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Research on Supply Chain Coordination based on Lateral Transshipment in the Background of New Retail

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Abstract. This paper realizes lateral transshipment coordination between multiple retailers and a supplier in the background of New Retail with parameters such as transshipment price. This paper takes a system with two retailers and one supplier as an example, and make the supplier participate directly in the sales process by an online store. Then, this paper gives the conditions that need to be satisfied in the case of coordinating each retailer and supplier, such as the transshipment price. Finally, the supply chain coordination model is compared with the newsboy model by constructing an example. It is found that the expected system profit and member profit at coordination are higher than under the newsboy model.

Keywords: lateral transshipment, transshipment price, coordination, multi-retailer

1. Introduction

With the development of our economy and the prosperity of our market, market competition is becoming more and more intense. Due to the increasing time sensitivity of customers, immediacy is becoming more and more important in the market competition criteria. In this background, lateral transshipment has gained more attention as a replenishment strategy that can increase or maintain supply levels while reducing total costs. Generally speaking, lateral transshipment is a management model in which units at the same level in the supply chain share inventory with each other - that is, the party with surplus inventory transshipments the excess inventory to the party with insufficient inventory, thereby increasing the sales volume of one party while reducing the surplus inventory at the end of the sales season of the other party, also known as inventory pooling [1].

And with the development of e-commerce, New Retail has become the hottest logistics model nowadays. Generally speaking, New Retail refers to a new model of Retail where online + offline and logistics are deeply integrated. In October 2016, Jack Ma first proposed the concept of "New Retail" at the Ali Yunqi Conference. As logistics models continue to innovate, with the popularity of smartphones and the rapid development of the mobile Internet, the smart logistics ecological model is gradually being built up, and the interaction between online and offline Retail is driving the overall development of the industry. In such an industry background, more and more suppliers and manufacturers choose to produce and sell part of their goods on e-commerce platforms, rather than selling all of them to downstream retailers and distributors as before. Therefore, the supply chain coordination model established by treating suppliers as a member of the lateral transshipment strategy can provide some reference value for these enterprises.

Most of the current lateral transshipment studies are based on a supply chain system consisting of two retailers. Wanpeng et al [2]. investigated a preventive lateral transshipment inventory strategy between retailers based on the condition that manufacturers provide two ordering opportunities with different ordering prices and consider two retailers using the interval between two orders for updating demand forecast information.Dehghani and Abbasi [3] proposed a new lateral transshipment strategy for perishable items and discussed its effect on supply chain performance using two retailers as an example improvement. Qi Xu and Xiaoqing [4] Gao discuss the optimal ordering and transshipment volume models for two independent dual-channel retailers based on noncooperative static game theory. Song, Zhilan et al [5]. used an equilibrium game strategy to construct an optimal model of inventory sharing for a dual-retailer system under a two-stage sales period, and designed a corresponding price coordination mechanism. Most of the studies that include suppliers in the supply chain coordination system are implemented by treating the supplier as a pure producer through contracts such as repurchase, which is not fully consistent with the background of New Retail. xie Lei et al. [6] investigate the effects of revenue uncertainty and relative bargaining power on the performance of repurchase contracts in a two-level supply chain consisting of sellers and buyers. Chengqi [7] Peng used multiple mental accounts to discuss the relationship between optimal ordering strategies and relevant parameters under repurchase contracts for a supply chain system consisting of one supplier and one retailer. Tian Yuan et al. [8] investigated the existence and uniqueness of the optimal ordering quantity for a decision model of supply chain delayed pricing strategy based on a single wholesale price contract and repurchase contract under a demand uncertain environment and performed numerical analysis. Liu, Long et al. [9] investigated the optimal decision to achieve a coordinated supply chain under repurchase contracts when prices are stochastic, sales cost information is asymmetric, and suppliers are risk averse.

It can be seen that most of the previous studies on lateral transshipment have been conducted for supply chain inventory management systems where only two retailer members. In the background of New Retail, if the number of retailers is increased, it will add many possibilities to the mathematical analysis of the supply chain and bring great difficulties for solving the optimal decision of the retailers in the coordination situation. There is also a lack of models for including suppliers as a coordinated member of the supply chain in the background of New Retail.

Therefore, under the premise that lateral transshipment exists between multiple retailers and suppliers, this paper considers the conditions that need to be satisfied for supply chain coordination by constructing certain mathematical models.

