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The pricing strategy of the discount of the e-commerce platform under the dual-channel supply chain

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***Abstract**: In the current situation of the rapid development of the Internet, e-commerce platforms attract consumers through shopping discount activities. This paper considers the participation of the first category of consumers under the game between e-commerce platforms and retailers and the second category of consumers who are more inclined to online purchase channels. Two kinds of consumers participate in the dual-channel supply chain network built by manufacturers, retailers and e-commerce platforms, among which manufacturers dominate the sales price of e-commerce platforms and the wholesale price of retailers. Haiser matrix is used to solve the optimal decision price. The results show that after the manufacturer participates in the discount activity of e-commerce platform, the actual purchase price of online channels decreases, while the retail price of offline channels increases, and the number of consumers will increase with the increase of discount rate b. In addition, this paper also studies the impact of platform credibility on the profits of supply chain members and on consumer surplus and social welfare, that is, after the implementation of pooling discount through the e-commerce platform, the platform credibility will contribute to the increase of consumer surplus and social welfare.*

***Keywords**: dual supply chain model； purchase discount； heese matrix； e-commerce platform； platform trust*

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I. The Introduction

At present, with the rapid development of the Internet, the communication between people has become convenient and fast, and all kinds of shops begin to turn to online transactions, to overcome some geographical and temporal limitations, and to create a new transaction mode. Driven by the reverse of the epidemic in recent years, this transaction mode has become more and more extensive, and various trading platforms have also emerged, and the sales strategies launched by Taobao, Jingdong, Pinduoduo and other platforms are becoming more and more novel.

In recent years, with the rapid development of e-commerce platforms, the online transaction volume has been increasing. According to the China E-commerce Market Data Monitoring Report (2022) released by China E-commerce Research Center, China's e-commerce transaction volume reached 43.83 trillion yuan in 2022, up 3.5% year on year. The national online retail sales reached 13.79 trillion yuan, up 4.0% year on year; the rural online retail sales reached 2.17 trillion yuan, up 3.6% year on year; the total import and export volume of cross-border e-commerce reached 2.11 trillion yuan, up 9.8% year on year, accounting for 5.0% of the total import and export volume.In addition, the revenue of e-commerce services reached 6.79 trillion yuan, up 6.1 percent year on year. The number of e-commerce employees reached 69.3718 million, up 3.1% year on year. In such an environment, consider how to get yourself to take more market share in the market? This is a new problem. At present, the platform implements pooling discount activities to reduce the price of products to attract consumers. For example, Pinduoduo implements the activity of "10,000 people join group", and Jingdong Mall offers discounts and "10 billion subsidies" for some commodities. The reason why these can attract consumers is that in a short period of time, these low-price commodities are scarce products for consumers.In his 2020 research, [1] showed that when products or purchase opportunities are scarce, there is competition among consumers, and when they succeed in obtaining the goods, it means that they "win". This repeated stimulus has made consumers more active in buying scarce products. This scarcity comes from the limited number of products provided by merchants, and the increased demand for products, or both, will lead to product scarcity. It is reflected in the e-commerce platform, mainly because the promoters control the promotion time, so that consumers can only buy products during this period, which causes the scarcity of purchase opportunities, thus arousing consumers' desire to buy.

When all kinds of e-commerce platforms implement the discount activity, the discount intensity of each platform, the pricing strategy of manufacturers and their corresponding offline stores are a problem worth considering. Here, this paper mainly considers the credibility of the platform itself and the discount rate of the platform. When the manufacturers are also involved in the supply chain network, the retailers 'sales share will be

affected to some extent. In order to ensure the continuous validity of the two-channel model, the manufacturers need to design decisions to ensure the retailer's profits.Therefore, when the platform implements the pooling discount activities, manufacturers need to consider how to set online channel prices and wholesale prices to maximize profits, and coordinate the revenue relationship with retailers. Through research, we will solve the optimal decision of e-commerce platforms and retailers in the dual-channel model led by manufacturers, analyze this, and put forward some reasonable management suggestions.

II. Literature review

Previous research found that the electric business platform spell discount activity to double channel in the supply chain manufacturers, retailers, electric business platform pricing strategy and profits will have a great impact on [2][3], in this case, this paper is based on the dual channel mode, to solve the manufacturer dominated when electric business platform to buy discount, online channel price and retailers of wholesale price decision, and under the electric business platform is not spell discount, online, retail channels of the optimal sales price. The literature studies related to this article will be detailed in this section. The previous research literature is mainly summarized from three aspects.

