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Research on Supply Chain Cooperation Strategy of Low-carbon E-commerce Considering Targeted Promotion under Carbon Trading Regulation

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Abstract

Considering the regulation of carbon cap-and-trade schemes, this paper analyses the influence of external carbon trading regulation and internal platform targeted promotion services on the choice of supply chain cooperation strategies. First, two low-carbon e-commerce supply chain (LCESC) decision-making models under the agency or resale mode are constructed and solved. Then, contrasts the equilibrium solutions under the two models, analyzes the effect of key parameters on the equilibrium solution, and discusses the influence of carbon trading price on decisions and earnings through numerical analysis. The results show that: (1)different cooperation strategies do not influence emission reduction decisions and earnings of manufacturer;(2)in terms of platform operation mode, the choice of supply chain cooperation strategy only depends on the platform commission rate;(3)Interestingly, the example analysis shows that maintaining a higher carbon trading price is helpful in improving the product price, the level of platform targeted promotion efforts and the manufacturer's earnings under the agency model. The conclusions of this paper provide a scientific reference for LCESC management and cooperation strategy selection.

Keywords: Carbon trading regulation, Targeted promotion service, Low-carbon e-commerce supply chain, Cooperation strategy;

1. Introduction

With the increasingly serious environmental problems, protecting the environment has become a global consensus, and various policies and regulations emerge in endlessly. Studies have shown that carbon cap-and-trade policy is one

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of the most efficient environmental regulations[1].Under this regulation, manufacturers are expected to make prudent decisions about production and emissions reduction.

Nowadays, with the high popularity of Internet technology, many low-carbon enterprises have turned their attention to integrated e-commerce platforms such as Jingdong and Taobao, which integrate sales and promotion functions. In fact, the cooperation strategy of LCESC is affected by many factors, such as the operation mode of the platform and targeted advertising services. As far as the platform operation mode is concerned, it mainly includes agency mode and resale mode[2].Under the agency mode, manufacturers sells products directly on the platform, and the pricing right of the product belongs to the manufacturer, and the platform takes a commission to obtain profits, such as Tmall , Taobao and so on; under the resale mode, the manufacturer first sells products to the platform, which then resell them to consumers to make profits by earning price differences, and the pricing right of the products belongs to the platform, such as Jingdong. Platform operation mode determines the profit structure and product pricing power of LCESC members, so it will affect the formulation of supply chain strategy. Manufacturers must decide whether it is an agency model or a resale model when dealing with multiple platforms. In terms of targeted advertising, it has become a significant profit channel for platforms due to its important role in increasing sales and creating demand. But the level of targeted promotion efforts of the platform under different operation modes will also change, and carbon emission regulations may have an important influence on the decisions of manufacturers and platforms. The choice of LCESC cooperation strategy is still an unclear problem.

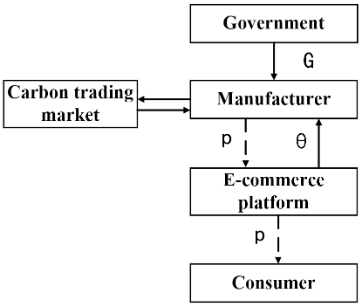
In present research, there are many studies on the decision of supply chain members under the regulation of carbon. Tang et al.(2020)[3] analyzed the quantitative models in the study of carbon emissions trading system, which provide a lot of management enlightenment for the decision-making of all parties involved in the trading system. With the high popularity of e-commerce platform, Hagiu (2007)[4] began to discuss the selection strategy of e-commerce platform business model, compared e-commerce platform profit under wholesale mode and agency mode, and analyzed the possible equilibrium conditions. Subsequently, the operation strategy of e-commerce platform has attracted the attention of many scholars, such as Abhishek et al.(2016)[2]、Zhang et al.(2022)[5]、Xu et al.(2023)[6].There are also some scholars who study LCESC, such as Han et al.(2018)[7]、Han et al.(2020)[8] studied the supply chain performance and coordination under the platform's participation on sales of low-carbon goods and cutting the emission. About targeted advertising promotion services, Sayedi et al.(2014)[9] studied the phenomenon of poaching and considered its impact on companies' allocation of advertising investment between traditional and search advertisement. Shen et al.(2021)[10] proposed a method for online advertisement publishers to better allocate advertising resources by constructing and solving mixed integer nonlinear programming and Poisson regression models. Some scholars have introduced targeted advertising in the field of e-commerce platform, for example, Hao et al. (2022)[11] considered a supply chain composed of sellers and platform under dual-channel sales, and analyzed the advertising mode, targeted promotion strategy of platform and seller's registration decision.