2. Mathematical Model

2.1. Problem description

This paper study a supply chain consisting of one supplier and two retailers. The supplier not only supplies to the two retailers, but also sells through the online store itself. The demand between the supplier and the retailers is independent of each other. At the beginning of the period, the retailer initiates an order with the supplier, and the supplier produces products according to the retailers' order and the order from its own online store. The inventory between the two retailers and the supplier can be shared, i.e., the supply chain members a and b agree in advance that when one party is out of stock and the other has excess inventory, the excess inventory will be transshipped to the out-of-stock party. The transshipment cost is borne by the transshipping party, while the transshipping party needs to pay the transshipment price.

2.2. Mathematical Modeling

For the sake of description, two retailers are considered as supply chain member 1,2 and the suppliers are considered as member 3.

The relevant parameter symbols are shown in Table 1.

Table 1: Symbol Description Table

r_i	Unit selling price of member i
q_i	Order quantity of member i
d_i	Demand for member i's
l_i	Unit out-of-stock cost of member i
c_i	Unit purchase price of member i
c_{ij}	Forwarding price of goods transshipmented from member i to j
v_i	Marginal value per unit of member i
t_{ij}	Unit transshipment cost of member i to j
m	Supplier's unit manufacturing cost
T_{ij}	The amount of transshipment from member i to j
s_i	Unit residual value of member i

To ensure sales, retailers are generally located in busy areas with high traffic. Since online stores do not need physical stores to receive customers, their warehouses are generally located in remote areas to save inventory costs. Therefore, it is assumed that the distance between the warehouse of the online store and the offline retailer is greater than the distance between retailers. The physical distance between the three is shown in Table 2.

Table 2: Members's Distance Table

	Retailers1	Retailers2	Online Shop3
Retailers 1	/	k_{12}	k_{13}
Retailers 2	k_{12}	/	k_{23}
Online Store 3	k_{13}	k_{23}	/

Let . In the case of transshipment, retailers 1and 2 have priority in requesting replenishment from each other. If the online store 3 is out of stock, the retailer 2 is given priority to request replenishment. If member i transshipped products to member j, the cost of transshipment is borne by member i, and member j is required to pay member i a transshipment price per unit of products c_{ij}.

From the above conditions, we can get that the total expected profit of the system is:

$$\pi^t = \sum_{i=1}^{3} E[p_i \min(q_i^t, d_i) - l_i(d_i - q_i^t)^+ + s_i\left(q_i^t - d_i\right)^+ - mq_i - \sum_{j=1}^{3} t_{ij}T_{ij}] \quad (1)$$

In equation (1), q_i^t denotes the net order quantity of retailer i after conducting inter-retailer transshipment, the $q_i^t = q_i - \sum T_{ij} + \sum T_{ji}$. The first part of equation (1) represents the sales revenue of the system, the second part represents the cost of out-of-stocks lost by the system, the third part represents the salvage revenue obtained by the system, the fourth part represents the manufacturing cost of the supplier, and the fifth part represents the cost of inter-retailer transshipment in the system.

And the expected profits for the supplier and online stores is

$$\pi_3^d = E[p_3\, min(\, q_3^t, d_3) - l_3(d_3 - q_3^t)^+ + s_3(q_3^t - d_3)^+ - mq_3 + \sum_{i=1}^{2}(c_i - m)q_i + \sum_{j=1}^{3}(c_{3j}T_{3j} - t_{3j}T_{3j} - c_{j3}T_{j3}) \quad (2)$$

The first part of equation (2) represents the sales revenue of the online store, the second part represents the out-of-stock cost lost by the online store, the third part represents the salvage revenue received by the online store, the fourth part represents the manufacturing cost of the goods in the online store, the fifth part is the purchase revenue received by the supplier from the retailer minus the manufacturing cost, and the sixth part represents the transshipment cost received by the supplier after the horizontal transshipment between systems.

And the expected profits for retailer i (i=1,2) is

$$\pi_i^d = E[p_i\, min(\, q_i^t, d_i) - l_i(d_i - q_i^t)^+ + s_i(q_i^t - d_i)^+ + \sum_{j=1}^{3}(c_{ij}T_{ij} - t_{ij}T_{ij} - c_{ji}T_{ji}) - c_iq_i] \quad (3)$$

The first part of equation (3) represents the sales revenue of retailer i, the second part represents the out-of-stock cost lost by retailer i, the third part represents the salvage revenue received by retailer i, the fourth part represents the transshipment cost received by retailer i after horizontal transshipment between systems, and the fifth part represents the purchase cost of retailer i.

