



## Mixed Channel OEM Supply Chain Pricing and Service Competition Strategy Considering Brand Dealer Penalties

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### Abstract

The paper constructs a mixed channel OEM supply chain model consisting of brand dealer and manufacturer, with brand dealer acting as the main parties of Stackelberg and manufacturer as the subordinate. This paper compares the profit changes of the supply chain in three situations: single brand channel, the mixed dual channel after the manufacturer opens the direct channel and dual channels where brand dealer penalize manufacturer for direct sales channels. The research results prove that the introduction of direct sales channels by manufacturer can enhance the advantages of the game and gain more profits. Under certain conditions, brand dealer would also benefit from the introduction of direct sales channels, so as to achieve a win-win result. When brand dealers' profits are infringed, brand dealer can reduce the losses caused by direct sales channels by punishing direct sales channels. What's more, the better the direct channel acceptance, the better the effect of the method. The total profit of the supply chain is reduced with the increase of the direct channel acceptance.

**Key words:** Mixed channel; Brand premium; Price and service decision; Punishment means

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### INTRODUCTION

With the rapid development of China's economy, a large number of international brands have entered the Chinese

market. Generally speaking, there are two choices for brands to enter the new market. Investment construction and cooperation with large manufacturers. Because China's own processing industry is relatively mature and its processing cost is relatively low, most brands choose to cooperate with large manufacturers. For example, Clothing brands like "Zara" "Mango", sports brands like "Adidas" "Nike" did not choose to build their own factories in China. In addition, some well-developed brands may also retain high-value-added services such as design and sale, and outsource their production and processing to manufacturers. Manufacturers are in a weak position in cooperation with famous brand. In order to weaken the strong dominant power of brand owners, many manufacturers have opened up their own direct sales channels. On the hand, the purpose of manufacturers to develop direct marketing channels is to gain more consumer surplus and expand business scale. On the other hand, they form the relationship between the cooperation and competition with the brands, so as to gain more status in the supply chain of the game with the brands.

In real life, we observed on Taobao platform that merchants sale goods with "tailstock" and "original goods". This is a scenario in which manufacturers open direct sales channels. After supplying the Brand dealers with the agreed quantity of products, the manufacturers also sells the surplus products directly at a cheap price. It has become a common phenomenon for manufacturers to open direct channels in real life. In most cases, the leading brands will sign contracts with manufacturers and formulate corresponding penalties (in order to maintain the market share and profits of brand owners, prevent low-price products from direct channels from disrupting market order, etc.), For example, the U.S. depot inc. canceled cooperation with all manufacturers that use direct marketing channels (Jiang, Li, & He, 2016, pp.145-151). Of course in certain cases, manufacturers' opening up direct sales channels are also beneficial to

brand owners. Therefore, the first research content of this article lies in the influence of the manufacturers' private direct sales channels on the brand under different market conditions. The second research focuses on how brands take advantage of its dominant position and use punishments to curb the impact of manufacturers' direct sales channels.

A mixture of brand channels and direct selling channels exist between manufacturers and brands. In such a competitive partnership, it is possible to gain more benefits because of the introduction of new consumer groups, and may also lead to channel conflicts, thus reducing the efficiency of the supply chain. Therefore, the effective coordination of the mixed channel supply chain is significant. At present, the research of dual-channel supply chain mainly focuses on the problem of dual-channel supply chain coordination where manufacturers dominate. For example, Dumrong Siri, Fan, Jain and Moinzadeh (2008, pp.691-718) found that when manufacturers have high distribution costs, small wholesale prices and small changes in market demand, it is more advantageous to choose dual channel sales than single channels; Park and Keh (2003, pp.155-167) analyzed the pricing game under the three forms of direct sales, retail and mixed channels, and found that the introduction of direct channels would reduce market prices and increase market sales; Tsay and Agrawal (2004, pp.93-110) believed that if considering the cost of sales from different channels, the increase in direct sales channels would not have a negative impact on the retail channel. On the contrary, retailers hoped that manufacturers can increase direct sales channels. Dan Bin, Xu Guangye and Zhang Xumei (2016, pp.125-130) constructed the dual-channel supply chain model under the e-commerce environment and compared the optimal prices of the dual-channel supply chain under centralized and decentralized decision-making. Chiang, Chhajed and Hess (2003, pp.1-20) used game theory to analyze the competition between the manufacturer's online channel and the traditional retail channel. They believed that the online channel restricts the retailer's pricing behavior, but as the wholesale price decreased, the total sales would increase, and the benefits of both sides would increase. Eventually, the coordination between traditional channels and online channels would be realized. Yao and Liu's research (2005, pp.235-247) showed that OEM' adjustments to wholesale prices can harmonize the conflict between traditional channels and e-direct channels; Yan and Pei (2009, pp.306-314) studied the balance of prices and services after manufacturers opened up direct sales channels. Retailers are influenced by fierce competition, which would improve their service level, and make the whole supply chain have better performance.