To sum up, in the literature research of e-commerce platform operation strategy, there are few researchers considering directional promotion. Although some scholars have begun to study the advertising model and targeted promotion strategy of the platform in the double channel supply chain, there is even less literature on the consideration of low-carbon goods sales and cut emissions decisions under the constraints of cap-and-trade schemes. Therefore, based on two different operation modes (agency or resale) of the platform, this paper constructs two models of Stackelberg game under the constraints of cap-and-trade mechanisms, and compares the equilibrium solutions under different modes to study the choice of supply chain cooperation strategies.

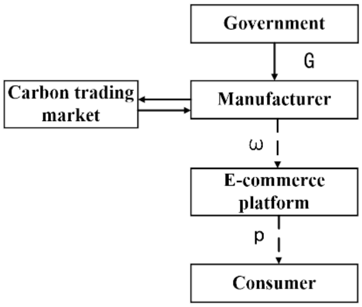
2. Problem description and model assumptions

This paper studies a LCESC composed of a manufacturer (leader) and an e-commerce platform under the regulation of carbon trading policy, and makes a Stackelberg game between them. Manufacturers belong to emission-control companies and are subject to government carbon allowances, while excess or insufficient can be exchanged on the carbon marketplace. And the platform is responsible for targeted advertising promotion to consumer groups, including low-carbon product performance display, personalized push, and search ranking optimization. This paper assumes that the sequences of events are: in the agency mode, the manufacturer first fixes the sales price p and the emission reduction e_m of each unit product, and then the platform spends the efforts of targeted promotion δ ;in the resale mode, the first, the manufacturer confirms the wholesale price ω and e_m , and then the platform determines p and δ . Fig. 1

illustrates the LCESC structure.



(a) Model M



(b) Model R

Fig. 1. Low-carbon e-commerce supply chain structures.

The following assumptions are made for complex cases to facilitate calculation:

(1) Refer to Ji et al.(2017)[12]and Zhang et al. (2022)[13], it is assumed that the sales price p , the unit emission reduction e_m and the targeted promotion effort level of the platform δ jointly affect low-carbon products market demand, and the market demand is $q=1-p+\beta e_m+\delta$,and β is the low-carbon sensitivity coefficient of consumers.

(2) Suppose the manufacturer cost of emission reduction is $c(e_m)$, the carbon emission abatement is e_m , $c(e_m)$ is a quadratic function of e_m , then $c(e_m)=ke_m^2/2(k>0)$, where k is the cost coefficient of carbon reduction. In a similar way, the platform targeted promotion cost is $c(\delta)=\delta^2/2(\delta>0)$ [14].

(3) In this paper, commission rate θ is set as exogenous variables, and it is determined before any action is taken by the supply chain partners and is rarely changed. The symbol and their definitions are shown in Table 1.

Table 1. Relevant symbols and their definitions.

Symbol	Definition
k	Cost coefficient of carbon reduction.
G	Carbon quota allocated to the manufacturer.
c_m	Unit production cost.
β	Consumers low-carbon sensitivity coefficient.
e_0	Initial carbon emissions.
p_c	Trading price for carbon emission.
θ	Commission rate per unit product of the platform.
q	Low-carbon goods market demand.
δ	Level of efforts for targeted promotion.
e_m	Carbon emission abatement.
ω	Wholesale price of the low-carbon goods.
p	Sales price of the low-carbon goods.
Π_i^j	Profit function.
Superscript $j=A,R$	Refers to agency model and resale model, respectively.
Subscript $i=m,\ p$	Refers to manufacturer and platform, respectively.

