service to customers of direct channel for maximizing its own profits and the manufacturer will require a higher service level for both channels to maximize its profits.

Comparing **Table 3** and **Table 4**, we can find that under the decentralized decision-making, manufacturer, retailer and supply chain's profits at the different service are higher than those at the same service, namely differential service is better than the same one; Compared to the same service, when retailers provide differentiated services the direct channel service level is slightly lower, retail channel service level increases slightly, but the two sides' profits increase.

In **Table 5**, the optimal service level which is provided by retailer equally is 0.74 and the corresponding system profit is 0.3178. The optimal differentiated service level respectively are s_d = 0.43 and s_r = 0.54 and correspondingly system profits is 3.742. **Table 5** shows that whether the retailer provides the same or differentiated services, system profits will increase at first and then decrease with the improvement of service level. Meanwhile, when the retailer provides differentiated services the profits of supply chain are always greater than that when the retailer provides the same services.

By comparing **Table 3**, **Table 4** and **Table 5**, we can find that no matter the retailer provides the same or differentiated services system profit in a centralized supply chain is always greater than that in a decentralized supply chain.

The numerical experiments shows that the retailer provides differentiated services is always better than provides the same service when the manufacturer and the retailer cooperate in service, and in a centralized decision-making model differentiated services provided by the retailer can maximize profits of supply chain system. To achieve the win-win cooperation and ensure the availability of the direct channel services, the manufacturer should establish strategic alliance with the retailer in order to share the information of demand forecasts and services. For further improving the operation performance of supply chain, the manufacturer should enhance the incentive power to motivate the retailer to provide a higher service level, such as appropriately increasing the service reward and the ratio of profit return.

6. Conclusion

As the key factors that influence consumer purchase behavior, Channel service is hard to be quantified. In this paper, by assuming that the information is completely symmetrical and there is no cross-buying situation, we study the strategy of service cooperation in a dual-channel supply chain that the manufacturer entrust its service to the retailer. We analyze the impact of differentiated services provided by the retailer on the profits of manufacturer, retailer and supply chain system in a centralized and a decentralized supply chain. The study found that differentiated services can optimize the system's profits in a centralized supply chain, and under the two decision-making models, differentiated services can simultaneously improve the profit of supply chain members. But in a decentralized supply chain, when the retailer provides differentiated services, the optimal service level provided for customers of direct channel will be slightly lower than that provided for traditional channel, and the manufacturer can't achieve the optimal profit at this time. Therefore, the manufacturer needs to motivate the retailer to improve its service level. It is noted that some assumptions in this paper are very strict, such as no cross purchase behavior among the consumers and information between the manufacturers and the retailer are completely symmetrical. All of these need further study and perfection.

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