At present, there are also some scholars concerned about the coordination of the OEM supply chain, which is dominated by brand dealers. Fan Xiaojun (2017) demonstrated that when the product online fitness is high enough, the introduction of online channels by OEM supply chain can motivate retailers to improve service quality. The higher the product's online fitness, the more obvious the improvement of service quality. Under certain conditions, the introduction of online channels can achieve win-win results for both brand dealer and manufacturer. Jiang Jinde (Jinang, Li, & He, 2016, pp.145-151; Jin, Li, & Song, 2014) demonstrated that the price discount and income compensation coordination mechanism can maximize the total profit of the supply chain and achieve a perfect win-win coordination among the members of the mixed channel supply chain. The article considered changes in the dual-channel utility after the introduction of direct sales channels, but did not investigate the costs of manufacturers in opening up direct sales channels.

The biggest difference between this study (consider the mixed channel OEM supply chain price and service competition strategy of the brand dealers' penalties) and the existing dual-channel supply chain coordination problem is that: In the traditional dual channel problem, the manufacturer is in the dominant position, generally the main side of the Stackelberg. In the mixed channel of brand channel and direct sell channel, the brand dealers are in the main side of the Stackelberg because of more market position. Therefore, the brand dealers can use dominant position to formulate "punishment measures" to effectively coordinate the manufacturers to open up direct channel problems, thus making the best profit. This study is based on the perspective of the dominant brand merchants, and studies how to formulate measures under the premise of manufacturers' new direct channels. The research would enrich and expand existing dual-channel supply chain coordination research, and it has strong practical significance.

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## 1. DECISION UNDER THE SINGLE BRAND CHANNEL

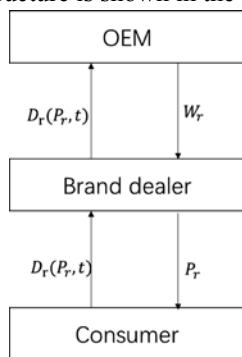
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In this paper, we use the subscript  $s$  to express the direct sales channel, use the subscript  $r$  to express the brand channel, and use the subscript  $sr$  to express the whole supply chain. The subscript 1, 2, and 3 correspond to the three situations in this article, the single channel, the mixed channel, and the brand merchant to punish the direct sales channel. let's explain the mathematical symbols involved in this article: Table 1 will explain the mathematical symbols involved in the paper.

**Table 1**  
**The Mathematical Symbols Involved in the Paper**

Parameter	Meaning
$P_{ri}$	Sales price of brand channel, $i=1, 2, 3$ represent different situations discussed in this paper;
$P_{si}$	Sales price of direct sales channel, $i=2, 3$ represent different situations discussed in this paper;
$D_{ri}$	market demand of brand channel, $i=1, 2, 3$ represent different situations discussed in this paper;
$D_{si}$	market demand of direct sales channel, $i=2, 3$ represent different situations discussed in this paper;
$W_{ri}$	Wholesale price of brand channel, $i=1, 2, 3$ represent different situations discussed in this paper;
$h_i$	Profit level obtained by brand dealers, $i=1, 2, 3$ represent different situations discussed in this paper;
$\lambda$	The consumer acceptance level of direct sell channel, we assume that under the same conditions, consumers' acceptance of direct sell channel is lower than the acceptance level of brand channel. $0 < \lambda < 1$ ;
$d$	Brand promotion coefficient of brand channel, Represents a unit brand service effort corresponding to the brand premium situation;
$t$	The promotion level of brand service, Represents the effort of the brand to pay for the brand premium.

Under the single brand, there is only a single manufacture and a single brand dealer. The game decision is a vertical game between the manufacturer and the retailer, and its structure is shown in the following figure 1.