3. Model analysis

3.1. Agency model(A)

In the agency model, the profit function of the manufacturer and the platform are respectively expressed as:

$$\Pi_m^A(p,e_m)=(1-\theta)pq-c_mq-\frac{1}{2}ke_m^2-p_c[(e_0-e_m)q-G]，\Pi_p^A(\delta)=\theta pq-\frac{1}{2}\delta^2.$$

Proposition 1. In the Model A, the optimal decision of the LCESC members and the optimal profit are as follows:

$$p^{A^*}=\frac{k-p_c(p_c+\beta)+(k-\beta(p_c+\beta))(c_m+p_ce_0)}{(-1+\theta)\left(-2k+(p_c+\beta)^2\right)},\ e_m^{A^*}=\frac{(p_c+\beta)(-1+c_m+p_ce_0)}{-2k+(p_c+\beta)^2},$$

$$\delta^{A^*}=\frac{\theta\left(k-p_c(p_c+\beta)+(k-\beta(p_c+\beta))(c_m+p_ce_0)\right)}{(-1+\theta)\left(-2k+(p_c+\beta)^2\right)},\ \Pi_m^{A^*}=Gp_c+\frac{-k-k(-2+c_m+p_ce_0)(c_m+p_ce_0)}{4k+2\left(-4k+(p_c+\beta)^2\right)},$$

$$\Pi_p^{A^*}=-\frac{\theta\left(-k+p_c(p_c+\beta)-(k-\beta(p_c+\beta))(c_m+p_ce_0)\right)\left(k(2-3\theta)+p_c\theta(p_c+\beta)+(k(-2+\theta)+\theta\beta(p_c+\beta))(c_m+p_ce_0)\right)}{2(-1+\theta)^2\left(-2k+(p_c+\beta)^2\right)^2}.$$

3.2. Resale model(R)

In the resale model, the profit function of the manufacturer and the platform are respectively expressed as:

$$\Pi_m^R(w,e_m)=(w-c_m)q-\frac{1}{2}ke_m^2-p_c[(e_0-e_m)q-G],\ \Pi_p^R(p,\delta)=(p-w)q-\frac{1}{2}\delta^2.$$

Proposition 2. In the Model R, the optimal decision of the LCESC members and the optimal profit are as follows:

$$\omega^{R^*}=-\frac{k-p_c(p_c+\beta)+(k-\beta(p_c+\beta))(c_m+p_ce_0)}{-2k+(p_c+\beta)^2},\ e_m^{R^*}=\frac{(p_c+\beta)(-1+c_m+p_ce_0)}{-2k+(p_c+\beta)^2},\ \delta^{R^*}=-\frac{k(-1+c_m+p_ce_0)}{2k-(p_c+\beta)^2}$$

$$p^{R^*}=\frac{-2k+p_c(p_c+\beta)+\beta(p_c+\beta)(c_m+p_ce_0)}{-2k+(p_c+\beta)^2},\ \Pi_m^{R^*}=Gp_c+\frac{-k-k(-2+c_m+p_ce_0)(c_m+p_ce_0)}{4k+2\left(-4k+(p_c+\beta)^2\right)},$$

$$\Pi_p^{R^*}=\frac{k^2(-1+c_m+p_ce_0)^2}{2\left(-2k+(p_c+\beta)^2\right)^2}.$$

4. Analysis of equilibrium solution

4.1. Comparative analysis under different cooperation strategies

Proposition 3. The comparison results of the equilibrium solution between model A and R are as follows:

(1) $e^{A^*}=e^{R^*}$, $\Pi_{\mathrm{m}}^{A^*}=\Pi_{\mathrm{m}}^{R^*}$;

(2) When $\frac{-p_c+p_cc_m-\beta+c_m\beta}{-2k+p_c\beta+\beta^2}<e_0<\frac{1-c_m}{p_c}$, $0<c_m<1$ and $\frac{k(-1+c_m+p_ce_0)}{-2k+(p_c+\beta)(p_c+c_m\beta)+p_c\beta(p_c+\beta)e_0}<\theta<1$,there are: $p^{A^*}>p^{R^*}$, $\delta^{A^*}>\delta^{R^*}$, vice versa.

According to Proposition 3, the manufacturer's optimal e_m are equal under the two distinct cooperation strategies. Different cooperation strategies do not affect the carbon emission reduction decisions. k 、 e_0 and θ have an important impact on p and δ .