In this paper, we analyze the supply chain transshipment scenarios in the background of New Retail and finally identify the 20kind of supply chain transshipment scenarios. This provides the basis for the following theoretical study and case analysis of supply chain coordination conditions. 20The scenarios are shown in Table III. The probability symbols in Table 3 are shown in Table 4.

Table 3: Transshipment Scenarios And Probability Of Occurrence Table

	Can the initial order quantity meet the demand				Whether demand can be met after transshipment		
Probability	1	2	3	Transshipment Status	1	2	3
Pr_1	Yes	Yes	Yes	-	-	-	-
Pr_2	Yes	Yes	No	2→3	-	-	Yes
Pr_3				2→3 1→3	-	-	Yes
Pr_4				2→3 1→3	-	-	No
Pr_5	Yes	No	Yes	1→2	-	Yes	-
Pr_6				1→2 3→2	-	Yes	-
Pr_7				1→2 3→2	-	No	-
Pr_8	No	Yes	Yes	2→1	Yes	-	-
Pr_9				2→1 3→1	Yes	-	-
Pr_{10}				2→1 3→1	No	-	-
Pr_{11}	Yes	No	No	1→2 1→3	-	Yes	Yes
Pr_{12}				1→2 1→3	-	Yes	No
Pr_{13}				1→2	-	No	No
Pr_{14}	No	Yes	No	2→1 2→3	Yes	-	Yes
Pr_{15}				2→1 2→3	Yes	-	No
Pr_{16}				2→1	No	-	No
Pr_{17}	No	No	Yes	3→2 3→1	Yes	Yes	-
Pr_{18}				3→2 3→1	No	Yes	-
Pr_{19}				3→2	No	No	-
Pr_{20}	No	No	No	-	No	No	No

Table 4: Probability Symbolic Expressions Table

Probability Number	Symbolic expressions
Pr_1	$P(Q_1 > D_1, Q_2 > D_2, Q_3 > D_3)$
Pr_2	$P(Q_1 > D_1, Q_2 > D_2, Q_3 < D_3, Q_2 - D_2 > D_3 - Q_3)$
Pr_3	$P(Q_1 > D_1, Q_2 > D_2, Q_3 < D_3, Q_2 - D_2 < D_3 - Q_3 < Q_2 - D_2 + Q_1 - D_1)$
Pr_4	$P(Q_1 > D_1, Q_2 > D_2, Q_3 < D_3, D_3 - Q_3 > Q_2 - D_2 + Q_1 - D_1)$
Pr_5	$P(Q_1 > D_1, Q_2 < D_2, Q_3 > D_3, Q_1 - D_1 > Q_2 - D_2)$
Pr_6	$P(Q_1 > D_1, Q_2 < D_2, Q_3 > D_3, Q_1 - D_1 < D_2 - Q_2 < Q_1 - D_1 + Q_3 - D_3)$
Pr_7	$P(Q_1 > D_1, Q_2 < D_2, Q_3 > D_3, Q_1 - D_1 + Q_3 - D_3 < D_2 - Q_2)$
Pr_8	$P(Q_1 < D_1, Q_2 > D_2, Q_3 > D_3, Q_2 - D_2 > D_1 - Q_1)$
Pr_9	$P(Q_1 < D_1, Q_2 > D_2, Q_3 > D_3, Q_2 - D_2 < D_1 - Q_1 < Q_3 - D_3 + Q_2 - D_2)$
Pr_{10}	$P(Q_1 < D_1, Q_2 > D_2, Q_3 > D_3, Q_3 - D_3 + Q_2 - D_2 < D_1 - Q_1)$