**Figure 1**  
**Structure Under the Single Brand Channel**

### 1.1 Requirement Function

In a single channel, consumers only buy in brand channels. The value of products is represented by  $V$ . Due to the heterogeneity of consumers, the evaluation of product value would be different, assuming that the product value is evenly distributed among  $[0,1]$ . By offering  $t$  brand service, the brand brings  $dt$  premium to consumers. The utility of the consumer is (Fan, Liu, 2017):  $U_r = V - P_r + dt$ , Therefore, only when the product value  $V_r = P_r - dt > 0$ , would the consumer buy the product. Consumer demand for brand channels is  $D_r = 1 - P_r + dt$

### 1.2 Pricing and Service Decision

In the single brand channel, the brand dealer occupies the dominant position, the manufacture and the brand dealer carry on the sequential Stackelberg, its actual decision order is: the brand dealer first decides its profit level  $h_1$  and the brand service level  $t_1$ , Therefore, the selling price of brand channels is  $P_{r1} = W_{r1} + h_1$ . The manufacture decides the optimal wholesale price  $W_{r1}$  under the brand profit level  $h_1$  and brand service level  $t_1$  have been decided, We use the inverse order to solve the problem.

The manufacture's profit expression is  $\pi_{s1} = W_{r1}D_{r1} = W_{r1}(1 - P_r + dt)$

The brand dealer's profit expression is  $\pi_{r1} = (P_{r1} - W_{r1})D_{r1} - t_1^2 = h_1(1 - P_r + dt) - t_1^2$ ,

Decision result is:

The best profit level of the brand is  $h_1 = \frac{2}{8-d^2}$ ; The best wholesale price is  $W_{r1} = \frac{2}{8-d^2}$ ;

The optimal price of brand channel is  $P_{r1} = \frac{6}{8-d^2}$ ; The best service level of brand dealer is  $t_1 = \frac{d}{8-d^2}$

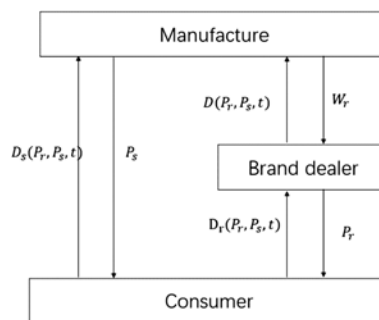
The demand for brand channel is  $D_{r1} = \frac{2}{8-d^2}$ ; The biggest profit for the brand dealer is  $\pi_{r1} = \frac{1}{8-d^2}$ ;

The biggest profit for the OEM is  $\pi_{s1} = \frac{4}{(8-d^2)^2}$ ; The total profit of the supply chain is  $\pi_{sr1} = \frac{12-d^2}{(8-d^2)^2}$ ;

The constraint that must be met is  $8-d^2 > 0$

## 2. OEM MIXED DUAL CHANNEL DECISION

The mixed channel refers to brand channels and direct sales channels opened up by manufacture. There is a vertical game and horizontal game decision between the brand dealers and the manufacture, which makes the channel chaos easily. Its structure is shown in figure 2 below.



**Figure 2**  
**Structure Under Mixed Channel**

### 2.1 Requirement Function

When manufacture introduce direct sell channels, consumers can buy goods from brand channels and direct sales channels, use  $V$  to express the value of the product and assume a uniform distribution between  $[0, 1]$ . Consumers can obtain brand premiums in the brand

channel, and the brand channel construction is more mature, so the acceptance of brand channels is even higher. Assume that the consumer acceptance of the brand channel is 1, the acceptance of the direct sales channel is  $\lambda$  ( $\lambda < 1$ ). For the brand channel, the utility obtained by the consumer is:  $U_r = V - P_r + dt$  that is, if the value of the product is distributed among  $[P_r - dt, 1]$ , the consumer will purchase the product from the brand channel. For direct sales channels, the utility that consumers get is:  $U_s = \lambda V - P_s$  that is, consumers only purchase the product in the direct sales channel when the product value is distributed among  $[\frac{P_s}{\lambda}, 1]$ . When  $U_r = U_s$ , namely  $V_{rv}^* = \frac{P_r - P_s - dt}{1 - \lambda}$ , Consumers purchase indifference goods from two channels. When  $V_{rs} < V_{rs}^*$ ,  $U_r < U_s$ . The utility of buying from direct sales channels is higher at this time, when  $V_{rs} > V_{rs}^*$ ,  $U_r > U_s$ . The utility of buying from brand channels is higher.

When  $V_s < V_r$ , we get  $V_s < V_r < V_{sr}$ . Firstly assume  $V_{sr} < 1$ , namely  $0 < V_s < V_r < V_{sr} < 1$ , When the product value among

$[0, \frac{P_s}{\lambda}]$ , consumers will not buy goods from any channel, when the product value among  $[\frac{P_s}{\lambda}, \frac{P_r - P_s - dt}{1 - \lambda}]$ , consumers will buy from direct sales channel, when the product value among  $[\frac{P_r - P_s - dt}{1 - \lambda}, 1]$ , consumers will choose to purchase from the brand channels.