Among them, in the study of the dual-channel model of manufacturers, the dual-channel sales model found by Chiang et al. reduces the impact of the "dual marginal effect" on the overall profit of the supply chain to a certain extent, [4]. Lu et al. proposed that the relative effectiveness of the network directly affects the profit function of the manufacturer, and the low effectiveness of the network channel will greatly reduce the profit of the manufacturer [5]. Matsui And other studies show that the pricing order of the wholesale price and the final online sales price affects the overall revenue of the dual-channel supply chain. The decision order of manufacturers deciding the online sales price first and then deciding the wholesale price given offline to retailers will realize the optimization of profits [6].The emergence of retail giants has changed the structure of market rights. When Li and others found that small and medium-sized manufacturers opened online channels, they were limited to the compulsory contracts of retailers and had to follow the price [7] of dominant retailers. Jafari Compared the retailers dominated, under different game mode of dual channel members of the supply chain model, found that retailers income less affected by the game mode, and the retail price under the retailer and manufacturers cooperation [8]. the literature mainly from the aspects of channel rights structure research supply chain pricing strategy, not considering the competition strategy between the channels of the dual channel supply chain members decision.

As for the dual-channel supply chain, the e-commerce platform attracts consumers by implementing the discount activity. In terms of the discount, scholars discussed the price decision of the supply chain and the benefit function of the overall supply chain through the discount. For example, Dhar et al. built a model of the influence of cross-discount coupon strategies on consumer utility among different products, and obtained the limitation of cross-discount coupon setting that can improve sales and profits 9]. Hu et al. compared the changes in the overall profit of the supply chain when different members of the supply chain launched discount coupons, and found that the upstream and downstream members of the supply chain had the largest [10] when the total revenue of the supply chain jointly launched discount coupons. More about the nature of the discounts, some scholars have also proposed the relevant discussion.This paper implemented by the electric business platform, is essentially a limited discount mode and net discount mode, limited discount concept put forward by Dr Robert Cialdini, the model is a time limit discount model is a clear end date and / or not available time price discount, namely occasionally to a commodity with time limit price discount, preferential price only in a limited time effective [9]. The net discount mode, that is, the commodity operators directly show consumers the price after the price discount.For example: the original price of the goods is 100 yuan, but now the discount price is 90 yuan. The discount model is characterized by reducing the calculation pressure of consumers, the discount price is simple and clear, and it is easier to attract consumers to [10]. According to discount psychology research, some discount models will stimulate consumers 'desire to buy, while some discount models will actually destroy consumers' desire to buy [11]. The researchers identified specific psychological incentives that attract consumers to engage in certain discount model promotions and encourage them to buy goods, because when consumers find a good price discount, it actually changes their thinking style [12].

After the platform purchase discount activity, how to make consumers trust themselves? This is another problem considered in this paper, which is the trust of the platform. In the previous literature, three out of five respondents believed that word of mouth is the most influential decision-making information source [13]. Genfun & Straub believes that trust can increase consumers' willingness to shop online.[14] After the discount on the e-commerce platform, the original revenue structure of the supply chain will be changed. In order to ensure the overall profit of the supply chain, the interests of members of the supply chain will not be damaged, and profit coordination among members is needed. Among them, the adjustment scheme adjusts the pricing, income compensation and income sharing methods.Such as Cattani try to adopt unified pricing strategy to ease the contradiction between direct sales channels and entity channels, found that under certain conditions can form

a win-win situation [15]. ZuFeng etc that manufacturers implement compensation policy can improve the channel pricing and revenue, and compensation amount and retailer marketing efforts and sales cost of retailers [16]. Wang Wenbin etc based on previous research based on electric business platform mixed sales supply chain model, guarantee supply chain upstream and downstream members can profit from direct channels of [17].Li built considering different risk preference of dual channel supply chain model, manufacturers and retailers finally risk sharing contract coordinate the members of the channel income [18]. In view of this, this paper will refer to the described literature, will build dominated by manufacturers dual channel supply chain model, the electric business platform as a member of the game model, in considering the electric business platform for discount and no discount, the electric business optimal price decision platform and retailers.

III. Problem description and model building

3. 1The hypothesis of the model

1、In order to construct the model, this paper assumes that a manufacturer, an e-commerce platform and a retailer participate in the game, where the manufacturer provides equal quality goods for the e-commerce platform and retailers, and consumers purchase goods from online and offline channels respectively.