Pr_{11}	$P(Q_1 > D_1, Q_2 < D_2, Q_3 < D_3, Q_1 - D_1 > D_2 - Q_2 + D_3 - Q_3)$
Pr_{12}	$P(Q_1 > D_1, Q_2 < D_2, Q_3 < D_3, D_2 - Q_2 < Q_1 - D_1 < D_2 - Q_2 + D_3 - Q_3)$
Pr_{13}	$P(Q_1 > D_1, Q_2 < D_2, Q_3 < D_3, Q_1 - D_1 < D_2 - Q_2)$
Pr_{14}	$P(Q_1 < D_1, Q_2 > D_2, Q_3 < D_3, Q_2 - D_2 > D_1 - Q_1 + D_3 - Q_3)$
Pr_{15}	$P(Q_1 < D_1, Q_2 > D_2, Q_3 < D_3, D_1 - Q_1 < Q_2 - D_2 < D_1 - Q_1 + D_3 - Q_3)$
Pr_{16}	$P(Q_1 < D_1, Q_2 > D_2, Q_3 < D_3, Q_2 - D_2 < D_1 - Q_1)$
Pr_{17}	$P(Q_1 < D_1, Q_2 < D_2, Q_3 > D_3, Q_3 - D_3 > D_1 - Q_1 + D_2 - Q_2)$
Pr_{18}	$P(Q_1 < D_1, Q_2 < D_2, Q_3 > D_3, D_2 - Q_2 < Q_3 - D_3 < D_1 - Q_1 + D_2 - Q_2)$
Pr_{19}	$P(Q_1 < D_1, Q_2 < D_2, Q_3 > D_3, Q_3 - D_3 < D_2 - Q_2)$
Pr_{20}	$P(Q_1 < D_1, Q_2 < D_2, Q_3 < D_3)$

Based on the above analysis, when considering the New Retail supply chain under lateral transshipment for centralized decision making, it is necessary to put the system expected profit π^t to q_1 , and q_2， q_3 The derivative is obtained as

$$\begin{aligned}\partial\pi^t/\partial q_1 = {} & (p_1 + l_1)(Pr_{10} + Pr_{16} + Pr_{18} + Pr_{19} + Pr_{20}) + (p_2 + l_2)(Pr_7 + Pr_{13}) + (p_3 \\ & + l_3)(Pr_4 + Pr_{12} + Pr_{15}) + s_1(Pr_1 + Pr_2 + Pr_3 + Pr_5 + Pr_{11}) + s_2(Pr_8 + Pr_{14}) \\ & + s_3(Pr_6 + Pr_9 + Pr_{17}) - t_{12}(Pr_6 + Pr_7 + Pr_{13}) + t_{21}(Pr_8 + Pr_{14} + Pr_{15}) \\ & - t_{13}(Pr_4 + Pr_{12}) + t_{31}(Pr_9 + Pr_{17}) - t_{23}Pr_{15} + t_{32}Pr_6 - m\end{aligned}$$

$$\begin{aligned}\partial\pi^t/\partial q_2 = {} & (p_1 + l_1)(Pr_{10} + Pr_{16} + Pr_{18}) + (p_2 + l_2)(Pr_7 + Pr_{13} + Pr_{19} + Pr_{20}) + (p_3 \\ & + l_3)(Pr_4 + Pr_{12} + Pr_{15}) + s_1(Pr_3 + Pr_5 + Pr_{11}) + s_2(Pr_1 + Pr_2 + Pr_8 + Pr_{14}) \\ & + s_3(Pr_6 + Pr_9 + Pr_{17}) + t_{12}(Pr_5 + Pr_{11} + Pr_{12}) - t_{21}(Pr_9 + Pr_{10} + Pr_{16}) \\ & - t_{13}(Pr_{12} - Pr_3) - t_{31}(Pr_{18} - Pr_9) - t_{23}(Pr_3 + Pr_4 + Pr_{15}) + t_{32}(Pr_6 + Pr_{17} + Pr_{18}) \\ & - m\end{aligned}$$

$$\begin{aligned}\partial\pi^t/\partial q_3 = {} & (p_1 + l_1)(Pr_{10} + Pr_{18}) + (p_2 + l_2)(Pr_7 + Pr_{19}) + (p_3 \\ & + l_3)(Pr_4 + Pr_{12} + Pr_{13} + Pr_{15} + Pr_{16} + Pr_{20}) + s_1(Pr_3 + Pr_{11}) + s_2(Pr_2 + Pr_{14}) \\ & + s_3(Pr_1 + Pr_5 + Pr_6 + Pr_8 + Pr_9 + Pr_{17}) + t_{13}(Pr_{11} + Pr_3) - t_{31}(Pr_{10} + Pr_{18}) \\ & + t_{23}(Pr_2 + Pr_{14}) - t_{32}(Pr_7 + Pr_{19}) - m\end{aligned}$$

$$\partial\pi^t/\partial q_1 = \partial\pi^t/\partial q_2 = \partial\pi^t/\partial q_3 = 0 \tag{4}$$

