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Decisions of Green Supply Chain under Fairness Concerns and Different Power Structures

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ABSTRACT

This article constructs a two-stage dynamic game model for green manufacturers, retailers, and consumers to address the issue that fairness preference in manufacturing can impact supply chain decision-making. This is done by discussing decision-making under the three power structures of green-manufacturer-dominated, retailer-dominated, and the Nash-equilibrium, and compares the balanced decision under the three power structures. The results show that in the manufacturer-dominated and Nash equilibrium games, product greenness, retailer profits, manufacturer profits, total supply chain profits, and a manufacturer's utility all decrease as the fairness preference increases, whereas the retail price and wholesale price are just the opposite of each other. In the retailer-dominated game, the retail price, product greenness, and total supply chain profits are not impacted by the fairness preference. The wholesale price, manufacturer's profits, and manufacturer's utility increases as the fairness preference increases, whereas the retailer profits decrease.

KEYWORDS

Fairness Concern, Green Supply Chain, Power Structure, Stackelberg Game

1. INTRODUCTION

The development of society and the increase in people's environmental awareness have led to the further development of the green supply chain, as shown in the performance improvement of green supply chains, the improvement in green technologies, and the improvement in energy-saving and emission-reduction. However, some problems have also arisen in the development process, such as sharing of investment costs and the distribution of channel profits. In particular, many scholars have paid attention to the issue of supply chain participants considering both shouldering more social and environmental responsibilities and obtaining more benefits to achieve fair treatment of stakeholders. Therefore, it is of extraordinary realistic significance to study the impact of fairness preference on decision-making regarding green supply chains from the perspective of participant behavior.

Fairness concern is a common phenomenon in our daily lives. For example, people may pay attention to their own money income while paying attention to their peers' income. If their wages are lower than their peers', it will lead to negative emotions and reduction in work efficiency; at the same time, fairness concerns also exist in commercial transactions. For example, the retailer also

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pays attention to whether it is treated fairly. If it is not, it will take revenge, which will result in a reduction in the supply chain performance. Therefore, fairness concern plays a role that cannot be ignored in the choice of optimal decision.

Early scholars such as Cui (2007) and Pavlov (2009) confirmed that fairness concern has an impact on the decision-making of supply chain participants. Not only manufacturers but also retailers will be impacted by fairness concern. However, the impact of fairness concern on supply chain members differs among different power structures: for example, Wal-Mart, who is a leading retailer in the supply chain, occupies a powerful position, which creates a disadvantage for followers, thus generating fairness concern. Here is another example: Chrysler is an auto manufacturer. As a leader, it may have price discrimination against dealers, which in turn causes dealers to be treated unfairly and ultimately reduces supply chain performance, thus reducing the competitiveness of the supply chain (see Nie et al., 2017).

Based on the above analysis, we would like to discuss the following issues: first, how can fairness concern be addressed better? How does fairness preference impact the green supply chain? Second, how does fairness preference impact supply chain decision-making under different power structures (manufacturer-dominated, retailer-dominated, and Nash equilibrium)?

To solve the problems raised above, we studied the impact of fair preference on the decision-making regarding green supply chains under different power structures when manufacturers focus on fairness. We want to find the optimal pricing, wholesale price, and product greenness of the supply chain when there is relative fairness and the fairness preference is optimal. For this reason, we considered three types of games between the manufacturer and the retailer, namely manufacturer-dominated Stackelberg, retailer-dominated Stackelberg and Nash equilibrium games.

In this supply chain system, manufacturers produce green products, and they independently make investment in green products, determine the wholesale price of products and the greenness of products to maximize their own profits. Meanwhile, manufacturers have fairness preference and use Nash bargaining as a reference point. This preference will impact the manufacturer's wholesale price and product greenness, but it does not change the characteristics of the product; influenced by the manufacturer's decision, the retailer will set the retail price to maximize its own profit.

This paper differs from the previous literature in the following aspects. 1) This paper uses Nash bargaining as a reference point for fairness. The previous literature has basically discussed the retailer's fairness concern. Here, we will consider the manufacturer's fairness concern because in the green supply chain, there exists green investment. This is how the green supply chain is different from the traditional supply chain. 2) The paper discusses the impact of fairness preference on the decision-making regarding green supply chains under different models of dominance, whereas most of the literature considers only the decentralized and centralized systems.

The rest of the paper is structured as follows: Section 2 reviews the literature; Section 3 constructs a two-stage green supply chain model with fairness concern; Section 4 analyzes the optimal decision-making under the three power structures; Section 5 performs a comparative analysis of game equilibrium under the three power structures; Section 6 uses calculation examples to test the model and obtains some potential conclusions; Section 7 summarizes the conclusions of the paper and notes future research work.

2. LITERATURE REVIEW

The study of green supply chains started to catch the attention of relevant scholars in the context of sustainable development. From green procurement to the proposal of the concept of green supply chain in 1996, the curtain of research on the green supply chain was officially raised (see Beamon, 1999). In recent years, the research about green supply chains has entered a diversified stage. By using the game theory approach, Zhu et al. (2016) constructed a competition model for a manufacturer and a retailer, in addition to a model for two manufacturers and two retailers, and they studied the competition