2、This paper assumes that no matter the size of the buckle rate a, manufacturers will always choose to cooperate with e-commerce platforms, and will provide products to retailers.

3、To facilitate comparative utility, it is assumed that consumers purchase one product in the online and retail channels on the e-commerce platform and two products on the e-purchase discount on the e-commerce platform.

4、This paper assumes that the second type of consumers will choose to give up online channels to buy products when t is very young, otherwise, they will always choose to buy products through online channels.

3.2Description of parameters

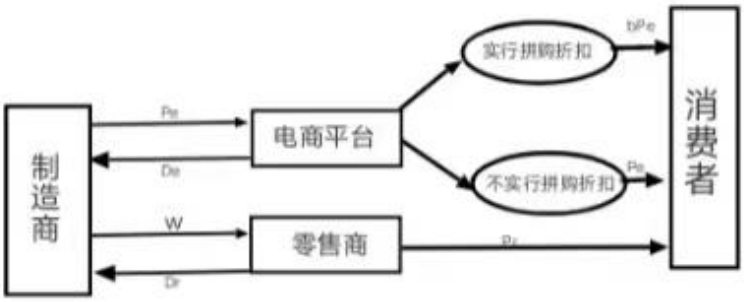
Table 1Description of the parameters

a	Button point rate：The manufacturer joins the platform according to the online transaction amount.0<a<1
w	Wholesale prices from manufacturers to retailers
Q	Initial market capacity
v	The estimated value of the product by retail channel consumers. And v is evenly distributed between [0, Q]
t	Consumers' trust in e-commerce platforms.0<t<1
tv	The estimated value of consumers for online channel products
m	Consumer store-to-store costs
b	Discount rate 1 / 2 <b <1
c	discount c
λ	The proportion of the second category of consumers
v	V Follow the 0-1 distribution, enough hours, equal to 0; otherwise, equal to 1
t	The utility of consumers in buying products in retail channels
tv	The utility of the first category of consumers buying products through online channels
m	The second type of utility of consumers buying products through online channels
b	Demand function of the consumption channel
c	Demand function of the online channel
λ	The profit function of the e-commerce platform
π_{m}	The manufacturer's profit function
π_{r}	The retailer's profit function
P_{e}	Sales price of the manufacturer's online channels
P_{r}	Retail prices of retailers through offline channels
w^{*}	The best wholesale price that the manufacturer gives to the retailers
P_{e}^{*}	Manufacturers' best selling price on the online channel
P_{r}^{*}	The best retail price for retailers in offline channels

3.3Model building

On the basis of the dual-channel supply chain, this paper considers to divide consumers into two categories. The first type of consumers buying products online depends on their trust in e-commerce platforms; the second type of consumers buying products to online platforms has nothing to do with the trust of the platform, because they are more inclined to online purchasing channels. There are two situations in this article: one is that the e-commerce platform does not purchase discount;The other is the e-commerce platform to buy a discount. Firstly, the manufacturer specifies the wholesale price w to the retailer and the selling price on the platform. The retailer specifies its retail price according to the wholesale price w; the e-commerce platform specifies the proportion of the online transaction amount. That is, buckle point rate a. Then according to their own situation to choose to buy discount or not to buy discount. If the e-commerce platform discounts to attract more consumers, the discount rate b, of which 1 / 2 <b <1, the price of two goods is greater than the price of one commodity. This paper assumes that if the e-commerce purchase discount, only two products.

This paper assumes that the capacity of the market is Q, the estimated value of retail channel consumers to the productv, v in the interval [0, Q] uniform distribution; set, the trust of consumers in the e-commerce platform is t (0 <t <1), the estimated value of online channel products is t v, t depicts the degree of the platform trust, but also reflects the alternative strength of online channels to retail channels. A schematic diagram of the corresponding dual-channel supply chain is shown



