Study on the Value of Online Retailer Freight Insurance Strategy based on Customer Return Behavior

Shi Tao [1, a], Xiao Xiao [1, b] and Guofeng Liu [2, c]

[1]School of Economics and Management, Chongqing University of Posts and Telecommunications, Chongqing 400065, China;

[2]Key Laboratory of Modern Logistics, Chongqing 400065, China.

[a]379825492@qq.com, [b]XiaoFrank1993@163.com, [c]18716286613@163.com

Abstract

This paper analyzes the transaction decision-making of a supply chain is made up of retailers who strives to promote and consumers who used to return without reason. Firstly, we develop one online transaction decision model which integrated return freight insurance policy, its results indicate that the retailer offer freight insurance policy can obviously improve the profits of online retailers and the entire supply chain. Then we proposes three types of freight insurance policy: full return freight insurance, separate return freight insurance and contingency return freight insurance, and get corresponding effective solution. The findings reveal, the implementation of freight insurance policy can enhance the profit of the supply chain and its members under different trading conditions. The higher the value of the product is, the higher the benefit generated by implementing the full return freight insurance policy is, the higher the sales and profits of the retailer when using separate return freight insurance and the price reduction policy, and the higher the volume of online transaction and the overall profits of supply chain when adopting the contingency return freight insurance policy. Finally, we use numerical simulations to verify the validity of the conclusions, compare this three types return policies, and analyse the impact of their sensitivity of freight insurance on the profit of overall supply chain and its members, which provide managerial suggestions for the online retailer to develop a appropriate return policy.

Keywords

Return freight insurance; Money-back guarantees; Online retailer.

1. Introduction

With the rapid development of Internet technology and e-commerce transactions, the China Online Retail Market Data Monitoring Report released by China E-Commerce Research Center in shows that the transaction scale of China's online retail market in 2016 reached 787.5 billion dollars(5.3288 trillion yuan), up 39.1 percent from last year which reached 565.7 billion dollars (3.83 trillion yuan). In the online trading environment, products don’t meet customer’s expectations is the most common problem of shopping. In order to reduce the risk of uncertainty consumers faced, the retailer have reduced the requirement for consumer returns which made it easy for consumers to return, such as the product is allowed to be returned for 7 days without any reason even if the product don’t have quality problems or appearance defects. Subsequently, for goods returned without reason for 7 days, the return freight insurance launched by Alibaba Group and Huatai Insurance can solve the problem of consumer returns caused by consumers' deviation in the valuation of products before they purchase.

After Huatai Insurance and Taobao launched the return freight insurance, the risk of online shopping for consumers was reduced, and the online shopping environment has been improved, which increased online transactions and sales at online retailers. On the contrary, consumers' tolerance for

products is also reduced, and they will return without hesitation as long as the products do not meet consumer expectations, resulting in a surge in online retailers' returns. Therefore, under the emerging trend of Internet insurance, retailers provide some value-added services-the return freight insurance to reduce online shopping risks, improve online retailers' profitability, and enhance the competitiveness of open e-commerce platforms.

With the rapid development of e-commerce, increasing POP open e-commerce companies have conducted extensive research on consumer returns. The literature on consumer returns issues mainly focus on return costs, return conditions and return services. Chu W et al proposed a policy which refund part of the purchase price on the basis of the residual value of product was returned, namely the retail can only charge part of the price according to the residual value after consumers return product[2]. Consequently this return policy can effectively reduce the loss of the retail due to consumer return product in online shopping. Yao & Hsiao have analysed the return policy which take return cost, product quality and pricing into consideration, and mainly discussed the pricing of the return policy which provide one-way decision-making reference for the e-commerce enterprise to formulate the return policy[3-6].Akcay studied the return without reason after consider the heterogeneity of consumer's preference, demand uncertainty and return cost, then proposed a return policy allocating cost that can increase market demand and constrain consumer returns, eventually maximize corporate profits[7]. The research on return conditions mainly focuses on trouble cost which means the time and labor cost of consumer returns and obstacle cost which means the cost of consumer deal with extra work due to returns. Companies can influence consumer return behavior by adjusting trouble cost and obstacle cost. Samar K et al. and Shulman studied retailer return policy from multiple perspectives, suggests that a loose return policy can lead to a surge in returns. If necessary, retailers can increase the difficulty of return to hold back consumers to return by setting the costly cost of returns, for example, shorten the return period and increase the return cost can effectively reduce the number of return for consumer[8-10].