When  $V_s < V_r$ , we get  $V_s < V_r < V_{sr}$ . Secondly assume  $V_{sr} > 1$ , namely  $0 < V_s < V_r < 1 < V_{sr}$ . When the product value among  $[0, \frac{P_s}{\lambda}]$ , consumers will not buy goods from any channel. when the product value among  $[\frac{P_s}{\lambda}, 1]$ , consumers will buy from direct sales channel.

When  $V_r < V_s$ , we get  $0 < V_{sr} < V_r < V_s < 1$ , When the product value among  $[P_r - dt, 1]$ , consumers will not buy goods from any channel, when the product value among  $[P_r - dt, 1]$ , consumers will choose to purchase from the brand channels.

**Table 2**  
**Channel Market Requirements Under Different Defined Domains**

Domain	The market demand of direct sales channel	The market demand of brand channel
$0 < V_s < V_r < V_{sr} < 1$	$\frac{P_r - P_s - dt}{1 - \lambda} - \frac{P_s}{\lambda}$	$1 - \frac{P_r - P_s - dt}{1 - \lambda}$
$0 < V_s < V_r < 1 < V_{sr}$	$1 - \frac{P_s}{\lambda}$	0
$0 < V_{sr} < V_r < V_s < 1$	0	$1 - P_r + dt$

The premise of this article is that the manufacture opens up direct sales channels and forms a horizontal competition with the brand dealer, the cases of the second single channel and the third single channel would not be considered. This article only considers the case of  $0 < V_s < V_r < V_{sr} < 1$ , namely the market demand of direct sales channel is  $D_s = V_{sr} - V_s = \frac{P_r - P_s - dt}{1 - \lambda} - \frac{P_s}{\lambda}$ , the market demand of brand channel is  $D_r = 1 - V_{sr} = 1 - \frac{P_r - P_s - dt}{1 - \lambda}$ .

**2.2 Pricing and Service Decisions.**

In mixed channels, a sequential Steinberg game is also carried out between manufacture and brand dealer. Its actual decision order is: the brand dealer first decides its profit level  $h_2$  and the brand service level  $t_2$ . Therefore, the selling price of brand channels is  $P_{r2} = W_{r2} + h_2$ . The manufacture decides the optimal wholesale price  $W_{r1}$  and the selling price of direct sales channel  $P_{s2}$  under the brand profit level  $h_2$  and brand service level  $t_2$  have been decided, we use the inverse order to solve the problem.

The manufacture's profit expression is  $\pi_{s2} = W_{r2} D_{r2} + P_{s2} D_{s2} = W_{r2} (1 - \frac{P_r - P_s - dt}{1 - \lambda}) + P_{s2} (\frac{P_r - P_s - dt}{1 - \lambda} - \frac{P_s}{\lambda})$

The brand dealer's profit expression is  $\pi_{r2} = (P_{r2} - W_{r2}) D_{r2} = t_2^2 (1 - \frac{P_r - P_s - dt}{1 - \lambda}) - t_2^2$

Decision result is:

The best profit level of the brand is  $h_2 = \frac{4(1-\lambda)^2}{8-8\lambda-d^2}$ ;  
 The best service level of brand dealer is  $t_2 = \frac{d-d\lambda}{8-8\lambda-d^2}$ ;  
 The best wholesale price is  $W_{r2} = \frac{1}{2} + \frac{d^2(1-\lambda)-4(1-\lambda)^2}{2(8-8\lambda-d^2)}$ ;  
 The optimal price of brand channel is  $P_{r2} = \frac{1}{2} + \frac{d^2(1-\lambda)-4(1-\lambda)^2}{2(8-8\lambda-d^2)}$ ;  
 The optimal price of direct sales channel is  $P_{s2} = \frac{\lambda}{2}$ ;  
 The demand for brand channel is  $D_{r2} = \frac{4-4\lambda}{2(8-8\lambda-d^2)}$ ;  
 The demand for direct sales channel is  $D_{s2} = \frac{4-4\lambda-d^2}{2(8-8\lambda-d^2)}$ ;  
 The biggest profit for the brand dealer is  $\pi_{r2} = \frac{(1-\lambda)^2}{8-8\lambda-d^2}$ ;  
 The biggest profit for the OEM is  $\pi_{s2} = \frac{4(4\lambda-20\lambda^2-4\lambda d^2+12\lambda^3+4\lambda^2 d^2+4)+\lambda d^4}{4(8-8\lambda-d^2)^2}$ ;  
 The total supply chain profit is  $\pi_{sr2} = \frac{4(4\lambda-20\lambda^2-4\lambda d^2+12\lambda^3+4\lambda^2 d^2+4)+\lambda d^4}{(8-8\lambda-d^2)^2} + \frac{(1-\lambda)^2}{8-8\lambda-d^2}$ ;  
 The constraint that must be met is  $8-8\lambda-d^2 > 0$