Graph 1Dual-channel supply chain schematic diagram

3.4 Demand function and profit function

First of all, the e-commerce platform does not adopt the strategy of pooling discount. Consumers in the retail channels to buy products, need to pay the price of the product, also need to pay extra cost to the store, so the utility of consumers in retail purchase products, including v on behalf of the retail channel consumers to the estimated value of the product, on behalf of the retail price, m for consumers to offline channels to buy products to the store cost.We are divided into two categories of online consumers. The first type of consumers prefer more offline channels, because they can feel the quality of products offline, but choose buying products online due to the discount or the credit of the e-commerce platform; The second type of consumers are more inclined to online consumption channels, and buying products online has nothing to do with the credit of the platform. The consumers here may be inconvenient to go offline or lack the time to compare products offline. The second number of consumers, this paper assumes the second type of consumers in Q accounted for, although the second type of consumers choose online channel has nothing to do with t, but when the electric business platform trust is very small, the second type of consumers will give up online purchase, so this paper cited to express the number of consumers, including z obey 0-1 distribution, when t very small, z is equal to 0;Vice versa, t=1. The utility of the products in the first category is, while the utility of the second category is. Since consumers purchase products through online channels with certain purchase risks, the biggest factor of consumers 'purchase through online channels depends on the degree of consumers' trust in the platform, namely t， Therefore, the estimated value of consumers for online channel products is tv. For the online channel sales price.

If the customer is to the estimated value of the product $U_r > U_e$， $U_{\mathrm{r}} \geq 0$， $U_{\mathrm{e}} \geq 0$， Then customers will choose to buy products through offline channels;The estimated value of the product $U_r < U_e$ and $U_{\mathrm{r}} \geq 0$， $U_{\mathrm{e}} \geq 0$， customers will choose to buy the product online channels.After that, the demand function of the retail

channel and the online channel can be obtained are as follows: $U_r < U_e$, $D_e = \frac{tP_r + tm - P_e}{t(1-t)} + z\lambda Q$ The profit functions of e-commerce platforms, manufacturers and retailers are as follows: $\pi_p = aP_eD_e$, $\pi_m = wD_r + (1-a)P_eD_e$, $\pi_r = (P_r - w)D_r$.

If the e-commerce platform to buy the discount strategy.Since the e-commerce platform needs to attract manufacturers to purchase discounts, manufacturers will be discounted c on the basis of the deduction rate a proportion（0<c<1），The pooling and purchase discount rate is b（1/2<b<1）,Let b be the constant. To facilitate the calculation, this paper considers buying two products on the platform.The utility function of the first type of consumers purchased through online channels is $U_{e1} = tv - 2bP_e$, The utility function of the second type of consumers is $U_{e2} = v - 2bP_e$. The utility function of the retail channel remains unchanged. After that, the demand functions to the retail channels and online channels are respectively: $D_r = (1-z\lambda)Q - \frac{P_r + m - 2bP_e}{1-t}$, $D_e = \frac{2(tP_r + tm - 2bP_e)}{t(1-t)} + z\lambda Q$ The profit functions of e-commerce platforms, manufacturers and retailers are as follows: $\pi_p = acP_eD_e$, $\pi_m = wD_r + (1-ac)P_eD_e$, $\pi_r = (P_r - w)D_r$.

IV. Model solution and proof derivation

4.1The e-commerce platform does not solve the model of the purchase discount

In such cases, as the manufacturer decides the supply chain structure, the manufacturer will play a two-stage Staelberg game with the retailer first. In the first stage, the manufacturer decides the online direct price of the product and the wholesale price to the retailer; in the second stage, the retailer decides the retail price of the offline channel. And at the same time the platform does not purchase the discount strategy.At this time, the demand functions of the retail channel and the online channel are respectively:

$$U_r < U_e \quad (1)$$

$$D_e = \frac{tP_r + tm - P_e}{t(1-t)} + z\lambda Q \quad (2)$$

The profit functions of e-commerce platforms, manufacturers and retailers are as follows:

$$\pi_p = aP_eD_e \quad (3)$$

$$\pi_m = wD_r + (1-a)P_eD_e \quad (4)$$

$$\pi_r = (P_r - w)D_r \quad (5)$$

Because of being led by the manufacturer，The retail price will be biased in formula (5),Can be solved as:

$$U_{e2} = v - 2bP_e \quad (6)$$

In equation (4), the profit functionis:

$$D_r = (1 - z\lambda)Q - \frac{P_r + m - 2bP_e}{1 - t} \quad (7)$$

In Equation (7), the profit function of the manufacturer determines the wholesale price w and the sales price of online channels respectively:

$$D_e = \frac{2(tP_r + tm - 2bP_e)}{t(1-t)} + z\lambda Q \quad (8)$$

$$\pi_{\mathrm{p}} = \mathrm{ac}P_e D_e \quad (9)$$

$$\pi_m = wD_r + (1-ac)P_e D_e \quad (10)$$

$$\pi_{\mathrm{r}} = (P_r - w)D_r \quad (11)$$

$$\frac{\partial^2 \pi_{\mathrm{m}}}{\partial \mathrm{w} \partial P_{\mathrm{e}}} = \frac{2-\mathrm{a}}{2(1-t)} \quad (12)$$