There is a critical value $(-k+kc_m+kp_ce_0)/(-2k+(p_c+\beta)(p_c+c_m\beta)+p_c\beta(p_c+\beta)e_0)$,when θ is greater than it, p and δ are greater in model A than in model R, and vice versa. This reason is that when θ is too high, the profit of the platform increases, which leads to the improvement of δ and market requirement. Manufacturers also raise p to pass on the increased agency cost of the platform to consumers.

4.2. Effect of β on equilibrium solution

Proposition 4. In the Model A, the effect of β on the equilibrium solution is as follows:

(1) $\frac{\partial e^{A^*}}{\partial \beta} > 0$;

(2) When $\frac{-p_c + p_c c_m - \beta + c_m \beta}{-2k + p_c \beta + \beta^2} < e_0 < \frac{1 - c_m}{p_c}$, $0 < c_m < 1$ and $\beta \geq p_c$ or $0 < \beta < p_c$, $k > \frac{p_c^3 + 2p_c^2 \beta + p_c \beta^2}{2\beta}$,

there are: $\frac{\partial p^{A^*}}{\partial \beta} > 0$, $\frac{\partial \delta^{A^*}}{\partial \beta} > 0$;

(3) When $\frac{-p_c + p_c c_m - \beta + c_m \beta}{-2k + p_c \beta + \beta^2} < e_0 < \frac{1 - c_m}{p_c}$, $0 < c_m < 1, 0 < \beta < p_c$ and $k < \frac{p_c^3 + 2p_c^2 \beta + p_c \beta^2}{2\beta}$,

there are: $\frac{\partial p^{A^*}}{\partial \beta} < 0$, $\frac{\partial \delta^{A^*}}{\partial \beta} < 0$.

According to Proposition 4, β has a positive impact on e_m, and the impact on p and δ is related to the relationship between them. When this relationship $(-p_c + p_c c_m - \beta + c_m \beta)/(-2k + p_c \beta + \beta^2) < e_0 < (1 - c_m)/p_c$ and $0 < c_m < 1$ are satisfied, a higher degree of low-carbon preference ($\beta \geq p_c$) can stimulate an increase in p and δ. The reason is that the higher β, the more willing customers are to buy low-carbon goods, so the demand for products increases, which leads to the rise of p. When $0 < \beta < p_c$, a higher k ($k > (p_c^3 + 2p_c^2 \beta + p_c \beta^2)/2\beta$) represents a higher carbon reduction cost, the manufacturer will choose to raise p, and the platform will increase δ, so as to obtain more profits. On the contrary, when k is low ($k < (p_c^3 + 2p_c^2 \beta + p_c \beta^2)/2\beta$), manufacturers need to reduce p to increase demand, then the platform will not make more promotion efforts.

Proposition 5. In the Model R, the effect of β on the equilibrium solution is as follows:

(1) $\frac{\partial e^{R^*}}{\partial \beta} > 0$, $\frac{\partial p^{R^*}}{\partial \beta} > 0$, $\frac{\partial \delta^{R^*}}{\partial \beta} > 0$;

(2) When $\frac{-p_c + p_c c_m - \beta + c_m \beta}{-2k + p_c \beta + \beta^2} < e_0 < \frac{1 - c_m}{p_c}$, $0 < c_m < 1$ and $\beta \geq p_c$ or $0 < \beta < p_c$, $k > \frac{p_c^3 + 2p_c^2 \beta + p_c \beta^2}{2\beta}$, there is: $\frac{\partial \omega^{R^*}}{\partial \beta} > 0$;

(3) When $\frac{-p_c + p_c c_m - \beta + c_m \beta}{-2k + p_c \beta + \beta^2} < e_0 < \frac{1 - c_m}{p_c}$, $0 < c_m < 1$, $0 < \beta < p_c$ and $k < \frac{p_c^3 + 2p_c^2 \beta + p_c \beta^2}{2\beta}$, there is: $\frac{\partial \omega^{R^*}}{\partial \beta} < 0$.