At the same time, develop the obstacle cost has also been applied to management practices by many companies to stop consumer returning products. For example, Nike which is the famous sports brand in the global put forward some return policy including many barriers such as products that must remain as it is, can't be repaired or washed, meanwhile consumer must provide a valid receipt or invoice when they return products. In some literature about return service is provided by the retailer, Ofek and Chen from the perspective of strategic support services, studied the impact of store-assisted services on customer returns, and pointed out that shop-assisted service strategies can reduce consumer returns[11-12]. Li developed a programmatic online sales model from the perspective of product quality risk, discussed the impact of service compensation strategy which is base on the product quality risk and return without reason on the profitability of online retailers, and pointed out consumer service compensation strategies can effectively reduce consumer returns[13]. Pappaspointed out that the endowment effect can reduce the economic and product risks of consumers shopping, and can also reduce the perceived risk of consumption[14].

However, the above research mainly focuses on the characteristics of consumer returns, and pay a little attention to the combination of consumer returns and freight insurance policy. Consequently, this paper from the perspective of the open e-commerce platform enterprise introduces the return freight insurance to the retailer online sales model, and uses the retail price and return freight insurance as the decision variables to study the online retailer's full return freight insurance, separate return freight insurance and contingency return freight insurance decision-making models, and find the optimal return freight insurance policy for the open online retailers to improve retailers' profitability and supply chain performance. Finally, we compare the economic benefits of the three kinds return freight insurance policies, and provide managerial suggestions for the online retailer to develop a suitable return policy.

2. Problem Description and Hypotheses

In a two-level supply chain consisting of online retailer who selling only one product and consumers in the homogeneous market who can return for seven days without reason, if both parties are rational, adopting differentiated return freight insurance policy can generate positive benefits to product market demand and open trading environment.

Consumers cannot directly see the product before buy the product in the online shopping, so it is difficult for them to assess product value. In order to reduce the consumer's psychological cost and time cost, online retailers usually provide different return freight insurance policy according to the attributes of the products. The common return freight insurance policy is as follows:

Policy 1 Full return freight insurance. It is a return freight insurance paid by retailers who aim to expand the market demand and attract more potential consumers in online trading.

Policy 2 Separates return freight insurance. It is a return freight insurance paid by consumers in online trading.

Policy 3 Contingency return freight insurance. It means retailer and consumer pay the corresponding freight insurance fees based on the value of the product in online trading, sometimes retailers or consumers pay the overall freight insurance fees, sometimes retailer and consumer each pay a portion of freight insurance fees based on a certain percentage.

In general, after receiving the product, the consumer decides whether to return the product according to the quality of the product and the freight insurance service they chose. Zhai and Liu assume the price is the only factor influencing the number of market demand and return.

In order to reflect the impact of return freight insurance strategy on demand, return amount and supply chain profit, this paper assumes that market demand and return amount are not only affected by product price, but also moderated by the return freight insurance policy. The description of related variable and parameter in the model is as table 1.

Table 1. The description of related variable and parameter in the model

Variables	Statements
p	Product price include freight in online shopping
c_m	Unit production cost of the new product
w	Average cost of return freight insurance
p_r	Refund provided by online retailers
p_s	The average price of a resale product
π_1	Expecting profit of online retailer provide full return freight insurance
π_2	Expecting profit of online retailer provide separates return freight insurance
π_3	Expecting profit of online retailer provide contingency return freight insurance
λ	The proportion of return freight insurance online retailer provide

The demand function and return function based on the linear model are as follows:

$$D = d - \varphi p + \beta\lambda w$$

$$R = r - \psi[w + w(1-\lambda)] = r - \psi(2w - \lambda w)$$

The online retailer's profit can be expressed as:

$$\Pi(p, w) = (p - c_m)D - pR + (p_s - c_s)R - \lambda wD$$

Among $d > 0$ denote the market demand, $\varphi > 0$ denote the sensitivity coefficient of the market demand to the product price, $\beta > 0$ denote the sensitivity coefficient of the market demand to the return freight insurance provided by retailer, $r > 0$ denote the basic amount of return in the market, $\psi > 0$ denote the sensitivity coefficient of the return amount to the proportion of return freight insurance online retailer provide.