Solving the above formula, we can get the optimal wholesale price, online sales price and offline retail price:

$$P_{\mathrm{e}}^* = \frac{3\mathrm{t}(1-t-\mathrm{z}\lambda)Q + mt + \frac{2}{1-a}t}{-7t+2at+8} \quad (13)$$

$$\mathrm{w}^* = \frac{(1-t-\mathrm{z}\lambda)Q}{2} + \frac{(3-2a)[3\mathrm{t}(1-t-\mathrm{z}\lambda)Q + mt + \frac{2}{1-a}t]}{2(-7t+2at+8)} - \frac{m}{2} \quad (14)$$

$$\mathrm{P}_{\mathrm{r}}^* = \frac{3(1-t-\mathrm{z}\lambda)Q}{4} + \frac{(5-2a)3\mathrm{t}(1-t-\mathrm{z}\lambda)Q + mt + \frac{2}{1-a}t}{4(-7t+2at+8)} - \frac{3m}{4} \quad (15)$$

4.2 Model solution of the purchase discount on e-commerce platforms

When the e-commerce platform chooses the purchase discount, the demand functions of the retail channel and the online channel are respectively:

$$D_r = (1-\mathrm{z}\lambda)Q - \frac{P_r + m - 2\mathrm{b}P_e}{1-t} \quad (16)$$

$$D_e = \frac{2(\ tP_r + tm - 2\mathrm{b}P_e\ )}{t(1-t)} + \mathrm{z}\lambda Q \quad (17)$$

The profit functions of e-commerce platforms, manufacturers and retailers are as follows:

$$\pi_{\mathrm{p}} = \mathrm{ac}P_e D_e \quad (18)$$

$$\pi_m = wD_r + (1-ac)P_e D_e \quad (19)$$

$$\pi_{\mathrm{r}} = (P_r - w)D_r \quad (20)$$

Because led by the manufacturer, the retail price will be biased in type (20), which can be solved:

$$U_{e2} = v - 2bP_e \quad (21)$$

By substituting the retail price of equation (21) to equation (19), the manufacturer's profit function is:

$$D_r = (1-z\lambda)Q - \frac{P_r + m - 2\mathrm{b}P_e}{1-t} \quad (22)$$

In the profit function of the manufacturer, the wholesale price w and the sales price of the online channel are calculated respectively:

$$D_e = \frac{2(\ tP_r + tm - 2\mathrm{b}P_e\ )}{t(1-t)} + \mathrm{z}\lambda Q \quad (23)$$

$$\pi_{\mathrm{p}} = \mathrm{ac}P_e D_e \quad (24)$$

$$\pi_m = wD_r + (1-ac)P_eD_e \quad (25)$$

$$\pi_r = (P_r - w)D_r \quad (26)$$

$$\frac{\partial^2 \pi_m}{\partial w \partial P_e} = \frac{2-a}{2(1-t)} \quad (27)$$

For the above formula, we can conclude that the Hess e matrix, the first order master formula is less than 0.

When the second order master is greater than 0, Hesse is a negative matrix, and the target profit function is a strictly concave function of the manufacturer's online channel price and the retailer's channel price, with maxima。 Therefore, the optimal wholesale price, online sales price and offline retail price can be obtained:

$$w^* = \frac{(1-t-z\lambda)Q}{2} + \frac{(3-2a)[3t(1-t-z\lambda)Q + mt + \frac{2}{1-a}t]}{2(-7t+2at+8)} - \frac{m}{2} \quad (28)$$

$$P_r^* = \frac{3(1-t-z\lambda)Q}{4} + \frac{(5-2a)3t(1-t-z\lambda)Q + mt + \frac{2}{1-a}t}{4(-7t+2at+8)} - \frac{3m}{4} \quad (29)$$

$$P_r = \frac{(1-t-z\lambda)Q - m + 2bP_e^* + w^*}{2} \quad (30)$$

V. Analysis of the model Nash equilibrium solution

Proposition 1 The sales price of online channels decreases with the increase of discount rate b, and the price of retail channels has two situations: 1) the price of retail channels increases with the increase of discount rate b.2) The retail channel price will first decrease with the increase of discount rate b, and then increase with the increase of discount rate b. In addition, the discount rate of the e-commerce platform has a consistent impact on the prices of various channels. This paper further compares the sales prices of the two decision models on the offline and retail channels.