According to Proposition 5, it is different from the model A, β has a positive impact on e_m, p and δ. This shows that when consumers prefer low-carbon goods, manufacturers will choose to increase e_m in order to increase sales. After the increase of demand, the platform, as a resale channel, has greater motivation to improve δ and its own p, to better grasp the consumer preference psychology and help the business development of low-carbon products. The impact of β on ω is like the model A.

4.3. Effect of k on equilibrium solution

Proposition 6. In the Model A, the effect of k on the equilibrium solution is as follows:

(1) $\frac{\partial e^{A^*}}{\partial k} < 0$;

(2) When $\frac{-p_c+p_c c_m-\beta+c_m\beta}{-2k+p_c\beta+\beta^2}<e_0<\frac{1-c_m}{p_c}$, $0<c_m<1$ and $p_c \geq \beta$,there are: $\frac{\partial p^{A^*}}{\partial k}>0$, $\frac{\partial \delta^{A^*}}{\partial k}>0$;

(3) When $\frac{-p_c+p_c c_m-\beta+c_m\beta}{-2k+p_c\beta+\beta^2}<e_0<\frac{1-c_m}{p_c}$, $0<c_m<1$ and $\beta \geq p_c$,there is: $\frac{\partial p^{A^*}}{\partial \beta}<0$, $\frac{\partial \delta^{A^*}}{\partial \beta}<0$.

According to Proposition 6, in model A, the manufacturer's e_m decreases with the increase of k, because the increase means that carbon reduction investment of the manufacturer increases, so they will consider reducing the emission reduction. When this relationship $(-p_c+p_c c_m-\beta+c_m\beta)/(-2k+p_c\beta+\beta^2)<e_0<(1-c_m)/p_c$, $0<c_m<1$ and $p_c \geq \beta$ are satisfied, carbon trading and abatement cost of the product will increase with k increases. To cut costs, p is raised, forcing some consumers to give up buying the product. At this time, the platform will expand demand by improving δ. But, when $\beta \geq p_c$, the increase of k has little impact on the carbon cost of manufacturers, and a higher degree of β can decrease p and increase the demand, and the platform also doesn't need to put too much effort into promoting low-carbon products.

Proposition 7. In the Model R, the effect of k on the equilibrium solution is as follows:

(1) $\frac{\partial e^{R^*}}{\partial k}<0$, $\frac{\partial p^{R^*}}{\partial k}<0$, $\frac{\partial \delta^{R^*}}{\partial k}<0$;

(2) When $\frac{-p_c+p_c c_m-\beta+c_m\beta}{-2k+p_c\beta+\beta^2}<e_0<\frac{1-c_m}{p_c}$, $0<c_m<1$ and $p_c \geq \beta$,there is: $\frac{\partial \omega^{R^*}}{\partial k}>0$;

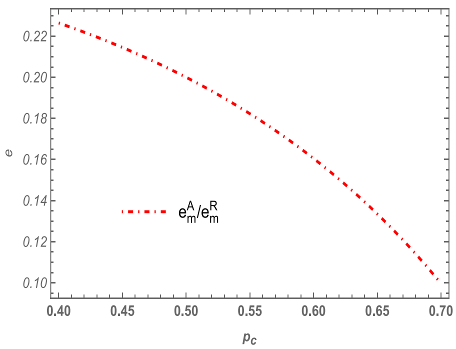
(3) When $\frac{-p_c+p_c c_m-\beta+c_m\beta}{-2k+p_c\beta+\beta^2}<e_0<\frac{1-c_m}{p_c}$, $0<c_m<1$ and $\beta \geq p_c$,there is: $\frac{\partial \omega^{R^*}}{\partial k}<0$.

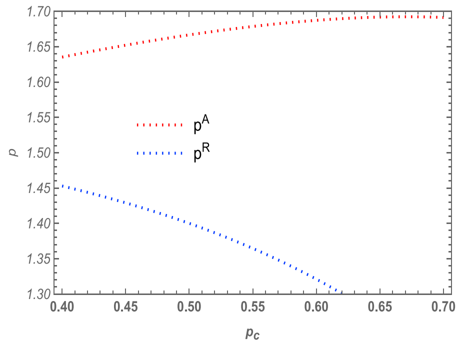
According to Proposition 7, unlike the model A, there is a negative impact of k on e_m, p and δ. The increase of k leads to the increase of product carbon reduction cost, and the manufacturer reduces e_m for the purposes of cost saving. At this time, the demand abated, the platform needs to reduce p to attract consumers to buy them, and the targeted promotion investment of the platform will also decrease, which leads to the decline of δ. The impact of k on ω is like the model A.

