Article

Green Supply Chain Pricing and Performance: a Fairness Preferences and Green Marketing Perspective

Hong Huo [1], Haiyan Zhong[1,]*and Xiaoli Zhang [2]

[1] School of Management, Harbin University of Commerce, Harbin 150028, China; 13904658991@163.com (H.H), zhonghaiyan0511@163.com
[2] Department of Accounting, Harbin Finance University, Harbin, 150030, China; zhangxl@hrbfu.edu.cn
* Correspondence: zhonghaiyan0511@163.com (H.Z)

Abstract: This study investigates optimal decisions in a green supply chain consisting of a manufacturer and a leading retailer considering the green marketing and fairness preferences of member firms. Four Stackelberg game decision models are constructed in which the manufacturer and the retailer engage in green marketing separately when the manufacturer has no and has fairness preferences. The impacts of fairness preferences and green marketing on the optimal decision in the green supply chain are comparatively analyzed. The study finds that member firms perform green marketing regardless of the presence or absence of fairness preferences and that such behavior increases the wholesale price, retail price, and market demand of low-carbon products as well as the profits of member firms and the supply chain. A more interesting finding is that the profit growth of member firms and the supply chain due to the manufacturer's green marketing is more pronounced than that due to the retailer's green marketing. When the retailer and the manufacturer engage in conduct green marketing, the manufacturer's fairness preferences have different effects on the wholesale price, retail price, market demand, level of green marketing efforts, member enterprises and profits of supply chain. Therefore, firms should consider the impact of green marketing and fairness preferences to make pricing and performance decisions, so as to achieve efficient operation of the whole supply chain and avoid double marginal effects. Finally, the above conclusions are verified through numerical simulation, providing a reference for the decision-making of member firms in the green supply chain.

Keywords: green supply chain; manufacturer's fairness preferences; leading retailer; Stackelberg Game

1. Introduction

With the increasingly severe conflicts between human society and the ecological environment, climate deterioration and resource scarcity, people have gradually realized that environmental protection and sustainable development are key factors for socioeconomic development. The enactment of environmental policies has put pressure on firms to control carbon emissions, making them attempt to improve the environmental performance of their products. The destruction of the ecological environment also affects people's lifestyle and consumption behavior, evidenced by consumers paying increasing attention to green energy conservation and environmental protection and increasingly favouring green products [1,2].

Consumers' increasing awareness of environmental protection and the requirements of sustainable development have led to widespread interest in green supply chains, which consider resource consumption and environmental protection [3-5]. In recent years, retailers have played an important role in green supply chains. Through green supply chains led by retailers such as Suning (China), Gome (China), and WalMart (USA), retailers usually gain more channel profits than other members [6]. In the green economy, when firms make decisions, they must pay attention to the interests and sur-

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 14 July 2021 doi:10.20944/preprints202107.0328.v1

vival of other members to ensure the efficient and sustainable development of the whole supply chain. Green marketing includes environmental awareness in marketing management and focuses on environmentally friendly products or services [7]. In the green supply chain, manufacturers use environmentally friendly technologies for green innovation and pollution reduction as well as green marketing of low-carbon products. For example, CocaCola, Dell, and Adidas use advanced technologies to generate green products and promote low-carbon products [8]. Retailers have direct contact with end consumers and can carry out targeted green marketing activities; retailers show consumers low-carbon products and encourage them to buy such products. For example, Philips uses the "Energy Star" label to promote green technology [9].

To date, relevant studies have also confirmed that green marketing can promote the market demand for low-carbon products, meet the green preferences needs of consumers, and promote the long-term growth of corporate profits [10,11]. To realize the economic value of supply chain firms, carbon emission reduction plans and conduct green marketing should be implemented to increase the sales of low-carbon products. Green marketing is becoming an important manifestation of competitive advantage among green supply chains, for example, the retail giant WalMart has developed a carbon emission reduction plan to cooperate with suppliers to reduce the waste of goods and packaging and protect natural resources and plans to achieve 100% recyclable packaging of its own brands by 2025; in addition, the firm conducts green marketing promotion to transform existing stores into green and energy-saving shopping stores[12,13].

However, in reality, the imperfect rationality of firms prevails in the decision-making of member firms in the green supply chain. Firms are particularly concerned about the fairness of profit distribution in the supply chain [14,15]. When there is a mismatch between profit and pay, leaders of firms can experience psychological tendencies towards unfairness, which usually impacts the decisions of leaders of supply chain member firms [16]. Therefore, firms are overly concerned about the fairness of profits and utilities, and this behavior can exacerbate the double marginalization of the supply chain and affect the sustainable development of the economy [17].

For example, WalMart obtains lower wholesale prices through its dominant advantage, leading to suppliers' preferences about fairness in obtaining benefits. Suppliers feel dissatisfied with WalMart's unfair practices and negotiate fair terms with WalMart. Fairness preferences change the decisions of firms and increase their benefits from the supply chain [18]. Therefore, fairness preferences also affect the decisions of member firms in the green supply chain. In the process of implementing green marketing by firms, as the market demand increases, the profits of the supply chain and member firms increase continuously; however, firms must pay extra green marketing costs [19]. The unequal power structure of the supply chain drives firms to pursue fair profits based on the consideration of their own strengths and contributions [20]. With an increase in fairness preferences coefficient, the benefits gained by firms through green marketing will be continuously redistributed among member firms, reducing the motivation of firms in green marketing and thus harm the overall benefits of the green supply chain [21,22]. Therefore, to achieve an effective use of resources, it is crucial for green supply chains to consider how member firms make optimal decisions when considering fairness preferences and green marketing in retailer-led green supply chains.

Existing studies investigate the coordination of green supply chains from different perspectives, such as carbon emission reduction, green investment and green marketing, or explore the decisions in green supply chains from the perspective of fairness preferences. To broaden the scope of research in this area, the present study considers both fairness preferences and green marketing to investigate the optimal decisions regarding retailer-led green supply chain pricing and performance. Specifically, we need to address the following problems:

1. How do supply chain members price and make optimal decisions when firms engage in green marketing?

2. Do fairness preferences increase the green marketing effort of member firms and the profits of both parties?

3. What are the patterns of the influence of green sensitivity and fairness preferences on firms' optimal strategies?

The rest of the paper is organized as follows. Section 2 comprehensively reviews the literature, analyses the existing research gaps and presents the research content and innovation of the present study. The problem statement and basic assumptions are presented in Section 3. Then, in Section 4, we establish four Stackelberg game profit decision models and solve for their balanced results by backward recursion. In Section 5 includes a comparatively analysis of the balanced results of different models. The main findings of the present study are summarized in Section 6 through numerical simulation analysis. Finally, in Section 7, the conclusions of the study are presented and recommendations for future research are provided. Compares the research content in the present study with the existing research findings. The present study focuses on addressing the sustainability decisions of green supply chain member firms and integrating green marketing and fairness preferences into re-tailer-led green supply chain management, so as to help promote coordinated economic and environmental development and achieve sustainable green supply chain development.

2. Reviews on Literature and Motivations

In this section, we review three main areas of literature relevant to the present study, namely, green supply chains, supply chains under fairness preferences, and supply chains considering green marketing. In addition, we provide the motivation for and highlights of the study.

2.1. Green Supply Chain

With increasing importance attached to environmental issues, green supply chains have received extensive attention from researchers. Ghosh et al. investigated coordination problems in manufacturer-led green supply chains, established cost-sharing contracts, and analyzed the influence of contract parameters on the decisions of supply chain agents in green supply chains [23]. On this basis, Zhou et al. confirmed that cooperative advertising contracts and cooperative advertising emission reduction cost-sharing contracts can be utilized to achieve coordination in manufacturer-led low-carbon supply chains [24]. Regarding retailer-led supply chains, Hu et al. effectively achieved supply chain coordination by designing reasonable contracts [25]. Considering closed-loop green supply chains, Mondal et al. studied the impact of different power structures on the optimal green investment decisions by channel members [8,26].

Considering carbon cap-and-trade regulations, Xu et al. designed wholesale price contracts and cost-sharing contracts, achieving joint emission reductions in the manufacturer-led supply chain without affecting profits [27], and Xu et al. investigated the use of revenue-sharing contracts and two-part tariff contracts to achieve a win-win outcome for supplier-led supply chain members [28]. Considering environmental regulations, Chen et al. studied carbon reduction strategies for two-tier supply chains using differential games [29]. Considering consumers' green preferences, Dong et al. conducted a comparative analysis of the profits of the manufacturer and the retailer when they invest individually or simultaneously to improve the greenness of products, concluding that the simultaneous investment by member firms is favourable to an increase in corporate profits [30]. In a competitive environment, Zhu et al. examined the pricing decisions for low-carbon products in the supply chain to provide an optimal pricing strategy [31]. Considering government subsidies and retailers' fairness preferences, Zhang et al. studied the pricing decisions in green supply chains in which manufacturers make carbon emission reduction efforts [17].

The above studies have discussed the coordination of green supply chains using contracts, consumer green preferences, and pricing decisions in green supply chains

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 14 July 2021 doi:10.20944/preprints202107.0328.v1

under carbon caps and environmental regulations. Most studies are based on supplier or manufacturer-led green supply chains, but retailer-led green supply chains are common in practice. In addition, the impact of green marketing and fairness preferences of member firms on supply chain decisions is not considered.

2.2. Supply Chains under Fairness Preferences

Most studies on supply chains are almost always based on the rational "economic man", while decision makers consider the fairness of income distribution. Ho et al. conducted a series of experiments that showed that people make decisions with certain behavioral preferences [32]. Many researchers have introduced the fairness preferences of firms into supply chain management. For example, Cui et al. and Caliskan et al. studied the impact of the fairness preferences of firms in manufacturer-led supply chains on channel decisions under linear and exponential demand functions [33,34]. Yang et al. showed that when retailers have fairness preferences, cooperative advertising strategies can be used to achieve supply chain coordination under certain conditions [35]. Nie & Du used an improved contract to coordinate a decentralized channel consisting of one supplier and two fairness-concerned suppliers [36]. Guan et al. studied manufacturers and retailers with Nash bargaining fairness concerns and used revenue and cost-sharing contracts to achieve supply chain coordination [37]. Zhang et al. examined the optimal decision in low-carbon supply chains under the influence of factors such as consumers' environmental awareness and retailers' fairness concerns [38], and Pu et al. proposed a fairness-embedded profit-sharing contract that coordinates the supply chain with fairness concerns to improve the utilities of the manufacturers and the retailers [39]. Many researchers have also introduced fairness concerns into the field of supply chain optimization and operation, such as the agricultural supply chain, dual-channel supply chain, and service supply chain, to reveal the impact of fairness preferences on firms' decision from various perspectives [20,40,41].

The above studies have focused on the optimal decisions in supply chains and the coordination of supply chains using relevant contracts considering fairness preferences. However, research on pricing and performance decisions in retailer-led supply chains from the perspective of sustainability and environmental protection is lacking. To fill this research gap, we consider both green marketing and fairness preferences to study optimal decisions for sustainable retailer-led supply chains.