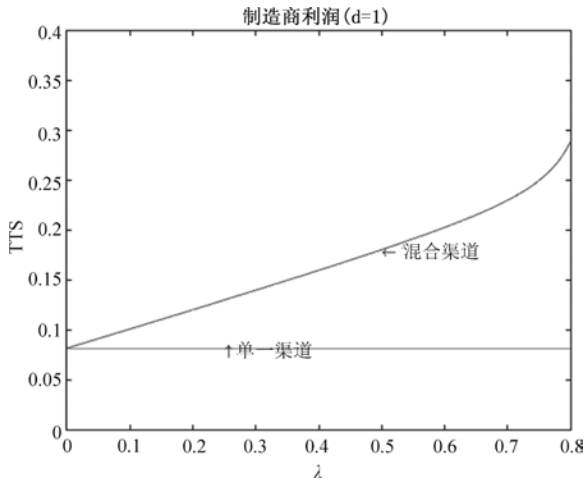
**2.3 Results Analysis**

Comparing the equilibrium results of single-channel and mixed-channel decisions, the following propositions can

be obtained:

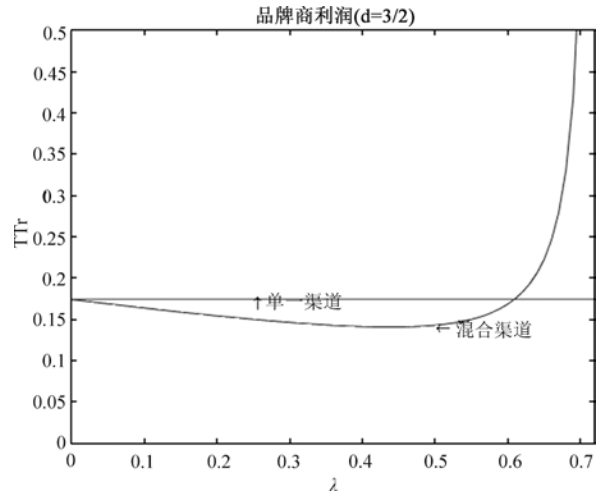
**Theorem 1:** Manufacture can develop direct sales channel to raise their profit level. What's more, the higher the acceptance of direct sales channel, the more obvious the profits of manufacture will be raised.

The reasonable explanation of this theorem is that: In a single brand channel, manufacture is in a weak position. By developing direct sales channel, manufacture can gain more status in the competition. Moreover, the higher the acceptance of direct sales channel  $\lambda$ , the better the effect of opening up direct sales channels. Figure 3 shows the change of manufacture's profit with the acceptance of direct sales channel  $\lambda$  when the brand premium coefficient  $d=1$  is assumed to be brand channel.



**Figure 3**  
**Changes In Manufacturer's Profit With Acceptance of Direct Selling Channel**

**Theorem 2:** It can be seen from  $t_2 - t_1 = \frac{d-d\lambda}{8-8\lambda-d^2} - \frac{d}{8-d^2} = \frac{d^2\lambda}{(8-d^2)(8-8\lambda-d^2)} > 0$ , manufacture's introduction of direct sales channels can stimulate brand dealer to improve their service quality. And from the  $\pi_{r2} - \pi_{r1} = \frac{(1-\lambda)^2}{8-8\lambda-d^2} - \frac{1}{8-d^2} = \frac{-8\lambda+8\lambda^2+2d^2-d^2\lambda^2}{(8-d^2)(8-8\lambda-d^2)}$ , It can be seen that when the condition of  $\lambda > \frac{8-2d^2}{8-d^2}$  is met, the introduction of direct sales channels by manufacture is not only beneficial to manufacture, but also beneficial to brand retailers. The following figure shows the change of brand dealer profit with the acceptance degree  $\lambda$  of the direct sales channel when the brand premium factor of the brand channel is assumed to be  $d = \frac{3}{2}$ . It can be seen that when  $\lambda > \frac{8-2d^2}{8-d^2}$  the profit of the brand dealer in the hybrid channel exceeded the profit of the single channel. Figure 4 below shows the change of brand profit with the acceptance of direct sales channel  $\lambda$  when  $d=3/2$  is assumed.