When considering the New Retail supply chain under lateral transshipment for decentralized decision making, it is necessary to combine the retailer's expected profit π_i^d for q_i , the derivative is obtained as

$$\begin{aligned}\partial\pi_1^d/\partial q_1 = {} & (p_1 + l_1)(Pr_{10} + Pr_{16} + Pr_{18} + Pr_{19} + Pr_{20}) + s_1(Pr_1 + Pr_2 + Pr_3 + Pr_5 + Pr_{11}) \\ & + c_{12}(Pr_6 + Pr_7 + Pr_{13}) + c_{13}(Pr_4 + Pr_{12}) + c_{21}(Pr_8 + Pr_{14} + Pr_{15}) \\ & + c_{31}(Pr_9 + Pr_{17}) - c_1\end{aligned}$$

$$\begin{aligned}\partial\pi_2^d/\partial q_2 = {} & (p_2 + l_2)(Pr_7 + Pr_{13} + Pr_{19} + Pr_{20}) + s_2(Pr_1 + Pr_2 + Pr_8 + Pr_{14}) + c_{12}(Pr_5 + Pr_{11} + Pr_{12}) \\ & + c_{23}(Pr_3 + Pr_4 + Pr_{15}) + c_{21}(Pr_9 + Pr_{10} + Pr_{16}) + c_{32}(Pr_6 + Pr_{17} + Pr_{18}) - c_2\end{aligned}$$

$$\begin{aligned}\partial\pi_3^d/\partial q_3 = {} & (p_3 + l_3)(Pr_4 + Pr_{12} + Pr_{13} + Pr_{15} + Pr_{16} + Pr_{20}) + s_3(Pr_1 + Pr_5 + Pr_6 + Pr_8 + Pr_9 + Pr_{17}) \\ & + c_{13}(Pr_3 + Pr_{11}) + c_{31}(Pr_{10} + Pr_{18}) + c_{32}(Pr_7 + Pr_{19}) + c_{23}(Pr_2 + Pr_{14}) - c_3\end{aligned}$$

$$\partial\pi_1^d/\partial q_1 = \partial\pi_2^d/\partial q_2 = \partial\pi_3^d/\partial q_3 = 0 \tag{5}$$

3. Calculation Process

According to the above equation, we can solve it in a certain way to get the optimal order quantity. The specific steps are as follows.

(1) Input the retailer's demand d_i.

(2) Input the necessary parameters c_i， m， τ_{ij}， v_i.

(3) Bring the parameters into the Equation 4, and use Newton down-hill method to iteratively find the retailer's optimal order quantity q_i^*.

(4) Bringing the retailer's optimal order quantity q_i^* into Equation 5, getting the transhippment price a

The retailer's optimal order quantity is q_i^* into the formula5 to obtain the transshipment price c_{12}， c_{13}， c_{23}.

(5) Output information such as order quantity and expected profit.

4. Numerical Analysis

Two offline retailers and one online store are known to obey a uniform distribution of [0,200], $d_i \sim U_i[0,200]$, with the same cost parameters for each member, respectively $p_1 = p_2 = p_3 = 40$, and $s_1 = s_2 = s_3 = 10$, and $l_1 = l_2 = l_3 = 0$, ,and $t_{12} = t_{21} = t_{13} = t_{31} = t_{23} = t_{32} = 2$, and $c_1 = c_2 = c_3 = 20$,$v_1 = v_2 = v_3 = 40$.$m = 15$. The specific transshipment rules have been described in the previous sections.

Let D = 200, then we get

$$\partial^2\pi^t/\partial Q_1{}^2 = -1/2D^3[(p_3 + l_3 - s_1 - t_{13})\left(Q_1{}^2 + Q_2{}^2 + 2Q_1Q_2 + 2Q_1Q_3 + 2Q_2Q_3\right) + (p_2 + l_2 - s_3 - t_{32})Q_3{}^2 + (p_2 - p_3 + l_2 - l_3 - t_{12} + t_{13})D(Q_1 + Q_2) + 2(p_1 - p_2 + l_1 - l_2 + t_{12})D^2]$$