2.3. Supply Chains Considering Green Marketing

Green marketing is a common way to encourage sustainable behavior and has been incorporated into the theory of sustainable supply chains, and the impact of green marketing on green supply chain decisions deserves attention and research [42]. Green marketing is also known as environmental marketing, ecological marketing, social marketing and sustainable marketing [43]. It is a marketing management process that uses profitable and sustainable approaches, such as product design, green promotion, green pricing, sales locations, and eco-labelling, to meet the needs of customers and society [44,45]. Green marketing aims to meet the needs of consumers, and it reduces the harmful effects on the environment and emphasizes the pricing and distribution of products to maintain an ecological focus [46,47]. Chen et al. pointed out that green marketing increases market demand and that it is an important green management practice that enables low-carbon products to fit with market demand, ensuring a competitive advantage for firms [48,49].

In the context of the global advocacy of reductions in low-carbon emissions, many researchers have studied decisions in supply chains that involve green marketing and made some breakthroughs. Zhang et al. investigated the impact of consumer environmental awareness on the order quantity, product pricing strategies and channel coordination of supply chain firms [50]. Basiri & Heydari studied the coordination of a two-stage green supply chain and used a coordination mechanism to determine green marketing strategies and low-carbon product quality decisions [51]. Jamali & Rasti Barzoki studied dual-channel green supply chains and found that centralized decision making results in a higher greenness of products than does decentralized decision-making [52]. On this basis, Heydari et al. investigated the optimal decisions of channel members in a three-tier dual-channel green product supply chain [53].

The above studies have focused on the decision-making and channel coordination of supply chain sustainability when companies engage in green marketing but have not investigated the impact of fairness concerns on supply chain decisions in green marketing. The present study is the first attempt to integrate both green marketing and fairness preferences into the decision-making on green supply chain sustainability to further broaden the research in the field of green supply chains.

Table 1. Papers that are most related to our research

Literature	Supply chain				Green supply chain		
	Manufacturer-led	Retailer-led	Manufacturer fairness preferences	Retailer fairness preferences	Carbon reduction	Green investment	Green marketing
[50] [51] [52] [53] [42]	√						√
[27] [28] [21]	√				√		
[8]	√	√				√	√
[26]	√	√				√	
[54]	√					√	√
[6]		√		√	√		
[38]	√			√		√	
[25]		√		√		√	
[34]	√		√	√			
[31]	√		√			√	
[17]	√			√	√		
[24]	√			√		√	
this paper		√	√				√

In summary, numerous studies have been carried out on green supply chain decision-making considering green marketing or fairness preferences alone. However, most studies have targeted manufacturer-led green supply chains, considering the green marketing efforts of retailers. [8,42,50,52,53,54] focused on the contract coordination of green supply chains but did not consider fairness preferences, while [6,24,25,31,34,38] considered fairness preferences and examined retailer or manufacturer-led supply chain decision-making and coordination but did not consider green marketing.

3. Model Description and Assumptions

In a two-stage green supply chain composed of a single manufacturer and a single retailer, the retailer is in a leading position in the supply chain, and the manufacturer, in a disadvantaged position, has fairness preferences. The manufacturer produces low-carbon products, the retailer orders and sells low-carbon products, and both the retailer and manufacturer can conduct low-carbon product marketing [8,9,45]. Consumers are environmentally conscious, and market demand is affected by retail prices and the green marketing effort. However, fairness preferences and green marketing affect supply chain decisions. Therefore, the present study discusses the pricing and performance decisions in the green supply chain under four scenarios where the manufacturer has and has no fairness preferences and the manufacturer and the retailer engage in green marketing. For convenience, the four models are described: in Model NM, the manufacturer has no fairness preferences and engages in green marketing; in Model NR, the manufacturer has no fairness preferences, and the retailer engages in green marketing; in Model MM, the manufacturer has fair preferences and engages in green marketing; and in Model MR, the manufacturer has fairness preferences, and the retailer engages in green marketing. The retailer is the leader of the Stackelberg game, with complete information, and the manufacturer is the follower. The operation process of the green supply chain is shown in Figure 1.

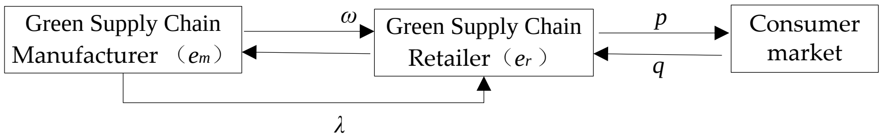


Figure 1. Retailer-led two-level green supply chain theoretical model

We make the following assumptions to make the models more realistic and economically feasible. Table 2 summarizes the definitions of symbols used in the article.

Table 2. Notation definition

Parameters	The Meanings of the Parameters
q	The actual demand of the market
a	The potential size of the total market demand
b	The demand sensitivity coefficient to price
m	The production unit profit of retailer
γ	The market demand sensitivity to green marketing efforts
η	The cost parameter for green marketing efforts, η is a constant
c	Manufacturer's unit production cost
λ	Manufacturer's fairness preferences coefficient
π_j^i	The profits of green supply chain member enterprises [1]
U^i	The utility of the manufacturer [1]
Decision variables	**The Meanings of the Decision Variables**
ω	Unit wholesale price of the products
p	The retail price of unit product
e	The level of green marketing efforts

[1] $i=\{NM,NR,MM,MR\}$, $j=\{m,r,s\}$ represent the profits of the manufacturer, the retailer and the overall SC under four scenarios where the manufacturer has and has no fairness preferences and the manufacturer and the retailer engage in green marketing.

Assumption 1. Market demand function. The market demand for the product is impacted by the green marketing of the firm. Considering a consumer preference for low-carbon products, we assume that the higher the level of green marketing efforts, the greater is the consumer demand for the product, while the product sales price remains unchanged[55]. Therefore, we use $g_0(e)=\gamma e$ to denote the increase in market demand brought by green marketing[56,57]. To ensure that the relevant expressions in this article make economic sense, it is assumed that market demand is a linear function of the retail price p and the level of green marketing efforts e and that the retailer's order quantity is equal to the actual market demand. Similar to the assumptions for demand function in previous studies [54,58,59], we establish the market demand function as: This is example 1 of an equation:

$$q(p)=a-bp+\gamma e \tag{1}$$

Assumption 2. The cost of green marketing. The more effort a firm puts into green mar keting, the higher the cost. As the level of green marketing efforts increases, so does the impact on the increase in market demand. Therefore, we define the cost of green marketing effort as $g(e)=\frac{\eta}{2}e^2$, where η is a constant in the coefficient for the cost of green marketing effort[21,57]. Because the sales effort has a certain limit, the cost of green marketing has economic significance, and without loss of generality, η should be large enough[40,60].

Assumption 3. The utility of the manufacturer's fairness preferences. The firms are concerned about their own interests as well as the interests of others and compare these interests to determine whether they are fair. The greater the fairness attention coefficient, the larger is the impact on firm decisions[37]. According to the fairness preferences model established by Fehr & Schmid based on benefit fairness, agents are more sensitive to losses and have more prominent unfavourable and unfair preferences when there is an equal profit loss[34,36,61]. Therefore, similar assumptions are made in previous research[62-66],we have that the utility of the manufacturer's fairness preferences is $U=(1+\lambda)\pi_m - \lambda\pi_r$, and $\pi_r > \pi_m$, $0 \le \lambda \le 1$, λ is the manufacturer's fairness preferences coefficient.

Assumption 4. Assuming that the market is a product market in a single period. Both the manufacturer and the retailer deal with a single product and do not consider out-of-stock products. The manufacturer produces a low-carbon product and sells the low-carbon product to the retailer at a wholesale price; the retailer sells the low-carbon product to the consumer at a retail price and earns a per unit profit; and there are no costs to the manufacturer and retailer other than the manufacturer's production cost. Assuming that all member firms of the green supply chain can carry out green marketing through corporate behaviors, we refer to assumption $0<\gamma<\sqrt{2b\eta}$ of previous research to ensure the feasibility of the relevant expression units and the concavity of the general function[23,67].

4. Optimal decisions in green marketing supply chains

4.1. Model MM and NM

The manufacturer has fairness preferences and conducts green marketing. In a retailer-led green supply chain, the manufacturer and the retailer make optimal decisions to maximize profits. We use a solution similar to that in the last section, withing the following decision sequence: the retailer first announces the retail price p . According to the fairness preferences coefficient λ , the manufacturer then determines the wholesale price ω and the level of green marketing efforts e .The profit functions of the manufacturer and the retailer are expressed as follows:

$$\pi_m^{MM}(\omega,e)=(\omega-c)(a-bp+\gamma e)-\frac{\eta}{2}e^2 \tag{2}$$

$$\pi_r^{MM}(p)=(p-\omega)(a-bp+\gamma e) \tag{3}$$

$$U^{MM}(\omega,e)=(1+\lambda)\pi_m^{MM}-\lambda\pi_r^{MM} \tag{4}$$

First, we substitute $p=m+\omega$ into Eq. (2), we can obtain:

$$U^{MM}(\omega,e)=(1+\lambda)[(w-c)(a-bm-bw+re)-\frac{\eta}{2}e^2]-\lambda m(a-bm-bw+re) \tag{5}$$

By solving the first-order and second-order partial derivatives of Eq. (4), we can get the Hessian matrix of $U^{MM}(\omega,e)$ as $H(U^{MM})=\begin{bmatrix}-2b(\lambda+1) & \gamma(\lambda+1)\\ \gamma(\lambda+1) & -\eta(\lambda+1)\end{bmatrix}$. We define $H_1(U^{MM})$, $H_2(U^{MM})$ as the first-order and second-order leading principal minors of $H(U^{MM})$ .We can get that $|H_1(U^{MM})|=-2b<0$ and $|H_2(U^{MM})|=(2b\eta-\gamma^2)(1+\lambda)^2$. For $|H_2(U^{MM})|>0$ to be true, then $2b\eta>\gamma^2$. According to assumption 4, $H(U^{MM})$ is negative definite matrix, $U^{MM}(\omega,e)$ is a strictly concave function of ω and e. Let $\frac{\partial U^{MM}(\omega,e)}{\partial\omega}=0$ and $\frac{\partial U^{MM}(\omega,e)}{\partial e}=0$, by solving the binary equations, we can obtain:

$$e^{MM}(m)==\frac{\gamma[(a-bc)(1+\lambda)-bm(1+2\lambda)]}{(2b\eta-\gamma^2)(1+\lambda)} \tag{6}$$

$$\omega^{MM}(m)=\frac{\eta(a+bc)(1+\lambda)-\gamma^2(c+\lambda m+c\lambda)-bm\eta}{(2b\eta-\gamma^2)(1+\lambda)} \tag{7}$$