$$P_e^* = \frac{3t(1-t-z\lambda)Q + mt + \frac{2}{1-a}t}{-7t+2at+8} \quad (13)$$

$$w^* = \frac{(1-t-z\lambda)Q}{2} + \frac{(3-2a)[3t(1-t-z\lambda)Q + mt + \frac{2}{1-a}t]}{2(-7t+2at+8)} - \frac{m}{2} \quad (14)$$

$$P_r^* = \frac{3(1-t-z\lambda)Q}{4} + \frac{(5-2a)3t(1-t-z\lambda)Q + mt + \frac{2}{1-a}t}{4(-7t+2at+8)} - \frac{3m}{4} \quad (15)$$

$$w^* = \frac{(1-t-z\lambda)Q}{2} + \frac{(3-2a)[3t(1-t-z\lambda)Q + mt + \frac{2}{1-a}t]}{2(-7t+2at+8)} - \frac{m}{2} \quad (28)$$

$$P_r^* = \frac{3(1-t-z\lambda)Q}{4} + \frac{(5-2a)3t(1-t-z\lambda)Q + mt + \frac{2}{1-a}t}{4(-7t+2at+8)} - \frac{3m}{4} \quad (29)$$

$$P_r = \frac{(1-t-z\lambda)Q - m + 2bP_e^* + w^*}{2} \quad (30)$$

From this we can get an inference of 1.

Corollary 1 By proposition 1 can be concluded that the manufacturers choose to participate in electric business platform after discount, customers in the electric business platform to buy product price will be reduced, if the

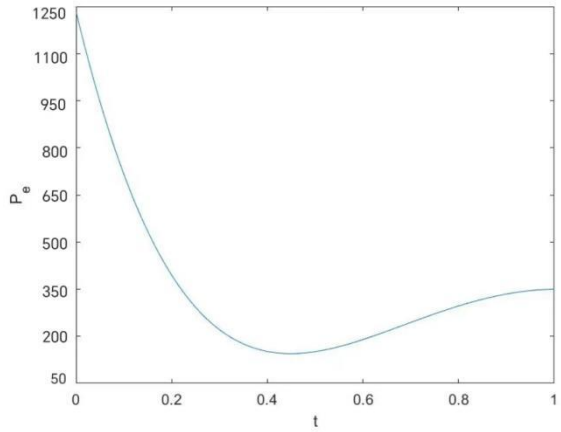
electric business platform is higher, credibility guaranteed product quality, and discount activities for real, don't cheat consumers, so consumers will be more inclined to in electric business platform to buy their own products, at the same time will lead to offline retail channels of consumers. In addition, while the e-commerce platform chooses the activity of pooling discounts, the e-commerce platform will appropriately increase the price of the products in order to ensure the interests of itself and the manufacturers.After electric business platform to spell purchase discount after the activity, despite the discount, not greatly reduce the manufacturers and electric business platform profits, at the same time consumers in electric business platform to buy products online prices will be reduced by the discount, but due to the loss of retail channel consumers, retailers in order to ensure their own profits, will increase on the product price. Therefore, in order to ensure the revenue of retail channel retailers, manufacturers should maintain the balance between online and offline channels, and implement products of different quality for online and offline channels, so as to make up for the loss of customers caused by the discount activities on online e-commerce platforms.

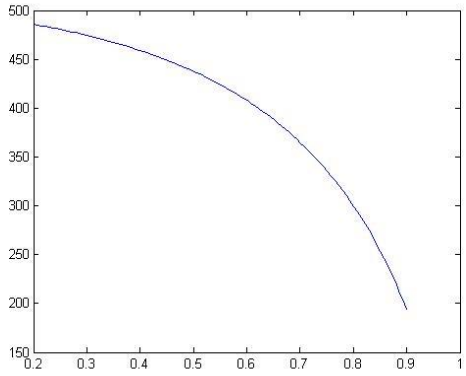
Proposition 2 The effect of b, t on the number of consumers:(1) When the e-commerce platform implements the joint purchase discount, the number of consumers who buy products through online and offline channels increases, and the number of consumers increases with the increase of the discount rate b.(2) When t is small enough, the number of consumers will decrease, regardless of the discount; otherwise, the number of consumers will increase with t.