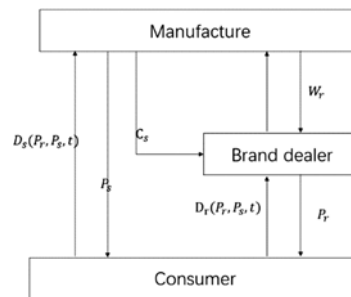


**Figure 4**  
**Changes of Brand Profit With the Acceptance of Direct Sales Channel**

The rational interpretation of this theorem is that there is not only price competition between manufacture and brand dealer but also service competition. When the acceptance of direct sales channels is relatively high, brand dealer can only increase the service level of their brand channels in order to attract consumers. Under the condition of  $\lambda > \frac{8-2d^2}{8-d^2}$ , It is possible for the brand operators to attract new consumers from the direct selling channel by improving the channel service level, thereby improving their overall profit level. Therefore, in real life, some brands strictly prohibit manufacture from opening up direct sales channels by signing contracts or threatening to replace manufacture. However, some brands have adopted a "turn a blind eye" attitude toward manufacture opening up direct sales channels.

### 3. DUAL CHANNELS WHERE BRAND DEALER PENALIZE MANUFACTURE FOR DIRECT SALES CHANNELS

Brand merchants use their dominant position to set up a penalty for each unit of direct selling product, which is shown in figure 5 below. Its market demand function is the same as before.



**Figure 5**  
**The Structure of Dual Channels Where Brand Dealer Penalize Manufacture for Direct Sales Channels**

### 3.1 Pricing and Service Decisions

In a dual channel where brand dealer penalize manufacture for direct sales channel, there is still a sequential Steinberg game between manufacture and brand dealer, and the decision sequence is the same as before. Brand dealer punish manufacturers for their own direct sales channels, and each unit direct product is fined  $C_s$ .

$$\text{The OEM's profit expression is } \pi_{s3} = W_{r3}D_{r3} + P_{s3}D_{s3} - D_{s3}C_s = W_{r2}\left(1 - \frac{P_r - P_s - dt}{1-\lambda}\right) + (P_{s3} - C_s)\left(\frac{P_r - P_s - dt}{1-\lambda} - \frac{P_s}{\lambda}\right)$$

$$\text{The brand dealer's profit expression is } \pi_{r3} = (P_{r3} - W_{r3})D_{r3} - t_3^2 + D_{s3}C_s = h_3\left(1 - \frac{P_r - P_s - dt}{1-\lambda}\right) - t_3^2 + C_s\left(\frac{P_r - P_s - dt}{1-\lambda} - \frac{P_s}{\lambda}\right)$$

Decision result is:

$$\text{The best profit level of the brand is. } h_3 = C_s + \frac{4(1-\lambda)^2}{8-8\lambda-d^2};$$

$$\text{The best service level of brand dealer is } t_3 = \frac{d-d\lambda}{8-8\lambda-d^2}$$

$$\text{The best wholesale price is } W_{r3} = \frac{1}{2} - \frac{C_s}{2} + \frac{d^2(1-\lambda) - 4(1-\lambda)^2}{2(8-8\lambda-d^2)};$$

$$\text{The optimal price of brand channel is. } P_{r3} = \frac{1}{2} + \frac{C_s}{2} \frac{d^2(1-\lambda) + 4(1-\lambda)^2}{2(8-8\lambda-d^2)};$$

$$\text{The optimal price of direct sales channel is } P_{s3} = \frac{\lambda}{2} + \frac{C_s}{2}$$

$$\text{The demand for brand channel is. } D_{r3} = \frac{4-4\lambda^2}{2(8-8\lambda-d^2)};$$

$$\text{The demand for direct sales channel is } D_{s3} = \frac{4-4\lambda^2-d^2}{2(8-8\lambda-d^2)} - \frac{C_s}{2\lambda}$$

$$\text{The biggest profit for the brand dealer is } \pi_{r3} = \frac{\lambda C_s - C_s^2}{2\lambda} + \frac{(1-\lambda)^2}{8-8\lambda-d^2};$$

$$\text{The biggest profit for the OEM is } \pi_{s3} = \frac{-4\lambda^2 - d^2\lambda - 8C_s + 8\lambda C_s + d^2 C_s + 4}{4(8-8\lambda-d^2)} - \frac{C_s(\lambda - C_s)}{4\lambda} + \frac{(1-\lambda)^2(d^2 - 4 + 4\lambda)}{(8-8\lambda-d^2)^2};$$

$$\text{The total supply chain profit is } \pi_{sr2} = \frac{\lambda C_s - C_s^2}{2\lambda} + \frac{(1-\lambda)^2}{8-8\lambda-d^2} + \frac{-4\lambda^2 - d^2\lambda - 8C_s + 8\lambda C_s + d^2 C_s + 4}{4(8-8\lambda-d^2)} - \frac{C_s(\lambda - C_s)}{4\lambda} + \frac{(1-\lambda)^2(d^2 - 4 + 4\lambda)}{(8-8\lambda-d^2)^2}$$