Next: we substitute the result of Eq. (6) , Eq. (7) and $p=m+\omega$ into Eq. (3), by solving the first-order and second-order derivatives of Eq.(3), we can get $\frac{\partial^2\pi_r^{MM}(m)}{\partial m^2}=-2b<0$, so $\pi_r^{MM}(m)$ is a strictly concave function of m , then set the first derivative equal to zero from $\frac{\partial\pi_r^{MM}(m)}{\partial m}$,we have the optimal m^{MM*}:

$$m^{MM*}=\frac{(a-bc)}{2b} \tag{8}$$

We substitute the result of Eq. (8) into Eq.(6), Eq.(7), and $p=m+\omega$, and get the optimal e^{MM*}、ω^{MM*} and p^{MM*}.Then, we substitute e^{MM*} and ω^{MM*} into Eq.(1), and get q^{MM*}:

$$\omega^{MM*}=\frac{(a-bc)[b\eta(1+2\lambda)-\lambda\gamma^2]}{2b(1+\lambda)(2b\eta-\gamma^2)}+c \tag{9}$$

$$e^{MM*}=\frac{\gamma(a-bc)}{2(2b\eta-\gamma^2)(1+\lambda)} \tag{10}$$

$$p^{MM*}=\frac{(a-bc)[(3+4\lambda)b\eta-(1+2\lambda)\gamma^2]}{2b(1+\lambda)(2b\eta-\gamma^2)}+c \tag{11}$$

$$q^{MM*}=\frac{b\eta(a-bc)}{2(2b\eta-\gamma^2)(1+\lambda)} \tag{12}$$

Finally, we substitute Eq. (9)-(12) into Eq. (3) and Eq. (4), and obtain the maximum profits under the manufacturer conducting green marketing with fairness preferences:

$$\pi_r^{MM*}=\frac{\eta(a-bc)^2}{4(2b\eta-\gamma^2)(1+\lambda)} \tag{13}$$

$$\pi_m^{MM*}=\frac{\eta(a-bc)^2(1+2\lambda)}{8(1+\lambda)^2(2b\eta-\gamma^2)} \tag{14}$$

$$\pi_s^{MM*}=\frac{3\eta(a-bc)^2(1+2\lambda)}{8(1+\lambda)^2(2b\eta-\gamma^2)} \tag{15}$$

Proposition 1: The manufacturer has no fairness preferences, When $\lambda=0$, model MM becomes model NM, the optimal equilibrium results of the wholesale price, the retail price, the level of green marketing efforts and the order quantity can be obtained as follows:

$$\omega^{NM*}=\frac{\eta(a-bc)}{2(2b\eta-\gamma^2)}+c \tag{16}$$

$$p^{NM*}=\frac{(a-bc)(3b\eta-\gamma^2)}{2b(2b\eta-\gamma^2)}+c \tag{17}$$

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 14 July 2021 doi:10.20944/preprints202107.0328.v1

$$q^{NM*}=\frac{b\eta(a-bc)}{2(2b\eta-\gamma^2)} \tag{18}$$

$$e^{NM*}=\frac{r(a-bc)}{2(2b\eta-\gamma^2)} \tag{19}$$

Moreover, we can obtain the optimal profits of the manufacturer, the retailer and the overall SC without the manufacturer fairness preferences:

$$\pi_r^{NM*}=\frac{\eta(a-bc)^2}{4(2b\eta-\gamma^2)} \tag{20}$$

$$\pi_m^{NM*}=\frac{\eta(a-bc)^2}{8(2b\eta-\gamma^2)} \tag{21}$$

$$\pi_s^{NM*}=\frac{3\eta(a-bc)^2}{8(4b\eta-\gamma^2)} \tag{22}$$

Property1. *The impact of fairness preferences behavior on corporate decisions in the manufacturer's green marketing:* $\frac{\partial\omega^{MM*}}{\partial\lambda}>0$, $\frac{\partial p^{MM*}}{\partial\lambda}>0$, $\frac{\partial e^{MM*}}{\partial\lambda}<0$, $\frac{\partial q^{MM*}}{\partial\lambda}<0$, $\frac{\partial q^{MM*}}{\partial\lambda}<0$, $\frac{\partial\pi_m^{MM*}}{\partial\lambda}<0$, $\frac{\partial\pi_r^{MM*}}{\partial\lambda}<0$, $\frac{\partial\pi_s^{MM*}}{\partial\lambda}<0$.

The proof is given in Appendix A.1.

Property 1 indicate that as the manufacturer's fairness preferences coefficient λ increases, the wholesale price ω^{MM*} and the retail price p^{MM*} increase, while the level of green marketing efforts e^{MM*} , market demand q^{MM*} , manufacturer's profit π_m^{MM*} , retailer's profit π_r^{MM*} , and supply chain profit π_s^{MM*} decrease. This can be easily understood as follows. The manufacturer with fairness preferences is in a subordinate position in the distribution channel, and there are costs involved in conducting green marketing, resulting in an increase in the wholesale price. The increase in the wholesale price causes the retailer to increase the sales price, which in turn reduces the market demand for low-carbon products and ultimately leads to a decrease in the profits of the manufacturer, the retailer and the overall supply chain.

4. 2Model MR and NR

The manufacturer has fairness preferences and the retailer conducts green marketing. Similar as the last section, we use the following decision sequence: the retailer first announces the retail price p and the level of green marketing efforts e . According to the fairness preferences coefficient λ, the manufacturer then determines the wholesale price ω . The profit functions of the manufacturer and the retailer are expressed as follows: s follows:

$$\pi_m^{MR}(\omega)=(\omega-c)(a-bp+\gamma e) \tag{23}$$

$$\pi_r^{MR}(p,e)=(p-\omega)(a-bp+\gamma e)-\frac{\eta}{2}e^2 \tag{24}$$

$$U^{MR}(\omega,e)=(1+\lambda)\pi_m^{MR}-\lambda\pi_r^{MR} \tag{25}$$

First, we substitute $p=m+\omega$ into Eq. (25), and by solving the first-order and second-order derivatives of Eq. (25) , we can get $\frac{\partial^2 U^{MR}(\omega,e)}{\partial\omega^2}=-2b(1+\lambda)<0$, so

$U^{MR}(\omega,e)$ is a strictly concave function of ω. Then set the first derivative equal to zero from Eq. (25), we can obtain:

$$\omega(m,e)=\frac{1}{2b}\left(\frac{\lambda bm}{1+\lambda}+a+bc+re-bm\right) \quad (26)$$

we substitute the result of Eq. (24) into Eq.（23）, we can get:

$$\pi_r^{MR}(m,e)=m\left[\frac{a-bm+re-bc-\lambda mb}{2}\right]-\frac{\eta}{2}e^2 \quad (27)$$

Next, by solving the first-order and second-order partial derivatives of Eq. (27), we can get the Hessian matrix of $\pi_r^{MR}(m,e)$ as $H(\pi_r^{MR})=\begin{bmatrix}-b-\frac{\lambda b}{1+\lambda} & \frac{\gamma}{2}\\ \frac{\gamma}{2} & -\eta\end{bmatrix}$. We define $H_1(\pi_r^{MR})$, $H_2(\pi_r^{MR})$ as the first-order and second-order leading principal minors of $H(\pi_r^{MR})$ .We can get that, $\left|H_1(\pi_r^{MR})\right|=-b-\frac{\lambda b}{1+\lambda}<0$ and $\left|H_2(\pi_r^{MR})\right|=\frac{4b\eta(1+2\lambda)-\gamma^2(1+\lambda)}{1+\lambda}$. For $\left|H_2(\pi_r^{MR})\right|>0$ to be true, then $4b\eta(1+2\lambda)-\gamma^2(1+\lambda)>0$. According to assumption 4, $H(\pi_r^{MR})$ is negative definite matrix, $\pi_r^{MR}(m,e)$ is a strictly concave function of m and e . Let $\frac{\partial\pi_r^{MR}(m,e)}{\partial m}=0$ and $\frac{\partial\pi_r^{MR}(m,e)}{\partial e}=0$, by solving the binary equations, we can obtain the optimal e^{MR*} and m^{MR*}:

$$e^{MR*}=\frac{r(1+\lambda)(a-bc)}{4b\eta(1+2\lambda)-\gamma^2(1+\lambda)} \quad (28)$$

$$m^{MR*}=\frac{2\eta(1+\lambda)(a-bc)}{4b\eta(1+2\lambda)-\gamma^2(1+\lambda)} \quad (29)$$

Then, we substitute the result of Eq. (26) and Eq. (27) into Eq.（24）and $p=m+\omega$, and get the optimal ω^{MR*} and p^{MR*}. Then, we substitute e^{MM*} into Eq. (1) and q^{MR*}, we can obtain:

$$\omega^{MR*}=\frac{\eta(1+4\lambda)(a-bc)}{4b\eta(1+2\lambda)-\gamma^2(1+\lambda)}+c \quad (30)$$

$$p^{MR*}=\frac{3\eta(1+2\lambda)(a-bc)}{4b\eta(1+2\lambda)-\gamma^2(1+\lambda)}+c \quad (31)$$

$$q^{MR*}=\frac{b\eta(1+2\lambda)(a-bc)}{4b\eta(1+2\lambda)-\gamma^2(1+\lambda)} \quad (32)$$

Final, we substitute Eq. (26)-(30) into Eq. (22) and Eq. (23), and obtain the maximum profits:

$$\pi_m^{MR*}=\frac{b\eta^2(1+4\lambda)(1+2\lambda)(a-bc)^2}{\left[4b\eta(1+2\lambda)-\gamma^2(1+\lambda)\right]^2} \quad (33)$$

$$\pi_r^{MR*}=\frac{\eta(1+\lambda)(a-bc)^2}{2\left[4b\eta(1+2\lambda)-\gamma^2(1+\lambda)\right]} \quad (34)$$

$$\pi_s^{MR*}=\frac{\eta(a-bc)^2\{2b\eta(1+4\lambda)(1+2\lambda)+[4b\eta(1+2\lambda)-\gamma^2(1+\lambda)](1+\lambda)\}}{2\left[4b\eta(1+2\lambda)-\gamma^2(1+\lambda)\right]^2} \quad (35)$$

Under the basic assumptions, it is easy to prove that the above expression is greater than zero.

Proposition 2: The manufacturer has no fairness preferences, When $\lambda=0$, model MR becomes model NR，the optimal equilibrium results of the wholesale price, the retail price, the level of green marketing efforts and the order quantity can be obtained as follows:

$$\omega^{NM*}=\frac{\eta(a-bc)}{2(2b\eta-\gamma^2)}+c \tag{36}$$

$$p^{NR*}=\frac{3\eta(a-bc)}{4b\eta-\gamma^2}+c \tag{37}$$

$$e^{NR*}=\frac{r(a-bc)}{4b\eta-\gamma^2} \tag{38}$$

$$q^{NR*}=\frac{b\eta(a-bc)}{4b\eta-\gamma^2} \tag{39}$$

Moreover, we can obtain the optimal profits of the manufacturer, the retailer and the overall SC without the manufacturer fairness preferences:

$$\pi_m^{NR*}=\frac{b\eta^2(a-bc)^2}{(4b\eta-\gamma^2)^2} \tag{40}$$

$$\pi_r^{NR*}=\frac{\eta(a-bc)^2}{2(4b\eta-\gamma^2)} \tag{41}$$

$$\pi_s^{NR*}=\frac{\eta(a-bc)^2(6b\eta-\gamma^2)}{2(4b\eta-\gamma^2)^2} \tag{42}$$

Property2. *The impact of fairness preferences behavior on corporate decisions in the retailer's green marketing with the manufacturers' fairness preferences :*

$$\frac{\partial\omega^{MR*}}{\partial\lambda}>0,\frac{\partial p^{MR*}}{\partial\lambda}<0,\frac{\partial e^{MR*}}{\partial\lambda}<0,\frac{\partial q^{MR*}}{\partial\lambda}<0,\frac{\partial\pi_m^{MR*}}{\partial\lambda}>0,\frac{\partial\pi_r^{MR*}}{\partial\lambda}<0,\frac{\partial\pi_s^{MR*}}{\partial\lambda}<0.$$

The proof is given in Appendix A.2.