Corollary 2 Within a certain range, with the increase in discount rate b, offline channel retail prices will be reduced, the purpose is to attract more consumers choose to buy in retail channels, and at the same time online channels electric business platform for discount, online channels with higher prices, within a certain range of discount rate b improve the number of online channels of consumers,To sum up, after the spell purchase discount, the manufacturer of consumers will increase, but with the increase of the discount rate b, namely the discount, online channel discount activities to consumer attraction will decline, and the offline channels of retail prices lead to the loss of offline channels. Therefore, a lower discount rate does not necessarily allow the manufacturers to sell a large number of products, and a limit of the discount rate will allow the manufacturers to maximize the number of consumers. When t is small enough, for the e-commerce platform, the second consumers will lose. The utility of the first consumers for the products purchased by the e-commerce platform mainly depends on t, so the first consumers will also lose; on the contrary, the second consumers will stay, and the first consumers will increase due to the increased utility of the products purchased by the e-commerce platform.

Proposition 3 The impact of the platform trust degree t on the platform sales price and the wholesale price
It is obtained by the model after implementing the pooling discount strategy on the e-commerce platform

$P_e^* = \dfrac{3t(1-t-z\lambda)Q + mt + \dfrac{2}{1-a}t}{-7t+2at+8}$ and w^* solution，0<t<1,This assume t is large, that is, the second type of consumers will not lose.Using matlab mapping as shown in Figure 2 Figure 3,Observations found：(1) With the increasing value of the t $P_e^* = \dfrac{3t(1-t-z\lambda)Q + mt + \dfrac{2}{1-a}t}{-7t+2at+8}$ first decrease and then increase.（2）As t increases w^* is gradually decreasing。





Graph (2)The effect of t- $P_e^* = \frac{3t(1-t-z\lambda)Q + mt + \frac{2}{1-a}t}{-7t+2at+8}$ graph (3)The effect of t- w^*

This due to the electric business platform after spell purchase discount, in the (1) in order to get more consumers, electric business platform will implement price strategy, attract more consumers at the same time its platform trust also gradually increased, when the platform trust is larger, to obtain greater profits, platform will along with the platform trust to improve the platform product sales price.(2) in the electric business platform after spell discount, because the electric business platform consumers will be more and more, assume Q, the number of retail channels will be less and less, in order to balance online and offline channels, manufacturers will reduce the wholesale price w to increase the profits of retailers, maintain the balance of online channels.

Proposition 4 The impact of platform trust t on the profits of supply chain members
First of all, compare and analyze the change of the trust of all parties in the supply chain and the overall profit of the supply chain before and after the platform trust t, the trust of the platform t is 0.7, that is, the situation that the second type of consumers will not lose.The discount rate b is between 0.5 and 1, and the discount rate b=0.8, The values of the other parameters remain unchanged, After the e-commerce platform implements the pooling and purchase discount, As it is led by the manufacturer, E-commerce platforms, manufacturers and retailers will all significantly increase their revenue, And the revenue of offline channel retailers will decrease with the improvement of the platform credibility t, Analysis analyzing the model results, After the implementation of the joint purchase discount activity on the online channel e-commerce platform, The profits of all parties in the supply chain are greatly affected by the trust of the platform t, This is because consumers' valuation of the quality of discounted products they buy online channels is proportional to the platform trust t. Electric business platform, therefore, to improve their status, not only rely on discount and other preferential activities to attract consumers, should also be proactive to supervise and manage the quality of online consumer products and efforts to improve the credit of their platform, in order to attract more consumers online platform to buy products, get a higher market position.

Proposition 5 The influence of platform trust t and deduction rate a on consumer surplus and social welfare
For the platform trust t, the influence of a on consumer surplus, social welfare, this paper assumes that the discount rate b = 0.80, the range of buckle rate a is between (0,1), the range of platform credibility t is between (0,1), before and after the discount, consumer surplus, social welfare with the platform buckle rate and the credibility of the platform.It can be concluded that the discount facilitates the increase of consumer surplus and social welfare, because after the e-commerce platform, a large part of consumers will get products at a lower price, and the additional benefits perceived by consumers will increase; The increase of social welfare also proves that the e-commerce platform improves the total revenue of the supply chain, namely proposition 4.
Corollary 5 In addition, no matter which kind of decision pricing, consumer surplus and social welfare and platform trust t into positive correlation, at the same time reflects the rapid development of electric business platform will be beneficial to improve consumer surplus and other members of the supply chain, at the same time the high platform buckle rate a will bring certain negative impact on consumer surplus and social welfare.
Proposition 6 The weakening degree of the influence of b and t from λ
When λ is small, consumers mainly choose their own purchase methods by weighing b and t. When λ gradually increases, more people consume through online channels in the market. Therefore, the influence of b and t will gradually weaken, and for b, the influence of b will be weaker than that of t.When λ is big enough,

this is the majority of consumers in the market can only through online channels to buy goods, then consumers are no longer affected by b, t, this situation is reflected during the outbreak, in this case, the market is in a state of imbalance, the game in the supply chain profit is also imbalance, then is also harmful to consumers itself.