5. Numerical analysis

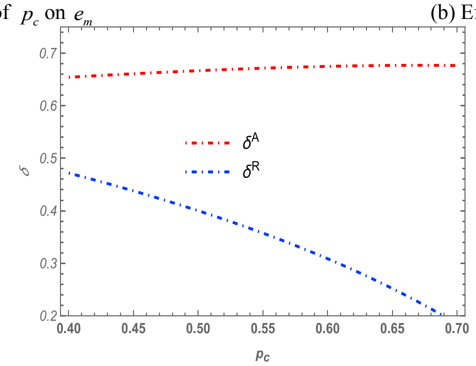
Aim at the problem that the profit function of LCESC members is too complex under different cooperation strategies, and for further reveal the influence of p_c on equilibrium decision and profits, this section carries out numerical analysis to explain more management implications. We consider the following representative reference values as an example: $\alpha=300$, $\beta=2$, $c_m=0.2$, $k=5$, $e_0=1$, $\theta=0.4$, $G=100$ and $p_c \in (0.4, 0.7)$.

5.1. Effect of p_c on decision variables





(a) Effect of p_c on e_m (b) Effect of p_c on p

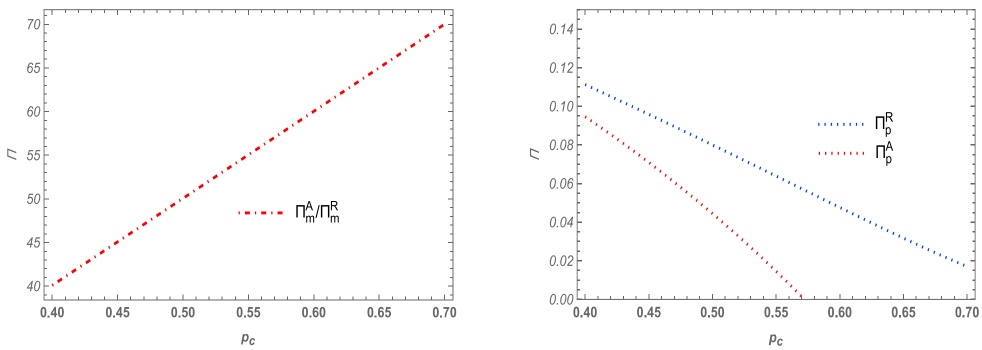


(c) Effect of p_c on δ

Fig. 2. Effects of p_c on e_m , p and δ in model A and R.

It can be seen from Fig. 2 (a) that e_m under the two cooperative strategies are equal and decrease with the increase of p_c . This is because if the manufacturer buys a certain amount of carbon emission rights, p_c rises, which results in increased carbon cost of the product, and the manufacturer reduces e_m to cut the cost. According to Fig. 2 (b) and (c), in model A, the manufacturer will transfer the increased carbon cost to consumers by raising p ,some consumers give up buying the product and reduce the demand. At this time, the platform will increase δ to increase the demand for the product. In model R, the rising p_c has less impact on the cost of the platform, but the reduction of e_m leads to the reduction of demand and profits,, the platform needs to reduce p to attract consumers, and its investment in targeted promotion efforts will also be reduced.

5.2. Effect of p_c on profit



(a) Effects of p_c on Π_m (b) Effects of p_c on Π_p

Fig. 3. Effects of p_c on Π_m and Π_p in the model A and R.

Figure.3 (a) demonstrates that the profits of manufacturer are equal in both cases, and different cooperation strategies do not affect them. They all increase with the increase of p_c , because if the manufacturer buys a certain amount of carbon emission rights, the profit brought by the increase of product price is higher than the carbon cost caused by the increase of carbon trading price. Figure.3 (b) shows that the platform profit in both cases decreases with p_c . The increase of it has little impact on the cost of the platform, but the reduction of e_m leads to the decrease of demand, which makes the profit of the platform decrease continuously, in other words, the platform is the indirect "victim" of the increase of p_c .