Property 2 indicate that as the fairness preferences coefficient of manufacturer increases, the wholesale price ω^{MR*} and the profit of the manufacturer π_m^{MR*} also increase, while the retail price p^{MR*}, level of green marketing efforts e^{MR*}, market demand q^{MR*}, retailer's profit π_r^{MR*} and the supply chain profit π_s^{MR*} decrease. This is not difficult to understand. The manufacturer with fairness preferences is upstream in the green supply chain and hence can effectively increase his/her own profit by increasing the wholesale price. The increase in the wholesale price reduces the incentive of the retailer for green marketing and the cost of sales effort, thereby lowering the sales price. This behavior leads to a reduction in market demand and hence a decrease in the profits of the retailer and the supply chain.

Property3. *The influence of green sensitivity on firm decision-making:*

$$\frac{\partial\omega^{i*}}{\partial\gamma}>0,\frac{\partial p^{i*}}{\partial\gamma}>0,\frac{\partial e^{i*}}{\partial\gamma}>0,\frac{\partial q^{i*}}{\partial\gamma}>0,\frac{\partial\pi_r^{i*}}{\partial\gamma}>0,\frac{\partial\pi_m^{i*}}{\partial\gamma}>0,\frac{\partial\pi_r^{i*}}{\partial\gamma}>0,\frac{\partial\pi_s^{i*}}{\partial\gamma}>0, \text{and}$$

$$i=\{NM,NR,MM,MR\}.$$

The proof is given in Appendix A.3.

Property 3 indicates that regardless of which firm engages in green marketing and whether fairness preferences are present, the wholesale price ω^{i*}, retail price p^{i*}, level of green marketing efforts e^{i*}, market demand q^{i*}, manufacturer's profit π_m^{i*}, retailer's profit $\pi_r^{i^*}$, and supply chain profit $\pi_s^{i^*}$ will all increase with the market demand sensitivity to green marketing efforts γ .

Green marketing increases the cost and price of low-carbon products but, more effectively, promotes the sales of low-carbon products. This behavior is always beneficial to the decision-making of member firms, and the greater is the green sensitivity, the more it can promote an increase in profits. Leading retailers should take effective measures to promote green marketing among firms and to increase the market demand for low-carbon products, thereby forming a virtuous low-carbon circular economy. This conclusion differs from the optimal decision of the manufacturer-led green supply chain in that the wholesale price is impacted by green sensitivity [22,59,68].

5. Analysis of equilibrium results

This section comparatively analyses the optimal balance in decision-making under four scenarios, namely, those in which the manufacturer and the retailer engage in green marketing separately when there is and is not fairness preferences. Through comparative analysis, the impact of green sensitivity and fairness preferences coefficient on the optimal decision of supply chain member firms is analyzed from the perspective of the profit maximization of members.

5.1. The impact of green marketing on green supply chain :（NM and NR）

Proposition 3. *A comparison of the two scenarios in which the manufacturer and the retailer engage in green marketing shows that when the green sensitivity satisfies* $0<\gamma<\sqrt{2b\eta}$ *, the following relationship is observed between firms decisions:*

$\omega^{NR*}<\omega^{NM*}$, $p^{NR*}>p^{NM*}$, $e^{NR*}<e^{NM*}$, $q^{NR*}<q^{NM*}$.

The proof is given in Appendix A.4.

Proposition 3 indicates that Compared with the scenario in which the retailer performs green marketing, the scenario in which the manufacturer engages in green marketing leads to a high wholesale price ω^{NM*} , high market demand q^{NM*} and large level of green marketing efforts e^{NM*} and low sales price p^{NM*} as well as an increase in the wholesale and retail prices brought by the green marketing costs paid by the manufacturer. Green marketing contributes to an increase in the market demand for low-carbon products, which in turn improves the motivation for green marketing effort. Therefore, green marketing by the manufacturer is more beneficial to the sales of low-carbon products.

Proposition 4. *Based on a comparison between the two scenarios in which green marketing is carried out by the manufacturer and the retailer, the performance decisions in the green supply chain have the following relationship:* $\pi_m^{NR*}<\pi_m^{NM*}$, $\pi_r^{NR*}<\pi_r^{NM*}$, $\pi_s^{NR*}<\pi_s^{NM*}$.

The proof is given in Appendix A.5.

Proposition 4 indicates that the profits of the manufacturer, retailer and supply chain when the manufacturer engages in green marketing are all greater than those when the retailer engages in green marketing, thereby showing that the manufacturer's green marketing is more conducive to an increase in the profits of the member firms and the overall supply chain. It is more important for the leading retailer to take strong measures to promote the manufacturer to carry out green marketing and participate in environmental protection and sustainable development.

5.2. The impact of fairness preferences on green supply chain:（MM, NM and NR, MR）

Proposition 5. *Based on a comparison of the two scenarios with and without fairness preferences, the decisions in the supply chain where the manufacturer performs green marketing have the following relationship:* $e^{MM*} < e^{NM*}$, $q^{MM*} < q^{NM*}$,

1. *When* $0 \le \gamma \le \sqrt{b\eta}$, *then* $p^{MM*} \ge p^{NM*}$, $\omega^{MM*} \ge \omega^{NM*}$;
2. *When* $\sqrt{b\eta} < \gamma < \sqrt{2b\eta}$, *then* $p^{MM*} < p^{NM*}$, $\omega^{MM*} < \omega^{NM*}$.

The proof is given in Appendix A.6.

Proposition 5 indicates that in the supply chain where the manufacturer engages in green marketing, the green marketing effort and market demand in the context of fairness preferences are smaller than those in the context without fairness preferences. When green sensitivity is low, the wholesale and retail prices in the context of fairness preferences are larger than those in the context without fairness preferences; and with the increase in green sensitivity, the wholesale and retail prices in the context of fairness preferences are lower than those in the context without fairness preferences. Therefore, in the supply chain with green marketing by the manufacturer, the fairness preferences of the manufacturer is not conducive to the sales of low-carbon products.

Proposition 6. *A comparison of the two scenarios with and without fairness preferences shows the following relationship for performance decisions in the supply chain where the manufacturer engages in green marketing:* $\pi_m^{MM*} < \pi_m^{NM*}$, $\pi_r^{MM*} < \pi_r^{NM*}$, $\pi_s^{MM*} < \pi_s^{NM*}$.
The proof is given in Appendix A.7.

Proposition 6 indicates that in the supply chain with green marketing by the manufacturer, the benefits of the manufacturer, the retailer and the supply chain in the context of fairness preferences are all smaller than those in the context without fairness preferences, and the fairness preferences reduce the benefits of the manufacturer, the retailer and the supply chain. Fairness preferences are not conducive to an increase in the profits of member firms and the overall supply chain. Firms should consider the impact of fairness preferences and accordingly make effective green marketing decisions.

Proposition 7. *Based on a comparison of the two scenarios with and without fairness preferences, the decisions in the supply chain where the retailer performs green marketing have the following relationship:* $\omega^{MR*} > \omega^{NR*}$, $p^{MR*} < p^{NR*}$, $e^{MR*} < e^{NR*}$, $q^{MR*} < q^{NR*}$.
The proof is given in Appendix A.8.

Proposition 7 indicates that in the supply chain with green marketing by the retailer, the green marketing effort, market demand and retail price in the context of fairness preferences are lower than those when the manufacturer has no fairness preferences. However, the wholesale price in the context of fairness preferences is higher than that in the context without fairness preferences. Because the manufacturer is upstream in the supply chain, the most direct way for the manufacturer to increase profit is to increase the wholesale price. A higher wholesale price discourages the retailer from green marketing efforts and reduces the market demand for low-carbon products. As the cost of green marketing efforts decreases, so does the retail price. Therefore, fairness preferences in the supply chain with green marketing by the retailer is also not conducive to the sales of low-carbon products.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 14 July 2021 doi:10.20944/preprints202107.0328.v1

Proposition 8. *A comparison of the two scenarios with and without fairness preferences shows the following relationship for performance decisions in the supply chain where the retailer engages in green marketing:* $\pi_m^{MR*} > \pi_m^{NR*}, \pi_r^{MR*} < \pi_r^{NR*}, \pi_s^{MR*} < \pi_s^{NR*}$.
The proof is given in Appendix A.9.

Proposition 8 indicates that in the supply chain with green marketing by the retailer, the profits of the retailer and the supply chain with fairness preferences are smaller than those without fairness preferences, and the profit of the manufacturer with fairness preferences is greater than that without fairness preferences. Therefore, fairness preferences is conducive to an increase in the manufacturer's profit but not to the increase in the profits of the retailer and the overall supply chain, and the leading retailer should take effective measures to reduce the manufacturer's fairness preferences.

6. Numerical simulation and analysis:

To better illustrate the above properties and propositions, we further verify them by numerical analysis in this section. The main parameters are as follows: $a = 400, b = 1, c = 2, \eta = 50$ and $\gamma \in [0,8], \lambda \in [0,1]$. In a retailer-led green supply chain with fairness preferences, we analyze the impact of the fairness preferences coefficient and green sensitivity on green supply chain pricing and performance when the manufacturer and retailer engage in green marketing. This finding provides a reference for corporate decision-making. The results are verified with numerical examples, as shown in Figures 2 to 7.