3. An Online Trading Model Integrating the Return Freight Insurance Policy

3.1 Full Return Freight Insurance Policy

Full return freight insurance policy means $\lambda = 1$ is the policy which provided by the retailer and aim at expanding the demand of product and attracting the potential customer. Under this condition, the demand is $D_1 = \mathrm{d} - \varphi\mathrm{p} + \beta\mathrm{w}$, the return is $R_1 = \mathrm{r} - \psi\mathrm{w}$, the retailer's profit is given as

$$\Pi_1(\mathrm{p},\mathrm{w}) = (\mathrm{p} - c_m)(\mathrm{d} - \varphi\mathrm{p} + \beta\mathrm{w}) - \mathrm{p}(\mathrm{r} - \psi\mathrm{w}) + (p_s - c_s)(\mathrm{r} - \psi\mathrm{w}) - \mathrm{w}(\mathrm{d} - \varphi\mathrm{p} + \beta\mathrm{w})$$

Under the return freight insurance policy, the retailer offers full return freight insurance policy when $\lambda = 1$, the only thing need to be analyzed is the optimal price p_1. Under the first-order optimal condition $\partial\pi_1/\partial p_1 = 0$, let $\Delta' = d - r + \varphi\mathrm{p} + 2\psi\mathrm{w}$, $\Delta'' = \psi(p_s - c_s) - \mathrm{d} - \beta c_m$, thus the resulting optimal product price is given as

$$p_1^* = \frac{\Delta' + (\beta + \varphi - \psi)\,\mathrm{w}}{2\varphi}$$

Under full return freight insurance policy, the optimal demand D_1^*、the optimal returns $R_1^*$and the optimal profits Π_1^* are given as

$$D_1^* = \frac{d + r - \varphi c_m - 2\psi\mathrm{w} + (\beta + \psi - \varphi)\,\mathrm{w}}{2}$$

$$R_1^* = r - \psi\mathrm{w}$$

$$\Pi_1^* = \frac{[\Delta' + (\beta + \varphi - \psi)\,\mathrm{w}]^2}{4\varphi} + (p_s - c_s)(r - 2\psi\mathrm{w}) + \Delta''\mathrm{w} - c_m(\mathrm{d} + \beta\mathrm{w})$$

Conclusion 1 According to D_1^*、$R_1^*$and Π_1^*, if the product price p_1 is known, the full return freight insurance policy can increase the market demand while reduce the cost of customer return and lead to the number of returns is on the increase. Meanwhile it also increase the loss of retail if the real value of product is low. Therefore the full return freight insurance policy is only suit for product with high profit such as electronic products, high - grade durable goods. And the profit of the entire supply chain has increased significantly compared to the policy without return freight insurance.

3.2 Separates Return Freight Insurance Policy

Separates return freight insurance policy means $\lambda = 0$ is promotional strategy which aim at reducing the cost of operating and returns for retailer, and the return freight insurance is paid by customer. Under this condition, the demand is $D_2 = \mathrm{d} - \varphi\mathrm{p}$, the return is $R_2 = \mathrm{r} - 2\psi\mathrm{w}$, the retailer's profit given as

$$\Pi_2(\mathrm{p},\mathrm{w}) = (\mathrm{p} - c_m)(\mathrm{d} - \varphi\mathrm{p}) - \mathrm{p}(\mathrm{r} - 2\psi\mathrm{w}) + (p_s - c_s)(\mathrm{r} - 2\psi\mathrm{w})$$

Under the return freight insurance policy, the consumers buy the return freight insurance policy when $\lambda = 0$,thus it's unnecessary to consider the retailer's return freight insurance policy and the only thing need to be analyzed is the optimal price p_1. Under the first-order optimal condition $\partial\pi_2 / \partial p_2 = 0$, the resulting optimal product price is given as

$$\mathrm{p}_2^* = \frac{\Delta'}{2\varphi}$$

Under separates return freight insurance policy, the optimal demand D_2^*、the optimal returns R_2^* and the optimal profits Π_2^* are given as

$$\mathrm{D}_2^* = \frac{\mathrm{d} + \mathrm{r} - \varphi\mathrm{c}_\mathrm{m} - 2\psi\mathrm{w}}{2}$$

$$R_2^* = r - 2\psi\mathrm{w}$$

$$\Pi_2^* = \frac{\Delta'^2}{4\varphi} + (p_s - c_s)(r - 2\psi\mathrm{w}) - c_m\mathrm{d}$$