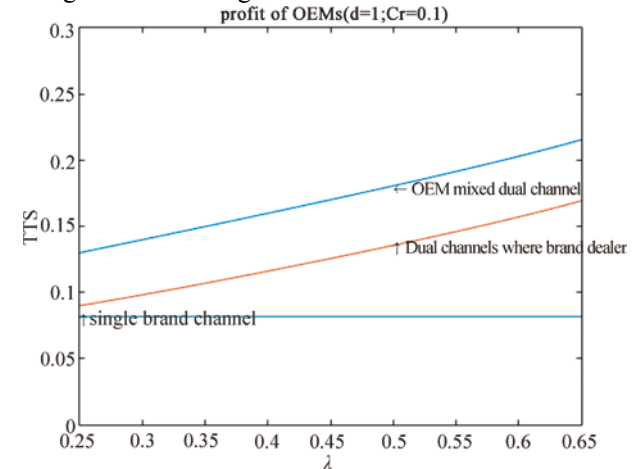
The constraint that must be met is  $8-8\lambda-d^2 > 0$

At the same time, in order to guarantee  $C_s < P_{s3}$  and  $D_{s3} > 0$ , we must meet  $C_s < \lambda$  and  $4\lambda - 4\lambda^2 - \lambda d^2 - 8C_s + 8\lambda C_s + d^2 C_s \geq 0$

### 3.2 Results Analysis

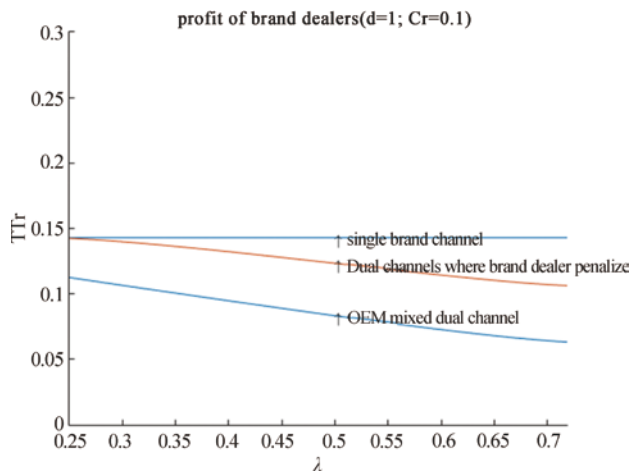
The following theorems are obtained by comparing the equilibrium results of the first single channel, second mixed channels and third kinds of brand dealers to punish the manufacturers by opening direct channels for punishment.

Theorem 1: comparing with OEM mixed dual channel and Dual channels where brand dealer penalize manufacture for direct sales channels :, Due to the restriction of  $\lambda > C_s$  we can see that after the implementation of the punishment measures, the manufacture's profit water is limited. Under other conditions, the manufacture's profit level increases with the increase in the direct sales channel acceptance  $\lambda$ . in order to mitigate the impact of brand punishment, manufacture would increase the sales price of their direct sales channels, so the market demand of direct selling channels would be reduced. The manufacture's profit change is shown in figure 6 below.