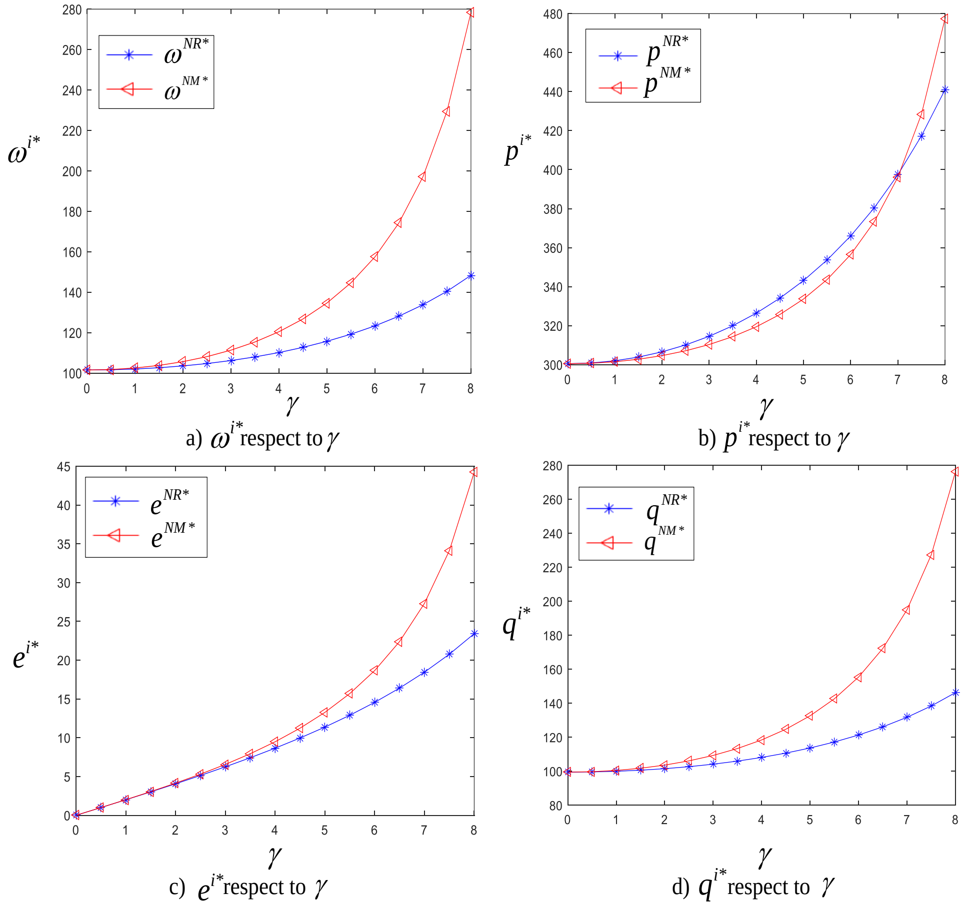
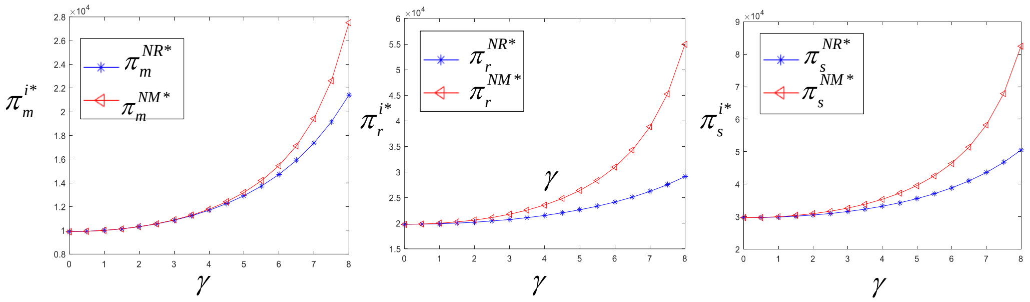


Figure2. ω^{i*}, p^{i*}, e^{i*}, q^{i*} with respect to γ ($i = NR, NM$)

Figure 2 shows that when there is no fairness preferences, regardless of whether the manufacturer or the retailer engages in green marketing, the wholesale price, retail price, level of green marketing efforts and market demand increase with the increase in the

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 14 July 2021 doi:10.20944/preprints202107.0328.v1

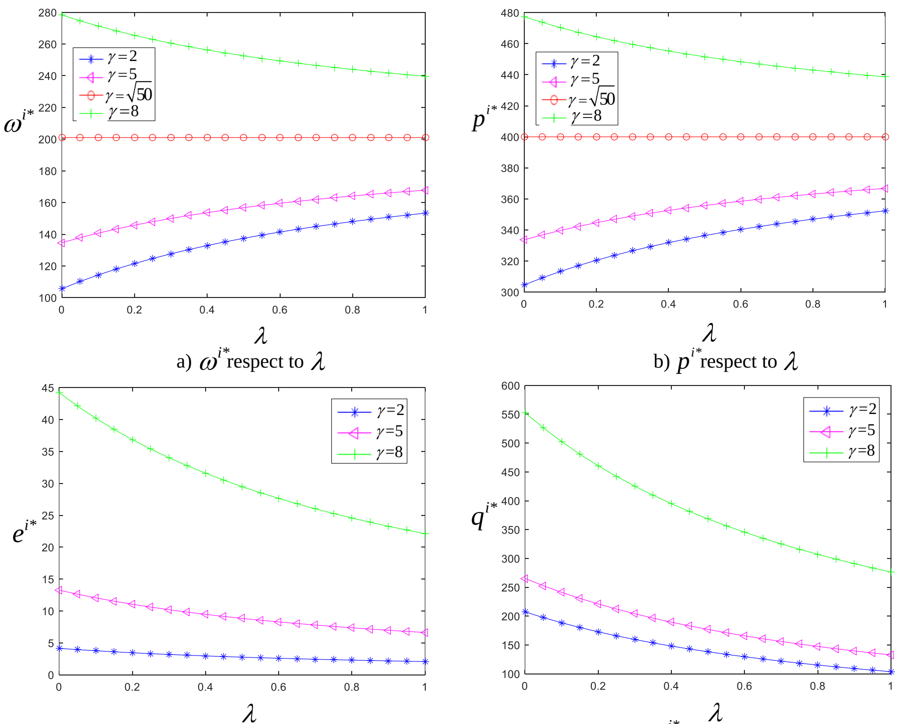
green sensitivity marketing coefficient. Further observation of Figure 2 (a, c, d) shows that regardless of the change in green sensitivity, the wholesale price, level of green marketing efforts, and product demand when the manufacturer performs green marketing are all higher than those when the retailer performs green marketing. From Figure 2 (b), when green sensitivity is low, the retail price when the retailer performs green marketing is higher than that when the manufacturer engages in green marketing, and when green sensitivity is high, the opposite occurs. Therefore, proposition 3 and property 3 are verified.



a) π_m^{i*} respect to γ d) π_r^{i*} respect to γ d) π_s^{i*} respect to γ

Figure3. $\pi_m^{i*}, \pi_r^{i*}, \pi_s^{i*}$ with respect to γ ($i = NR, NM$)

From Figure 3, when there is no fairness preferences, regardless of whether the manufacturer or the retailer engages in green marketing, the profits of the manufacturer, retailer and the supply chain all increase with the increase in the green sensitivity coefficient; these profits are all higher when the manufacturer performs green marketing than when the retailer engages in green marketing, and the greater the green sensitivity, the greater the difference between the two. Hence, the manufacturer's green marketing can better promote the benefits of member firms and the overall supply chain. These results verify proposition 4 and property 3.



a) ω^{i*} respect to λ b) p^{i*} respect to λ

c) e^{i*} respect to λ d) q^{i*} respect to λ

Figure4. $\omega^{i*}, p^{i*}, e^{i*}\ q^{i*}$ with respect to γ ($i = NM, NM; \gamma = 2、5、\sqrt{50}、8$)

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 14 July 2021 doi:10.20944/preprints202107.0328.v1

Figure 4 shows that When there is fairness preferences and the manufacturer performs green marketing Figure 4 (a,b), when the green sensitivity is low ($0 \le \gamma \le \sqrt{b\eta} = \sqrt{50}$) , as the fairness preferences coefficient increases, both wholesale and sales prices increase and are higher than those in the context without fairness preferences (NM $\lambda=0$); when the green sensitivity is high ($\sqrt{50} = \sqrt{b\eta} \le \gamma \le \sqrt{2b\eta}$), the opposite occurs. Under each green sensitivity From Figure 4 (c, d), both level of green marketing efforts and product demand decrease with the increase in the fairness preferences coefficient and are lower than those without fairness preferences (NM $\lambda=0$). Thus proposition 5 and property 3 is also verified.

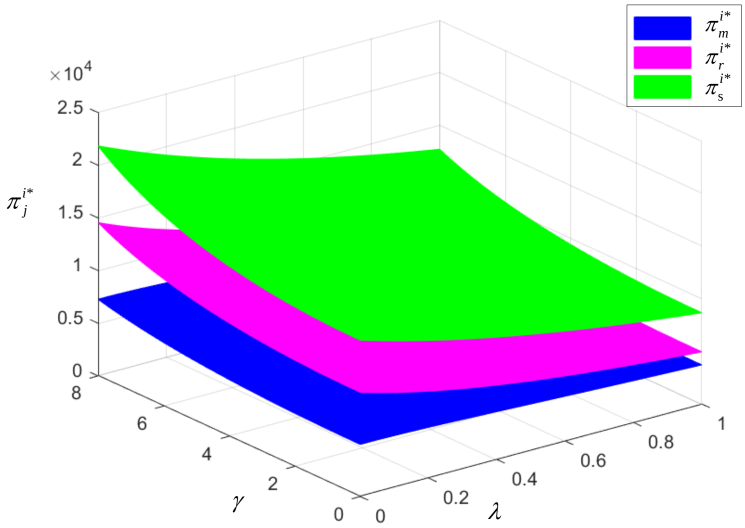
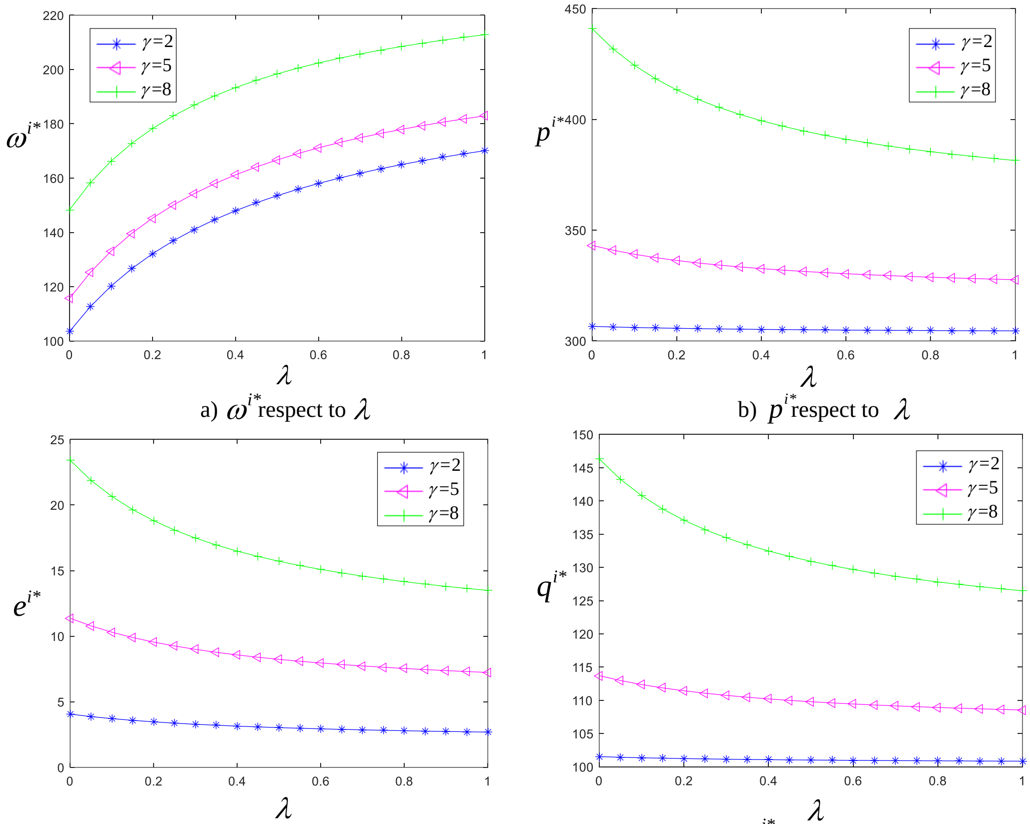


Figure5. π_m, π_r, π_s with respect to γ (MM, NM)