Conclusion 2 According to D_2^*、R_2^* and Π_2^*, if the product price p_2 is known, the separates return freight insurance policy can reduce the cost of customer return and the amount of returns meanwhile reduce the market demand. Consequently, the retailer who sell products with lower prices should control the cost of return freight insurance and use more favorable price strategy to attract customers. The retailer can take advantage of the price discount in the online shopping, namely reduce the product price to increase the product demand, and make up for the direct loss caused by the defect of the return freight insurance policy, eventually achieve the maximum profit of the online retailer. Meanwhile it also increase the loss of retail if the real value of product is low. Therefore the full return freight insurance policy is only suit for product with high profit such as electronic products, high - grade durable goods. And the profit of the entire supply chain has increased significantly compared to the policy without return freight insurance.

3.3 Contingency Return Freight Insurance

Contingency return freight insurance means $0 \le \lambda \le 1$, what return freight insurance policy is purchased by the consumer and retailer whose aim is maximize profits depends on the actual valuation of the product. To be specific $\lambda = 1$denote policy 1, $\lambda = 0$denote policy 2, and $0 < \lambda < 1$means the consumer and retailer share the return freight insurance in proportion. Under this condition, the demand is $D_3 = \mathrm{d} - \varphi\mathrm{p} + \beta\lambda\mathrm{w}$, the return is $R_3 = \mathrm{r} - \psi(2\mathrm{w} - \lambda\mathrm{w})$, the retailer's profit is given as

$$\Pi_3(\mathrm{p},\mathrm{w}) = (\mathrm{p} - c_m)(\mathrm{d} - \varphi\mathrm{p} + \beta\lambda\mathrm{w}) - \mathrm{p}[\mathrm{r} - \psi(2\mathrm{w} - \lambda\mathrm{w})] + (p_s - c_s)[\mathrm{r} - \psi(2\mathrm{w} - \lambda\mathrm{w})] - \lambda\mathrm{w}(\mathrm{d} - \varphi\mathrm{p} + \beta\lambda\mathrm{w})$$

To simplify the calculation, let $\widetilde{\mathrm{w}}=\lambda\mathrm{w}$, so the resulting is as follows

$$\Pi_3(\mathrm{p},\ \widetilde{\mathrm{w}}) = (\mathrm{p} - c_m)(\mathrm{d} - \varphi\mathrm{p} + \beta\widetilde{\mathrm{w}}) - \mathrm{p}[\mathrm{r} - \psi(2\mathrm{w} - \widetilde{\mathrm{w}})] + (p_s - c_s)[\mathrm{r} - \psi(2\mathrm{w} - \widetilde{\mathrm{w}})] - \widetilde{\mathrm{w}}(\mathrm{d} - \varphi\mathrm{p} + \beta\widetilde{\mathrm{w}})$$

Under $0 < \lambda < 1$, the thing need to be considered is the sensitive which is the retailer and consumer to return freight insurance policy, then analysing the product pricep_3^* and the return freight insurance $\widetilde{\mathrm{w}}_3^*$ provided by the retailer. Thus let $\partial\pi_3 / \partial p_3 = 0$, $\partial\pi_3 / \partial w = 0$ the optimal product price p_3^* and the optimal return freight insurance $\widetilde{\mathrm{w}}_3^*$ are given as

$$p_3^* = \frac{2\beta\Delta' + (\beta + \varphi - \psi)\Delta''}{4\beta\varphi - (\beta + \varphi - \psi)^2}$$

$$\mathrm{w}_3^* = \frac{(\beta + \varphi - \psi)\Delta' + 2\varphi\Delta''}{4\beta\varphi - (\beta + \varphi - \psi)^2}$$

Under contingency return freight insurance, the optimal demand D_3^*、the optimal returns R_3^* and the optimal profits Π_3^* are given as

$$D_3^* = d + \frac{\Delta'\beta(\beta - \varphi - \psi) + \varphi\Delta''(\beta + \psi - \varphi)}{4\beta\varphi - (\beta + \varphi - \psi)^2}$$

$$R_3^* = \mathrm{r} - 2\psi\mathrm{w} + \frac{\Delta'\psi(\beta + \varphi - \psi) + 2\varphi\psi\Delta''}{4\beta\varphi - (\beta + \varphi - \psi)^2}$$

$$\Pi_3^* = \frac{\Delta'^2\beta + (\beta + \varphi - \psi)\Delta'\Delta'' + \varphi\Delta''^2}{4\beta\varphi - (\beta + \varphi - \psi)^2} + (p_s - c_s)(r - 2\psi\mathrm{w}) - c_m\mathrm{d}$$