$$\partial^2\pi^t/\partial Q_2{}^2 = -1/2D^3[(p_3 + l_3 - s_1 - t_{13})Q_1{}^2 + 2(0.5 * p_3 + l_3 - s_2 - t_{23})Q_2{}^2 + (p_1 + l_1 + s_3 - t_{31})Q_3{}^2 + 2(p_3 + l_3 + s_2 - t_{23})(Q_1Q_3 + Q_2Q_3) + 2(p_3 + l_3 - s_2 - t_{23})Q_1Q_2 + 2(p_1 - p_3 + l_1 - l_3 - t_{21} + t_{23})D(Q_1 + Q_2) + 2(p_2 - p_1 + l_2 - l_1 + t_{21})D^2$$

$$\partial^2\pi^t/\partial Q_3{}^2 = -1/2D^3[(p_2 + l_2 - s_3)Q_1{}^2 + (p_2 + l_1 - s_3 - t_{31})Q_2{}^2 + (p_1 + l_1 - s_3 - t_{31} + t_{32})Q_3{}^2 + 2(p_2 + l_1 - s_3 - t_{31})Q_1Q_2 + 2(p_1 + l_1 - s_3 - t_{31})Q_1Q_3 + 2(p_1 + l_1 - s_3 - t_{31} + t_{32})Q_2Q_3 + 2D(p_2 - p_1 + l_2 - l_1 + t_{31})(Q_2 + Q_3) + 2(p_3 - p_2 + l_3 - l_2)D^2]$$

From the above three equations, we can see that $\partial^2\pi^t/\partial Q_i{}^2 \leq 0$ that the system profit function is a concave function of the retailer's order quantity. Therefore, there is a centralized decision to order the optimal order quantity that maximizes the expected profit of the supply chain system(Q_1, Q_2, Q_3) .

$$\partial^2\pi^t/\partial Q_1{}^2 = -1/2D^3[2(p_1 + l_1 - c_{10})D^2 + (c_{10} - s_1)(Q_1 + Q_2)(Q_1 + Q_2 + 2Q_3)]$$

$$\partial^2\pi^t/\partial Q_2{}^2 = -1/2D^3[2(p_2 + l_2 - c_{20})D_L{}^2 + (c_{20} - s_2)(2Q_1(Q_2 + Q_3) + Q_2(Q_2 + 2Q_3))]$$

$$\partial^2\pi^t/\partial Q_3{}^2 = -1/2D^3[2(p_3 + r_3 - c_{30})D^2 + (c_{30} - s_3)(Q_1 + Q_2 + Q_3)^2]]$$

Let $q_i^m = q_i/200, q_j^m = q_j/200$, then

From$p_i - c_{i0} \geq 0, c_{i0} - s_i \geq 0$, we have$\partial^2\pi^t/\partial Q_i{}^2 \leq 0$. Therefore, the optimal order quantity also exists under decentralized decision.

According to the above parameter description and calculation method, the optimal order quantity in the coordination situation is first found$q_1^* = q_2^* = 123.4$, $q_3^* = 157.7$. Then the optimal order quantity is brought into the formula5, and the transshipment price in the coordinated situation can be found as $c_{12} = 24.6$, $c_{13} = 21.2$, $c_{23} = 19.7$. After that, the corresponding expected profit of the system and the expected profit of the retailer are found. In order to show the reasonableness of the coordination method of forwarding price, this paper compares the expected profit under the centralized decision and the newsboy model by adding the expected profit. The specific data are shown in Table 5 below.

Table 5: Expected Profit Under The Three Scenarios

	Q_1	π_1^d	Q_2	π_2^d	Q_3	π_3^d
Centralized decision making	166.7	1250	166.7	1250	166.7	3750
Newspaper Boy Model	133.3	1333.3	133.7	1333.3	166.7	3416.7
Coordination situation	123.4	1472.3	123.4	1472.3	157.7	3781.3

From the above table, it can be seen that in the centralized case the expected profit of the system and the expected profit of the retailer are larger than the newsboy model, but the expected profit of the supplier is smaller than the newsboy model. In the coordination case, the expected profit of system, supplier, and retailer is higher than the other two cases, and the order quantity is less, which reduces the inventory risk.

5. Conclusion

This paper investigates the coordination mechanism of a system consisting of multiple retailers and a single supplier in the background of New Retail. To better fit the actual New Retail scenario, this paper uses an online store as a vehicle to make the supplier also participate in the sales process directly, and gives an example of a supply chain consisting of two retailers and one supplier to fulfill the conditions required to achieve supply chain coordination. Numerical analysis shows that the expected profits of the system, suppliers and retailers are higher than those of the newsboy model and centralized decision making in the coordination scenario.

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