Results from Figure 5 concluded that when there is fairness preferences and the manufacturer performs green marketing, as seen on the left side, with the increase in green sensitivity, the profits of the manufacturer, retailer and supply chain all increase, and as seen on the right side, as the fairness preferences coefficient increases, the profits of the manufacturer, retailer and supply chain all decrease. The profits of the manufacturer, retailer, and supply chain with fairness preferences are all smaller than those without fairness preferences (NM $\lambda=0$), and the greater the green sensitivity, the larger is the difference between the two. Therefore, the manufacturer's fairness preference is not conducive to an increase in the benefits of the manufacturer, retailer and supply chain; however, the manufacturer's green marketing is beneficial. Thus proposition 6 and property 3 are also verified.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 14 July 2021 doi:10.20944/preprints202107.0328.v1



a) ω^{i*} respect to λ b) p^{i*} respect to λ

c) e^{i*} respect to λ d) q^{i*} respect to λ

Figure6. ω^{i*}, p^{i*}, e^{i*} q^{i*} with respect to γ ($i = MR, NR; \gamma = 2、5、8$)

Figure 6 illustrates Regarding the manufacturer's fairness preferences and the retailer's green marketing, From Figure 6 (a), with the increase in the fairness preferences coefficient, the wholesale price increases and is greater than that when the manufacturer has no fairness preferences (NR: λ=0). Further observation of Figure 6 (b, c, d) shows that as the fairness preferences coefficient increases, the retail price, level of green marketing efforts, and product demand all decreases and are smaller than those for a manufacturer without fairness preferences（NR: λ=0）. With the increase in green sensitivity, the wholesale and sales prices, level of green marketing efforts, and product demand increase. Therefore, from the perspective of whether to strengthen market competitiveness or implement sustainable development, the green marketing decision of the leading retailer should consider the manufacturer's fairness preferences and make the optimal decision accordingly to ensure the profit of the green supply chain member firms, verifying proposition 7 and property 3.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 14 July 2021 doi:10.20944/preprints202107.0328.v1

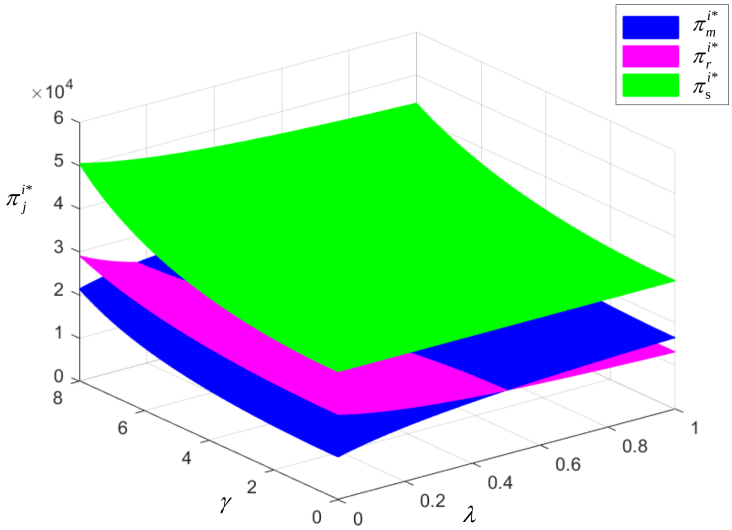


Figure7. π_m , π_r , π_s with respect to γ (MR, NR)

Figure 7 shows that regarding the manufacturer's fairness preferences and the retailer's green marketing, it can be seen on the left side that as green sensitivity increases, the profits of the manufacturer, retailer and supply chain all increase; on the right side, with the increase in the fairness preferences coefficient, the profits of the retailer and supply chain both decrease while the profit of the manufacturer increases. In manufacturer's fairness preferences case, the manufacturer's profit is larger than that without fairness preferences（NR: λ=0）, while the profits of the retailer and supply chain are smaller than those without fairness preferences. Hence, the retailer's green marketing is conducive to an increase in the profits of the manufacturer, the retailer and the overall supply chain, while the manufacturer's fairness preferences is conducive to an increase in his/her own profit but not to an increase in the benefits of the retailer and the overall supply chain. In actual firm operations, retailers engaging in green marketing must use an effective coordination mechanism to fairly distribute the profits of the green supply chain to reduce the manufacturer's excessive fairness preferences so that the green supply chain system can operate efficiently and stably. The property 3 and proposition 8 are also verified.

7. Conclusions

The present study investigates the impact of green marketing and fairness preferences on the decisions of member firms in a retailer-led green supply chain. The optimal decisions regarding supply chain pricing and performance are analyzed under four scenarios, namely, those in which the manufacturer and the retailer each engage in green marketing without and with fairness preferences. To better understand the research results, we further compare the wholesale price, retail price, level of green marketing efforts, market demand, and the performance of member firms and the supply chain under different scenarios.

This paper has the following management implications: (a) When firms engage in green marketing, regardless of the presence of fairness preferences, green marketing is always conducive to increasing wholesale prices, retail prices, level of green marketing efforts, market demand, and profits of manufacturers, retailers and the supply chain. With the continuous development of green marketing, the leading retailers gain more channel profits, which lead to an increase in manufacturers' fairness preferences. (b) Under manufacturers' fairness preferences and green marketing, fairness preferences increase wholesale and sales prices when green sensitivity is low and decrease these prices otherwise. Fairness preferences discourages manufacturers from making level of green marketing efforts and reduces the demand for low-carbon products, directly lowering the profits of manufacturers, retailers and the supply chain. (c) Considering fairness preferences, when retailers perform green marketing, with the increase in fairness preferences coefficient, the wholesale price increases while the sales price, sales effort and product demand decrease; although fairness preferences are conducive to an increase in their own profits, it is not conducive to an increase in the profits of retailers and the supply chain. (d) Although fairness preferences limits retailers' use of channel advantages to gain more profits, it reduces the profit of the overall supply chain. In short, the leading retailers should use an effective coordination mechanism to consider the fairness preferences of members while actively promoting green marketing by member firms to promote an increase in profits of member firms and the overall supply chain, ensure the efficient operation of the supply chain, and facilitate the green and sustainable development of the economy.

The present study has the following limitations. First, we only analyzed the manufacturers' fairness preferences and did not considered the impact of retailers' fairness preferences on decisions in the green supply chain. In addition, we assumed that the demand function is a linear function of green marketing and product price, limiting the adaptability of the model to some extent. Finally, we only considered a two-stage green supply chain; therefore, we need to further study green supply chains with multiple competing retailers and consider the impact of fairness preferences on firms' decisions, a worthy direction for future research.

Author Contributions: Writing—original draft preparation, H.Z., H.H. and X.Z.; Methodology and validation, H.Z. and X.Z.; Writing—review and editing, H.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This work is supported by the National Natural Science Foundation of China (Grant No. 71671054), the Philosophy and Social Science Fund Project of Heilongjiang Province (Grant No.20JLE386) and the Innovative Research Fund for Graduate Students of Harbin University of Commerce (Grant No. YJSCX2020-630HSD).

Institutional Review Board Statement: Not applicable

Informed Consent Statement: Not applicable
Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Proof of Properties and Propositions

Appendix A.1.Proof of Property 1

By virtue of Eq. (8) -(14), we can obtain that for $a-bc>0$ and $2b\eta-\gamma^2>0$,

$$\frac{\partial \omega^{MM*}}{\partial \lambda}=\frac{(a-bc)}{2b(1+\lambda)^2}>0,\ \frac{\partial p^{MM*}}{\partial \lambda}=\frac{(a-bc)}{b(1+\lambda)^2}>0,$$

$$\frac{\partial e^{MM*}}{\partial \lambda}=\frac{-\gamma(a-bc)}{2(2b\eta-\gamma^2)(1+\lambda)^2}<0,\quad \frac{\partial q^{MM*}}{\partial \lambda}=\frac{-b\eta(a-bc)}{2(2b\eta-\gamma^2)(1+\lambda)^2}<0,$$

$$\frac{\partial \pi_m^{MM*}}{\partial \lambda}=\frac{-\eta\lambda(a-bc)^2(1+\lambda)}{4(2b\eta-\gamma^2)(1+\lambda)^4}<0,\quad \frac{\partial \pi_r^{MM*}}{\partial \lambda}=\frac{-\eta(a-bc)^2}{4(2b\eta-\gamma^2)(1+\lambda)^2}<0.$$

Appendix A.2.Proof of Property 2

From Eq. (26) and (28)-(33), we can get that

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 14 July 2021 doi:10.20944/preprints202107.0328.v1

$$\frac{\partial \omega^{MR*}}{\partial \lambda}=\frac{\eta(a-bc)(8b\eta-3\gamma^2)}{\left[4b\eta(1+2\lambda)\text{-}\gamma^2(1+\lambda)\right]^2}>0,\ \frac{\partial p^{MR*}}{\partial \lambda}=\frac{-3b\eta^2(a-bc)}{\left[4b\eta(1+2\lambda)\text{-}\gamma^2(1+\lambda)\right]^2}<0,$$

$$\frac{\partial e^{MR*}}{\partial \lambda}=\frac{-4b\eta\gamma(a-bc)}{\left[4b\eta(1+2\lambda)\text{-}\gamma^2(1+\lambda)\right]^2}<0,\ \frac{\partial q^{MR*}}{\partial \lambda}=\frac{-b\eta\gamma^2(a-bc)}{\left[4b\eta(1+2\lambda)\text{-}\gamma^2(1+\lambda)\right]^2}<0,$$

$$\frac{\partial \pi_m^{MR*}}{\partial \lambda}=\frac{2b\eta^2[4b\eta(2\lambda+1)-(5\lambda+2)\gamma^2](a-bc)^2}{\left[4b\eta(1+2\lambda)\text{-}\gamma^2(1+\lambda)\right]^3}>0,$$

$$\frac{\partial \pi_r^{MR*}}{\partial \lambda}=\frac{-2b\eta^2(a-bc)^2}{\left[4b\eta(1+2\lambda)\text{-}\gamma^2(1+\lambda)\right]^2}<0,\ \frac{\partial \pi_s^{MR*}}{\partial \lambda}=\frac{2b\eta^2(a-bc)^2(-4\lambda\text{-}1)\gamma^2}{\left[4b\eta(1+2\lambda)\text{-}\gamma^2(1+\lambda)\right]^2}<0.$$

For, under the basic assumptions and the Hesse matrix assumption of the manufacturer's equity preferences, it is easy to obtain: $8b\eta-3\gamma^2>0$, $a-bc>0$, $4b\eta(1+2\lambda)\text{-}\gamma^2(1+\lambda)>0$, $4b\eta(2\lambda+1)-(5\lambda+2)\gamma^2>0$.

Appendix A.3.Proof of Property 3

When $i=NM$, then $\frac{\partial \omega^{NM*}}{\partial \gamma}=\frac{\eta\gamma(a-bc)}{(2b\eta-\gamma^2)^2}>0$, $\frac{\partial p^{NM*}}{\partial \gamma}=\frac{\eta\gamma(a-bc)}{2(2b\eta-\gamma^2)^2}>0$,

$$\frac{\partial e^{NM*}}{\partial \gamma}=\frac{(a-bc)(2b\eta+\gamma^2)}{2(2b\eta-\gamma^2)^2}>0,\ \frac{\partial q^{NM*}}{\partial \gamma}=\frac{b\eta(a-bc)}{(2b\eta-\gamma^2)^2}>0,$$

$$\frac{\partial \pi_r^{NM^*}}{\partial \gamma}=\frac{\eta\gamma(a-bc)^2}{2(2b\eta-\gamma^2)^2}>0,\ \frac{\partial \pi_m^{NM^*}}{\partial \gamma}=\frac{\eta\gamma(a-bc)^2}{4(2b\eta-\gamma^2)^2}>0,$$

$$\frac{\partial \pi_s^{NM^*}}{\partial \gamma}=\frac{\partial \pi_m^{NM^*}}{\partial \gamma}+\frac{\partial \pi_r^{NM^*}}{\partial \gamma}>0.$$

When $i=\{NR,MM,MR\}$,then the proof process is similar, it is not stated anymore.