Under the product price p_3 is known, let $\partial\pi_3 / \partial w = 0$, the critical point of contingency return freight insurance $\widetilde{\mathrm{w}}_3^o$ is as follows

$$\widetilde{\mathrm{w}}_3^o = \frac{\psi(\mathrm{p_s} - \mathrm{c_s}) + (\beta + \varphi - \psi)\mathrm{p}_3 - (\mathrm{d} + \beta\mathrm{c_m})}{2\beta}$$

Conclusion 3 When the product price p_3 depend on the market competition, there is p_3^*、$\widetilde{\mathrm{w}}_3^*$ making $\Pi_3^*(p_3^*,\ \widetilde{\mathrm{w}}_3^*) \ge \Pi_3(p_3,\mathrm{w})$. When the product price p_3 is known, there is $\widetilde{\mathrm{w}}_3^o$ making $\Pi_3^o(\mathrm{p}_3,$

$w_3^0) \geq \Pi_3(p_3,\ w)$. The resulting show if $\beta < 2\psi$, the sensitivity coefficient of the return which increase with the return freight insurance is greater than $1/2$ the sensitivity coefficient of the demand which increase with the same reason. Consequently, the retailer can chose the optimal decision based on their own demand and the sensitive that the consumer for the return freight insurance policy.

3.4 The Analyse of the Three Return Freight Insurance Policy

In conclusion, we find the Nature 1which can enhance the efficiency of retailer's operation management by comparing the model variables of the three types of return freight insurance policy. Meanwhile it provide reference for the retailer who select the reasonable return policy.

Nature 1 If the product price p is determined by market competition, the relevant consumer demand and return amount under Policy 1 and Policy 2 have the following relationship: $D_1^* > D_2^*,\ R_1^* > R_2^*$ which indicate online retailers should choose a full return shipping risk strategy when prioritizing consumer demand, if online retailers prioritize consumer returns, they should choose a separate return shipping risk strategy to reduce returns.

Nature 2 If the product price p is known, let the profit function of Policy 1 and Policy 2 equal, the product price is

$$p^o = \frac{d + \beta c_m + \beta w - \psi(p_s - c_s)}{\beta + \varphi - \psi}$$

Which is the critical point of function. If $p = p^o$, the profit of Policy 1 and Policy 2 are equal. If $p > p^o$ which means the retailer offers full return freight insurance policy, the amount of consumer's demand and the profit of supply chain are respectively more than the separates return freight insurance policy generated. It indicates the impact of the return freight insurance policy on the consumer is little, therefore the full return freight insurance policy is better than the separates return freight insurance policy when their sensitive to demand is less. On the contrary, if $p < p^o$ which means the return freight insurance policy has great influence on the returns, thus the separates return freight insurance policy is better than the full return freight insurance policy when their sensitive to demand is less.

Nature 3 When the product price p depend on the market competition, the less loss caused by the return is, the more the profit of retailer who choose contingency return freight insurance policy. Under the retailer offer return freight insurance, which can effectively reduce the risk of online shopping due to the uncertainty of product valuation, thus the retailer make consumer feel satisfied with online shopping by the low cost, meanwhile also increase the demand of the consumer. Therefore, the retailer can realize the profit maximization by adopting the contingency return freight insurance policy which means the retailer adjust the portion of the return freight insurance.

4. Numerical Analysis

4.1 Optimal Value

Experiments using examples to gain market parameters exogenous variables, to further demonstrate the validity of the proposed theory and analysis. Retailers online transaction process, exogenous market parameter settings as shown in Table 2.