**Figure 6**  
**Changes in Manufacture's Profit With Acceptance of Direct Selling Channel**

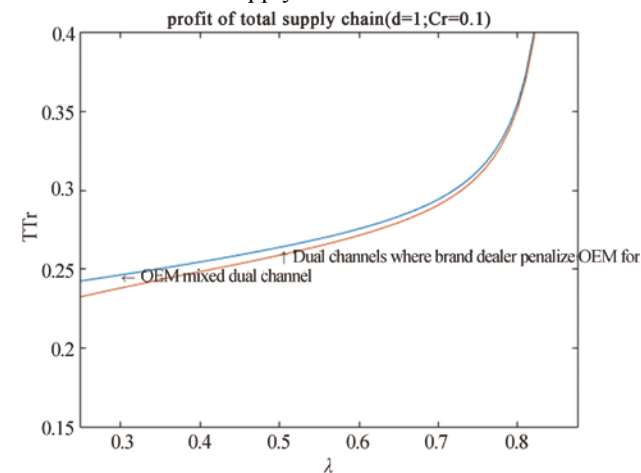
Theorem 2: comparing with OEM mixed dual channel and Dual channels where brand dealer penalize manufacture for direct sales channels.  $\Delta \pi_r = \pi_{r3} - \pi_{r2} = \frac{\lambda C_s - C_s^2}{2\lambda} + \frac{(1-\lambda)^2}{8-8\lambda-d^2} - \frac{(1-\lambda)^2}{8-8\lambda-d^2} = \frac{C_s(\lambda - C_s)}{2\lambda}$ , Due to the restriction of  $\lambda > C_s$  we can see that after the implementation of the punishment measures, the profit level of the brand dealers has increased significantly. The brand dealers can use penalty measures to "recover" some of the profits lost by the manufacture to open up direct sales channels. Under the condition of other fixed conditions, the profit level of the brand merchant increases with the increase of the direct sales channel acceptance  $\lambda$ . When  $4\lambda - 4\lambda^2 - \lambda d^2 - 8C_s + 8\lambda C_s + d^2 C_s = 0$ , namely  $D_{s3} = \frac{4-4\lambda-d^2}{2(8-8\lambda-d^2)} - \frac{C_s}{2\lambda} = 0$ , Branding companies can completely suppress manufacture's behavior of opening up direct sales channels through the establishment of penalties, so that the profits of brand dealer can reach the profit level of a single channel. Figure 7 below shows the change in the profitability of the brand with the direct sales channel  $\lambda$ .



**Figure 7**  
Changes of Brand Profit With the Acceptance of Direct Sales Channel

**Theorem 3:** Compared to the second case of mixed channels, the total profit level of the supply chain in the third scenario is reduced.  $\Delta \pi_{sr} = \Delta \pi_r + \Delta \pi_s = \frac{C_s(\lambda - C_s)}{2\lambda} + \frac{C_s(2\lambda - C_s)}{4\lambda} = \frac{C_s(\lambda - C_s)}{2\lambda} + \frac{C_s(2\lambda - C_s)}{4\lambda} = \frac{C_s(4\lambda - 3C_s)}{4\lambda}$  Due to the restriction of  $\lambda > C_s$ , it can be seen that the total profit of the supply chain decreases after the implementation of the penalty measures. Under other fixed conditions, the total profit of the supply chain decreases with the increase of the direct sales channel acceptance  $\lambda$  and increases with the increase of the unit punishment cost  $C_s$ . Figure 8 below shows the total profit of the supply chain as a function of the degree of acceptance of the direct sales channel

Reasonable explanation: branding penalties for direct sales channels will inhibit the development of direct sales channels and can not improve the service level of brand channels. In general, profits are only redistributed among brands and manufacturers. Moreover, punishment measures inhibit the development of direct sales channels and reduce the total supply chain level.



**Figure 8**  
Total Profit of Supply Chain Changes With the Acceptance of Direct Sales Channels

## CONCLUSION

This paper studies the channel confusion caused by the manufacture opening direct sales channel and compares the profit changes of the supply chain in three situations: single brand channel, the mixed dual channel after the manufacturer opens the direct channel and dual channels where brand dealer penalize manufacture for direct sales channels of the mixed dual channel. The results of the study verified that manufacturers' opening up of direct sales channels would significantly increase their revenues. Under certain conditions, both sides of the game would achieve a win-win result. Fierce channels can help brand channels improve service quality, reduce sales prices, attract more consumers and thus increase profits. At the same time, based on the perspective of brand owners, this research demonstrates that brands' use of their dominant position to punish fixed units of direct sales channels can effectively inhibit manufacturers from opening up direct sales channels. However, this type of restriction would bring about a drop in the total profit of the supply chain.

The main difference between this study and the former is that in the coordination of the supply chain of the OEM production chain, the brand dealers are in the main side of the Stackelberg. It is the first time to study the feasibility of brand dealers to punish direct sales channels from the perspective of branding, which is further enriching and expanding the research on dual channel supply chain.

This gives us some management inspiration: When the channel acceptance rate of direct selling channels is relatively high, opening up direct selling channels is not only beneficial to manufacturers, but also good for brand dealers. Therefore, generally speaking, large manufactures have more conditions to build mature direct sales channels, so brand owners are more likely to accept large manufacturers to open up direct sales channels, and strictly prohibit small workshops to open up direct sales channels. And when the profit of the brand business is infringed, the way to punish the direct channel can be taken, the better the channel acceptance is, the better the effect of the method. At the same time, the total profit of the supply chain would be less obvious with the increase of the direct channel acceptance.

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