Appendix A.4.Proof of Proposition 3

$$\omega^{NR*}-\omega^{NM*}=\frac{-\eta\gamma^2(a-bc)}{2(2b\eta-\gamma^2)(4b\eta-\gamma^2)}<0,$$

$$p^{NR*}-p^{NM*}=\frac{(a-bc)\gamma^2(b\eta-\gamma^2)}{2b(2b\eta-\gamma^2)(4b\eta-\gamma^2)}>0,$$

$$e^{NR*}-e^{NM*}=\frac{-\gamma^3(a-bc)}{2(2b\eta-\gamma^2)(4b\eta-\gamma^2)}<0,$$

$$q^{NR*}-q^{NM*}=\frac{-\eta b\gamma^2(a-bc)}{2(2b\eta-\gamma^2)(4b\eta-\gamma^2)}<0.$$

When $0<\gamma<\sqrt{b\eta}$, then Proposition 3 is proved.

Appendix A.5.Proof of Proposition 4

$$\pi_m^{NR*}-\pi_m^{NM*}=\frac{-\eta(a-bc)^2\gamma^4}{8(2b\eta-\gamma^2)(4b\eta-\gamma^2)^2}<0,$$

$$\pi_r^{NR*}-\pi_r^{NM*}=\frac{-\eta\gamma^2(a-bc)^2}{4(4b\eta-\gamma^2)(2b\eta-\gamma^2)}<0.$$

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 14 July 2021 doi:10.20944/preprints202107.0328.v1

According to formula $\pi_s = \pi_r + \pi_m$, we get $\pi_s^{NR*} \le \pi_s^{NM*}$.

Appendix A.6.Proof of Proposition 5

$$\omega^{MM*} - \omega^{NM*} = \frac{\lambda(a-bc)(b\eta-\gamma^2)}{2b(1+\lambda)(2b\eta-\gamma^2)} > 0,\quad p^{MM*} - p^{NM*} = \frac{\lambda(a-bc)(b\eta-\gamma^2)}{2b(1+\lambda)(2b\eta-\gamma^2)} > 0$$

When $0 \le \gamma \le \sqrt{b\eta}$, then $p^{NR*} \ge p^{NM*}, \omega^{MM*} \ge \omega^{NM*}$;

when $\sqrt{b\eta} < \gamma$, then $p^{NR*} < p^{NM*}, \omega^{MM*} < \omega^{NM*}$.

$$e^{MM*} - e^{NM*} = \frac{-\gamma\lambda(a-bc)}{2(2b\eta-\gamma^2)(1+\lambda)} < 0,\quad q^{MM*} - q^{NM*} = \frac{-b\eta\lambda(a-bc)}{2(2b\eta-\gamma^2)(1+\lambda)} < 0.$$

Appendix A.7.Proof of Proposition 6

$$\pi_m^{MM*} - \pi_m^{NM*} = \frac{-\eta\lambda^2(a-bc)^2}{8(1+\lambda)^2(2b\eta-\gamma^2)} < 0,\ \pi_r^{MM*} - \pi_r^{NM*} = \frac{-\lambda\eta(a-bc)^2}{4(2b\eta-\gamma^2)(1+\lambda)} < 0$$

According to formula $\pi_s = \pi_r + \pi_m$, we get $\pi_s^{MM*} - \pi_s^{NM*} < 0$.

Appendix A.8.Proof of Proposition 7

$$\omega^{MR*} - \omega^{NR*} = \frac{\eta(a-bc)(8b\eta-3\gamma^2)\lambda}{(4b\eta-\gamma^2)\left[4b\eta(1+2\lambda)-\gamma^2(1+\lambda)\right]} > 0,$$

$$p^{MR*} - p^{NR*} = \frac{-3\eta(a-bc)\gamma^2\lambda}{(4b\eta-\gamma^2)\left[4b\eta(1+2\lambda)-\gamma^2(1+\lambda)\right]} < 0,$$

$$e^{MR*} - e^{NR*} = \frac{-4b\eta(a-bc)\gamma\lambda}{(4b\eta-\gamma^2)\left[4b\eta(1+2\lambda)-\gamma^2(1+\lambda)\right]} < 0,$$

$$q^{MR*} - q^{NR*} = \frac{-b\eta(a-bc)\gamma^2\lambda}{(4b\eta-\gamma^2)\left[4b\eta(1+2\lambda)-\gamma^2(1+\lambda)\right]} < 0.$$

For，Under the basic assumptions and the Hesse matrix assumption of the manufacturer's fairness preferences, it is easy to obtain $8b\eta - 3\gamma^2 > 0$, $a - bc > 0$, $4b\eta(1+2\lambda)-\gamma^2(1+\lambda) > 0$, $4b\eta(2\lambda+1)-(5\lambda+2)\gamma^2 > 0$.

Appendix A.9.Proof of Proposition 8

$$\pi_m^{MR*} - \pi_m^{NR*} = \frac{b\eta^2(a-bc)^2\{4(4b\eta-\gamma^2)(2b\eta-\gamma^2)\lambda + \left[8(4b\eta-\gamma^2)^2-(8b\eta-\gamma^2)^2\right]\lambda^2\}}{\left[4b\eta(1+2\lambda)-\gamma^2(1+\lambda)\right]^2(4b\eta-\gamma^2)^2} > 0$$

Hypothesis 3 η is large enough to satisfy, that is $\gamma < \sqrt{2b\eta} < \sqrt{\dfrac{8(\sqrt{2}-1)b\eta}{2\sqrt{2}-1}}$, $\lambda > 0$ when equity concerns exist. $\pi_r^{NR*} - \pi_m^{NR*} = \dfrac{\eta(a-bc)^2(2b\eta-\gamma^2)}{2(4b\eta-\gamma^2)^2} > 0$,

$$\pi_r^{MR*} - \pi_r^{NR*} = \frac{-2b\eta^2\lambda(a-bc)^2}{\left[4b\eta(1+2\lambda)-\gamma^2(1+\lambda)\right](4b\eta-\gamma^2)} < 0,$$

According to formula $\pi_s = \pi_r + \pi_m$, we get $\pi_s^{MR*} - \pi_s^{NR*} < 0$.

References

1. Wang, M.L.; Kuo, T.C.; Liu, J.W. Identifying target green 3C customers in Taiwan using multiattribute utility theory. Expert Syst. Appl. 2009, 36, 12562–12569, doi:10.1016/j.eswa.2009.05.033.
2. Li, Q.; Sun, H.; Zhang, H.; Li, W.; Ouyang, M. Design investment and advertising decisions in direct-sales closed-loop supply chains. J. Clean. Prod. 2020, 250, 119552, doi:10.1016/j.jclepro.2019.119552.
3. Yuyin, Y.; Jinxi, L. Cost-sharing contracts for energy saving and emissions reduction of a supply chain under the conditions of government subsidies and a carbon tax. Sustain. 2018, 10, doi:10.3390/su10030895.
4. Meng, Q.; Li, M.; Liu, W.; Li, Z.; Zhang, J. Pricing policies of dual-channel green supply chain: Considering government subsidies and consumers' dual preferences. Sustain. Prod. Consum. 2021, 26, 1021–1030, doi:10.1016/j.spc.2021.01.012.
5. Lin, Y.H.; Kulangara, N.; Foster, K.; Shang, J. Improving green market orientation, green supply chain relationship quality, and green absorptive capacity to enhance green competitive advantage in the green supply chain. Sustain. 2020, 12, 1–22, doi:10.3390/su12187251.
6. Wang, Y.; Yu, Z.; Jin, M.; Mao, J. Decisions and Coordination of Retailer-led Low-carbon Supply Chain under Altruistic Preference. Eur. J. Oper. Res. 2021, doi:10.1016/j.ejor.2020.12.060.
7. Kinoti, M.W. Green marketing intervention strategy and sustainable development. Inernational J. Bus. Soc. Sci. 2011, 2, 263–273.
8. Mondal, C.; Giri, B.C. Pricing and used product collection strategies in a two-period closed-loop supply chain under greening level and effort dependent demand. J. Clean. Prod. 2020, 265, 121335, doi:10.1016/j.jclepro.2020.121335.
9. Yenipazarli, A.; Vakharia, A. Pricing, market coverage and capacity: Can green and brown products co-exist? Eur. J. Oper. Res. 2015, 242, 304–315, doi:10.1016/j.ejor.2014.09.039.
10. Phan, D.A.; Vo, T.L.H.; Lai, A.N.; Nguyen, T.L.A. Coordinating contracts for VMI systems under manufacturer-CSR and retailer-marketing efforts. Int. J. Prod. Econ. 2019, 211, 98–118, doi:10.1016/j.ijpe.2019.01.022.
11. Sana, S.S. Price competition between green and non green products under corporate social responsible firm. J. Retail. Consum. Serv. 2020, 55, 102118, doi:10.1016/j.jretconser.2020.102118.
12. Shen, W.; Gu, H.; Ball, L.J.; Yuan, Y.; Yu, C.; Shi, R.; Huang, T. The impact of advertising creativity, warning-based appeals and green dispositions on the attentional effectiveness of environmental advertisements. J. Clean. Prod. 2020, 271, 122618, doi:10.1016/j.jclepro.2020.122618.
13. Chen, H.C.; Yang, C.H. Applying a multiple criteria decision-making approach to establishing green marketing audit criteria. J. Clean. Prod. 2019, 210, 256–265, doi:10.1016/j.jclepro.2018.10.327.
14. Loch, C.H.; Wu, Y. Social preferences and supply chain performance: An experimental study. Manage. Sci. 2008, 54, 1835–1849, doi:10.1287/mnsc.1080.0910.
15. Hospitality; Restaurant What Your Customers Want. Restaur. Hosp. 2005, 76, 728–741.
16. Grillo, H.; Alemany, M.M.E.; Ortiz, A.; Fuertes-Miquel, V.S. Mathematical modelling of the order-promising process for fruit supply chains considering the perishability and subtypes of products. Appl. Math. Model. 2017, 49, 255–278, doi:10.1016/j.apm.2017.04.037.
17. Zhang, L.; Xue, B.; Liu, X. Carbon emission reduction with regard to retailer's fairness concern and subsidies. Sustain. 2018, 10, 1–28, doi:10.3390/su10041209.
18. Pan, K.; Cui, Z.; Xing, A.; Lu, Q. Impact of fairness concern on retailer-dominated supply chain. Comput. Ind. Eng. 2020, 139, 106209, doi:10.1016/j.cie.2019.106209.
19. Benjaafar, S.; Li, Y.; Daskin, M. Carbon footprint and the management of supply chains: Insights from simple models. IEEE Trans. Autom. Sci. Eng. 2013, 10, 99–116, doi:10.1109/TASE.2012.2203304.
20. Song, Y.; Chen, J.; Yang, Y.; Jia, C.; Su, J. A dual-channel supply chain model considering supplier's mental accounting and retailer's fairness concerns. Procedia Comput. Sci. 2018, 139, 347–355, doi:10.1016/j.procs.2018.10.280.
21. Ghosh, D.; Shah, J. Supply chain analysis under green sensitive consumer demand and cost sharing contract. Int. J. Prod. Econ. 2015, 164, 319–329, doi:10.1016/j.ijpe.2014.11.005.
22. Yan, B.; Wu, J.; Jin, Z.; He, S. Decision-making of fresh agricultural product supply chain considering the manufacturer's fairness concerns. 4or 2020, 18, 91–122.
23. Ghosh, D.; Shah, J. Supply chain analysis under green sensitive consumer demand and cost sharing contract. Int. J. Prod. Econ. 2015, 164, 319–329, doi:10.1016/j.ijpe.2014.11.005.
24. Zhou, Y.; Bao, M.; Chen, X.; Xu, X. Co-op advertising and emission reduction cost sharing contracts and coordination in low-carbon supply chain based on fairness concerns. J. Clean. Prod. 2016, 133, 402–413, doi:10.1016/j.jclepro.2016.05.097.
25. Hu, B.; Meng, C.; Xu, D.; Son, Y.J. Supply chain coordination under vendor managed inventory-consignment stocking contracts with wholesale price constraint and fairness. Int. J. Prod. Econ. 2018, 202, 21–31, doi:10.1016/j.ijpe.2018.05.009.
26. Mondal, C.; Giri, B.C.; Maiti, T. Pricing and greening strategies for a dual-channel closed-loop green supply chain; Springer US, 2020; Vol. 32; ISBN 0123456789.
27. Xu, X.; He, P.; Xu, H.; Zhang, Q. Supply chain coordination with green technology under cap-and-trade regulation; Elsevier, 2017; Vol. 183; ISBN 8657188206827.
28. Xu, J.; Chen, Y.; Bai, Q. A two-echelon sustainable supply chain coordination under cap-and-trade regulation. J. Clean. Prod. 2016, 135, 42–56, doi:10.1016/j.jclepro.2016.06.047.