Table 2. Exogenous market parameters

Parameter	d	r	c_m	c_s	p_s	w	Φ	β	ψ
value	1000	150	40	30	60	15	5	11	5

4.2 Optimal Value

4.2.1 The impact of the sensitivity coefficient β and ψ respectively change on the retailer's decision when the price p is known

Table 3. The impact of the sensitivity coefficient β and ψ respectively change on the retailer's decision when the price p is known

Variable	Return freight insurance of retailer			Return freight insurance strategy			Consumer's demand			Returns			Retailer's profit		
P	w	o	$\widetilde{w}_3^o$	o	w	w $-\widetilde{w}_3^o$	D_1^o	D_2^o	D_3^o	R_1^0	R_2^0	R_3^0	π_1^o	π_2^o	π_3^o
130	15	0	6.4	0	15	8.6	515	350	420	75	0	32	31125	31500	31945.5
p^o=132	15	0	7.5	0	15	7.5	504	339	421	75	0	38	31247	31247	31865.7
140	15	0	11.4	0	15	3.6	465	300	425	75	0	57	31275	30000	31420.5

As the Table3 shown, when the product price p is know, $p = p^o$ and $\pi_1^o = \pi_2^o$, which means the profit of the full return freight insurance policy is same with the separate return freight insurance policy, when $p > p^o$, $D_1^o > D_3^o > D_2^o$, $\pi_1^o > \pi_2^o, \pi_3^o > \pi_2^o$, the demand of the consumer and the profit of overall supply chain when the retailer offer the full return freight insurance respectively higher than the retailer offer the separate return freight insurance. When $p < p^o$, $\pi_2^o > \pi_1^o$, the retailer's profit when they chose the policy 2 is higher than they chose the policy 1. Therefore the resulting is in line with Nature 2.

4.2.2 The impact of the sensitivity coefficient β and ψ respectively change on the retailer's decision when the price p is determined by market competition

Table 4. The impact of the sensitivity coefficient β and ψ respectively change on the retailer's decision when the price p by market competition

Variable		Commodity price			Return freight insurance strategy			Consumer's demand			Returns			Retailer's profit		
β	ψ	p_1^*	p_2^*	p_3^*	w	o	$\widetilde{w}_3^*$	D_1^*	D_2^*	D_3^*	R_1^*	R_2^*	R_3^*	π_1^*	π_2^*	π_3^*
11	5	136.5	120	123.3	15	0	3.0	483	400	417	75	0	15	31336.3	32000	32045.5
10	4	133.5	117	118.0	15	0	0.9	483	415	419	90	30	34	28561.3	29345	29348.1
10	3	132	114	126.4	15	0	10.4	490	430	471	105	60	91	27020.0	26780	27080.4

As the Table4 shown, when the product price p depend on the market competition, the profit is maximum if the retailer adopt the contingency return freight insurance policy, meanwhile the retailer can realize the profit maximization by adjust the proportion of return freight insurance when they adopt the full return freight insurance policy and the separate return freight insurance policy, thus these meet $D_1^* > D_2^*$, $R_1^* > R_2^*$ and in line with the Nature 2 . Moreover, the loss caused by the return is low, the retailer's profit meet $\pi_3^* > \pi_1^*$, $\pi_3^* > \pi_2^*$, so these is in line with the Nature 3.

5. Conclusion

As consumer's return without reason gradually become a hot topic for open e-commerce transactions, the number of companies which studied return without reason is increasing. This paper builds a two-level supply chain is made up of retailers who strives to promote and consumers who used to return without reason, then studies retailer's strategic decision under the return freight insurance policy. Firstly, we develop one online transaction decision model which integrated return freight insurance policy, its results indicate that the retailer offer freight insurance policy can obviously improve the

profits of online retailers and the entire supply chain. Consequently, we propose three types of freight insurance policy models-full return freight insurance, separate return freight insurance and contingency return freight insurance, and build online trading models to analyze effective solutions. The findings reveal, the implementation of freight insurance policy can enhance the profit of the supply chain and its members under different trading conditions. The higher the value of the product is, the higher the benefit generated by implementing the full return freight insurance policy is, the higher the sales and profits of the retailer when using separate return freight insurance and the price reduction policy, and the higher the volume of online transaction and the overall profits of supply chain when adopting the contingency return freight insurance policy. Then, we use numerical simulations to verify the validity of the conclusions, compare these three types return policies, and analyses the impact of their sensitivity of freight insurance on the profit of overall supply chain and its members. Therefore, this paper provides three kinds of return freight insurance policies for online retailers, and retailers and consumers can flexibly choose corresponding policies according to their different conditions, thereby improving retailers' online profitability and overall supply chain performance.

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