VI. Conclusion

This paper is based on the two-channel supply chain model, led by manufacturers and composed of manufacturers, retailers and e-commerce platforms. By constructing the model and solving it using the Hesper matrix, we draw the following conclusions, First, after the manufacturers choose to participate in the electric business platform spell buy discount, customers in the electric business platform to buy product price will be reduced, if the electric business platform is higher, credibility guaranteed product quality, and discount for real, don't cheat consumers, so consumers will be more inclined to the electric business platform to buy their own products, at the same time will lead to offline retail channels of consumers. In addition, while the e-commerce platform chooses the activity of pooling the discount, the e-commerce platform will appropriately increase the price of the products in order to ensure the interests of itself and the manufacturers. After electric business platform to spell purchase discount after the activity, despite the discount, not greatly reduce the manufacturers and electric business platform, at the same time consumers in electric business platform to buy products online prices will be reduced by the discount, but due to the loss of retail channel consumers, retailers to ensure their own profits, will be on the product price prices, the retail prices increase.Second, after the spell purchase discount, the manufacturer of consumers will increase, but with the increase of discount rate b, namely the discount, online channel discount attraction to consumers will decline, and the offline channels of retail prices lead to the loss of offline channel consumers. Therefore, a lower discount rate does not necessarily allow the manufacturers to sell a large number of products, and a limit of the discount rate will allow the manufacturers to maximize the number of consumers. When t is small enough, for the e-commerce platform, the second consumers will lose. The utility of the first consumers for the products purchased by the e-commerce platform mainly depends on t, so the first consumers will also lose; on the contrary, the second consumers will stay, and the first consumers will increase due to the increased utility of the products purchased by the e-commerce platform.Third, in the electric business platform after spell discount, in order to get more consumers, electric business platform will implement price strategy, attract more consumers at the same time its platform trust also gradually increased, when the platform trust is larger, to obtain greater profits, platform will ascend with platform trust to improve the sales price of platform products.After the implementation of pooling discount on e-commerce platforms, as there will be more and more consumers on e-commerce platforms,Assuming that Q remains unchanged, the number of consumers in retail channels will be less and less. In order to balance online channels and offline channels, manufacturers will reduce the wholesale price w to increase the profits of retailers and maintain the balance between online and offline channels. In addition, it is concluded that when λ is small, consumers mainly choose their own purchase methods by weighing b and t. When λ gradually increases, more people consume through online channels in the market, which is that the influence of b and t will gradually weaken, and b is weaker than that of t. When λ is big enough, this is the majority of consumers in the market can only through online channels to buy goods, then consumers are no longer affected by b, t, this situation is reflected during the outbreak, in this case, the market is in a state of imbalance, the game in the supply chain profit is also imbalance, then is also harmful to consumers itself.

This paper puts forward reasonable suggestions for supply chain members: First, the development of e-commerce platform helps to improve the perceived benefits of consumers and the benefits of other members in the dual-channel supply chain. Other members of the supply chain should adapt to and actively improve their own development strategies to adapt to the development of e-commerce platform. Second, the electric business platform to improve their status, not only rely on discount preferential activities to attract consumers, should also be proactive to supervise and manage the quality of online consumer products and efforts to improve the credit of their platform, in order to attract more consumers online platform to buy products, get a higher market position. Finally, consumers should choose from their own perspective the consumption channels and products that are more suitable for them, so as to maximize their own utility and improve their own sense of happiness and gain.

Innovation and insufficiency: the innovation of this paper is to discuss manufacturers led dual channel supply chain model, in the electric business platform for discount and not spell discount activity two scenarios, in two different kinds of consumers, the first class consumers buy online rely on and t, the second type of consumers buy online is not affected by t, on the premise of manufacturer profit maximization after using Hesse matrix of the model Nash equilibrium solution and follow-up analysis. The deficiency is that the content of this paper does not deeply explore the pricing strategy of the discount of the e-commerce platform under the dual-channel supply chain, and the critical point t of the first category and the second type of consumers. In this paper, some situations and scenarios are simplified, and the coefficients are simplified, and the universality is limited.

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