6. Conclusion

The main results are as follows: (1) This paper constructs two decision-making models under the agency and resale mode, and introduces the carbon trading regulation and platform targeted advertising promotion services into the field of LCESC cooperation at the same time, and obtains the optimal emission reduction, price, targeted promotion effort level and supply chain members' profits; (2) Different cooperation strategies do not affect the manufacturer's emission reduction decision and profit; (3) From the perspective of platform operation mode, the choice of supply chain cooperation strategy only depends on the platform commission rate, when it is higher, the product price and the level of platform directional promotion efforts under the agency mode are higher than the resale mode;(4)From the perspective of carbon trading, it is interesting that the example analysis shows that the increase of carbon trading price leads to decreases in the optimal emission reductions under both the agency and resale modes; in the agency mode, the sales price decided by the manufacturer and the promotion of the platform are negatively correlated with the carbon trading price; in the resale mode, the opposite is true. In addition, the optimal profit direction of manufacturing is positive, and the optimal profit direction of platform may be negative.

In addition, there are still some limitations in this paper. This paper only considers information symmetry. In fact, manufacturers and platforms will have their own private information. Building a multi-stage model can also be one of the follow-up study directions.

References

[1] Zhou P, Wen W. (2020) "Carbon-constrained firm decisions: From business strategies to operations modelling." *European Journal of Operational Research* **281 (1)**: 1–15.

[2] Abhishek V, Jerath K, Zhang Z J. (2016) "Agency Selling or Reselling? Channel Structures in Electronic Retailing." *Management Science* **62 (8)**: 2259–2280.

[3] Tang L, Wang H, Li L, et al. (2020) "Quantitative models in emission trading system research: A literature review." *Renewable and Sustainable Energy Reviews* **132**: 110052.

[4] Hagiu A. (2007) "Merchant or Two-Sided Platform?" *Review of Network Economics* **(2)**.

[5] Zhang Z, Xu H, Ke G Y, et al. (2022) "Selecting online distribution modes for differentiated products in a platform supply chain." *International Journal of Production Economics* **244**: 108384.

[6] Xu X, Hong Z, Chen Y, et al. (2023) "When is it wise to use artificial intelligence for platform operations considering consumer returns?" *European Journal of Operational Research* **308 (3)**: 1188–1205.

[7] Han Q, Wang Y. (2018) "Decision and Coordination in a Low-Carbon E-Supply Chain Considering the Manufacturer's Carbon Emission Reduction Behavior." *Sustainability* **10 (5)**: 1686.

[8] Han Q, Wang Y, Shen L, et al. (2020) "Decision and Coordination of Low-Carbon E-Commerce Supply Chain with Government Carbon Subsidies and Fairness Concerns." *Complexity* **2020**: 1–19.

[9] Sayedi A, Jerath K, Srinivasan K. (2014) "Competitive Poaching in Sponsored Search Advertising and Its Strategic Impact on Traditional Advertising." *Marketing Science* **33 (4)**: 586–608.

[10] Shen H, Li Y, Guan J, et al. (2021) "A Planning Approach to Revenue Management for Non-Guaranteed Targeted Display Advertising." *Production and Operations Management* **30 (6)**: 1583–1602.

[11] Hao C, Yang L. (2022) "Platform advertising and targeted promotion: Paid or free?" *Electronic Commerce Research and Applications* **55**: 101178.

[12] Ji J, Zhang Z, Yang L. (2017) "Carbon emission reduction decisions in the retail-/dual-channel supply chain with consumers' preference." *Journal of Cleaner Production* **141**: 852–867.

[13] Xumei Zhang, Yanwen Zheng, Mengli Li, et al. (2022) "Research on supply chain cooperation strategy considering additional services and platform marketing efforts in O2O model." *Chinese Journal of Management Science* **30 (2)**: 181–190.

[14] Xie B, Li W, Jiang P, et al. (2022) "Cooperative Advertising Strategy Selection Problem for considering Pricing and Advertising Decisions in a Two-Period Online Supply Chain." *Mathematical Problems in Engineering* **2022**: 1–15.