29. Zu, Y.; Chen, L.; Fan, Y. Research on low-carbon strategies in supply chain with environmental regulations based on differential game. J. Clean. Prod. 2018, 177, 527–546, doi:10.1016/j.jclepro.2017.12.220.
30. Dong, C.; Liu, Q.; Shen, B. To be or not to be green? Strategic investment for green product development in a supply chain. Transp. Res. Part E Logist. Transp. Rev. 2019, 131, 193–227, doi:10.1016/j.tre.2019.09.010.
31. Zhu, W.; He, Y. Green product design in supply chains under competition. Eur. J. Oper. Res. 2017, 258, 165–180, doi:10.1016/j.ejor.2016.08.053.
32. Teck-Hua, H.; Juanjuan, Z. Designing pricing contracts for boundedly rational customers: Does the framing of the fixed fee matter? Manage. Sci. 2008, 54, 686–700, doi:10.1287/mnsc.1070.0788.
33. Cui, T.H.; Raju, J.S.; Zhang, Z.J. Fairness and channel coordination. Manage. Sci. 2007, 53, 1303–1314, doi:10.1287/mnsc.1060.0697.
34. Caliskan-Demirag, O.; Chen, Y.; Li, J. Channel coordination under fairness concerns and nonlinear demand. Eur. J. Oper. Res. 2010, 207, 1321–1326, doi:10.1016/j.ejor.2010.07.017.
35. Yang, J.; Xie, J.; Deng, X.; Xiong, H. Cooperative advertising in a distribution channel with fairness concerns. Eur. J. Oper. Res. 2013, 227, 401–407, doi:10.1016/j.ejor.2012.12.011.
36. Nie, T.; Du, S. Dual-fairness supply chain with quantity discount contracts. Eur. J. Oper. Res. 2017, 258, 491–500, doi:10.1016/j.ejor.2016.08.051.
37. Guan, Z.; Ye, T.; Yin, R. Channel coordination under Nash bargaining fairness concerns in differential games of goodwill accumulation. Eur. J. Oper. Res. 2020, 285, 916–930, doi:10.1016/j.ejor.2020.02.028.
38. Zhang, L.; Zhou, H.; Liu, Y.; Lu, R. Optimal environmental quality and price with consumer environmental awareness and retailer's fairness concerns in supply chain. J. Clean. Prod. 2019, 213, 1063–1079, doi:10.1016/j.jclepro.2018.12.187.
39. Pu, X.; Gong, L.; Han, G. A feasible incentive contract between a manufacturer and his fairness-sensitive retailer engaged in strategic marketing efforts. J. Intell. Manuf. 2019, 30, 193–206, doi:10.1007/s10845-016-1239-5.
40. Cao, Y.; Tao, L.; Wu, K.; Wan, G. Coordinating joint greening efforts in an agri-food supply chain with environmentally sensitive demand. J. Clean. Prod. 2020, 277, 123883, doi:10.1016/j.jclepro.2020.123883.
41. Liu, W.; Wang, D.; Shen, X.; Yan, X.; Wei, W. The impacts of distributional and peer-induced fairness concerns on the decision-making of order allocation in logistics service supply chain. Transp. Res. Part E Logist. Transp. Rev. 2018, 116, 102–122, doi:10.1016/j.tre.2018.05.006.
42. Chou, S.F.; Horng, J.S.; Sam Liu, C.H.; Lin, J.Y. Identifying the critical factors of customer behavior: An integration perspective of marketing strategy and components of attitudes. J. Retail. Consum. Serv. 2020, 55, 102113, doi:10.1016/j.jretconser.2020.102113.
43. Lampe, M.; Gazda, G.M. Green marketing in Europe and the United States: An evolving business and society interface. Int. Bus. Rev. 1995, 4, 295–312, doi:10.1016/0969-5931(95)00011-N.
44. Peattie, K. Delivered by Publishing Technology to : Manchester Metropolitan University Towards Sustainability : The Third Age of Green Marketing Delivered by Publishing Technology to : Manchester Metropolitan University. Society 2001, 129–146.
45. Zhu, Q.; Sarkis, J. Green marketing and consumerism as social change in China: Analyzing the literature. Int. J. Prod. Econ. 2016, 181, 289–302, doi:10.1016/j.ijpe.2016.06.006.
46. Endrikat, J. Market Reactions to Corporate Environmental Performance Related Events: A Meta-analytic Consolidation of the Empirical Evidence. J. Bus. Ethics 2016, 138, 535–548, doi:10.1007/s10551-015-2598-0.
47. Sarkar, A.N. Green Branding and Eco-innovations for Evolving a Sustainable Green Marketing Strategy. Asia-Pacific J. Manag. Res. Innov. 2012, 8, 39–58, doi:10.1177/2319510x1200800106.
48. Chen, Y.S.; Chang, T.W.; Lin, C.Y.; Lai, P.Y.; Wang, K.H. The influence of proactive green innovation and reactive green innovation on green product development performance: The mediation role of green creativity. Sustain. 2016, 8, doi:10.3390/su8100966.
49. Su, C.; Liu, X.; Du, W. Green supply chain decisions considering consumers' low-carbon awareness under different government subsidies. Sustain. 2020, 12, doi:10.3390/su12062281.
50. Zhang, L.; Wang, J.; You, J. Consumer environmental awareness and channel coordination with two substitutable products. Eur. J. Oper. Res. 2015, 241, 63–73, doi:10.1016/j.ejor.2014.07.043.
51. Basiri, Z.; Heydari, J. A mathematical model for green supply chain coordination with substitutable products. J. Clean. Prod. 2017, 145, 232–249, doi:10.1016/j.jclepro.2017.01.060.
52. Jamali, M.B.; Rasti-Barzoki, M. A game theoretic approach for green and non-green product pricing in chain-to-chain competitive sustainable and regular dual-channel supply chains; Elsevier B.V., 2018; Vol. 170; ISBN 8415683111.
53. Heydari, J.; Govindan, K.; Aslani, A. Pricing and greening decisions in a three-tier dual channel supply chain. Int. J. Prod. Econ. 2019, 217, 185–196, doi:10.1016/j.ijpe.2018.11.012.
54. Cui, L.; Guo, S.; Zhang, H. Coordinating a green agri-food supply chain with revenue-sharing contracts considering retailers' green marketing efforts. Sustain. 2020, 12, doi:10.3390/su12041289.
55. Luo, Y.; Wei, Q.; Ling, Q.; Huo, B. Optimal decision in a green supply chain: Bank financing or supplier financing. J. Clean. Prod. 2020, 271, doi:10.1016/j.jclepro.2020.122090.
56. Turken, N.; Carrillo, J.; Verter, V. Strategic supply chain decisions under environmental regulations: When to invest in end-of-pipe and green technology. Eur. J. Oper. Res. 2020, 283, 601–613, doi:10.1016/j.ejor.2019.11.022.
57. Chang, S.; Hu, B.; He, X. Supply chain coordination in the context of green marketing efforts and capacity expansion. Sustain. 2019, 11, doi:10.3390/su11205734.

58. Savaskan, R.C.; Bhattacharya, S.; Van Wassenhove, L.N. Closed-Loop Supply Chain Models with Product Remanufacturing. Manage. Sci. 2004, 50, 239–252, doi:10.1287/mnsc.1030.0186.
59. Yang, H.; Miao, L.; Zhao, C. The credit strategy of a green supply chain based on capital constraints. J. Clean. Prod. 2019, 224, 930–939, doi:10.1016/j.jclepro.2019.03.214.
60. Ji, J.; Zhang, Z.; Yang, L. Carbon emission reduction decisions in the retail-/dual-channel supply chain with consumers' preference. J. Clean. Prod. 2017, 141, 852–867, doi:10.1016/j.jclepro.2016.09.135.
61. Universities, O.; Kagel, J. A theory of fairness, competition, and cooperation* e. 1999, 817–868.
62. Charness, G.; Rabin, M. Understanding Social Preference with Simple Tests. SSRN Electron. J. 2005, doi:10.2139/ssrn.224577.
63. Bolton, G.E. A comparative model of bargaining: Theory and evidence. Am. Econ. Rev. 1991, 81, 1096–1136.
64. Ho, T.H.; Su, X.; Wu, Y. Distributional and peer-induced fairness in supply chain contract design. Prod. Oper. Manag. 2014, 23, 161–175, doi:10.1111/poms.12064.
65. Du, S.; Nie, T.; Chu, C.; Yu, Y. Reciprocal supply chain with intention. Eur. J. Oper. Res. 2014, 239, 389–402, doi:10.1016/j.ejor.2014.05.032.
66. Review, M. Fairness and Failures of Coordinating Contracts : on the Optimality of Pooling. 2010.
67. Song, H.; Gao, X. Green supply chain game model and analysis under revenue-sharing contract. J. Clean. Prod. 2018, 170, 183–192, doi:10.1016/j.jclepro.2017.09.138.
68. Zhang, X.; Xiu, G.; Shahzad, F.; Duan, Y. Optimal financing strategy in a capital-constrained supply chain with retailer green marketing efforts. Sustain. 2021, 13, 1–19, doi:10.3390/su13031357.