Dual-channel supply chain equilibrium problems regarding retail services and fairness concerns

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ARTICLE INFO

ABSTRACT

Channel competition is the inevitable result when a manufacturer adds a direct channel. Retailers must provide value-added services to products at cost to alleviate the intensity of channel conflict. Thus, retailers may exhibit fairness concerns. In this study, we consider a dual-channel supply chain where a manufacturer with a direct channel acts as the leader and a retailer is the follower. We assume that the retailer has fairness concerns and adds additional value to the product. First, without considering the retailer's fairness concerns, we model mixed channels where the manufacturer makes decisions about the wholesale price and the direct price, while the retailer makes decisions about the level of the value-added services and the retail price according to the Stackelberg game. Furthermore, we consider the game model by adding the retailer's fairness concerns and we present the conditions under which the manufacturer and the retailer can achieve optimal equilibrium strategies. We find that channel efficiency grows with increasing customer loyalty to the retail channel and falls with increases in the retailer's fairness concerns. We show that the entire supply chain cannot be coordinated with a constant wholesale price when the retailer provides value-added services and has fairness concerns.

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1. Introduction

Due to the growth in electronic commerce, an increasing number of manufacturers, such as IBM, Apple, Dell, Nike, and Estee Lauder, have opened direct channels (Tsay and Agrawal [1], Liu et al. [2]). The emergence of online direct channels has resulted in greater competition among retailers (Cai et al. [3]). Manufacturers compete with retailers in a dual-channel supply chain, so retailers may complain that orders placed through manufacturers' online channels should belong to them (Chiang et al. [4]). This is a source of channel conflict, which may undermine attempts to build cooperative relationships between manufacturers and retailers. Glock et al. [5] studied different types of competition under the multi-channel distribution system where the vendor supplied products through a direct channel and several traditional retailers. Sales through direct channels dramatically cannibalize the retailers' market share, so retailers must provide more value-added services to be more competitive. Therefore, retailers may feel unfairly treated because of channel encroachment by manufacturers and added investment in value-added services.

Empirical evidence has demonstrated that the members of a supply chain have social preferences, which are defined as intrinsic concerns for the welfare of other members (Loch and Wu [6], Loch and Wu [7]). Schweitzer and Cachon [8] analyzed the decision bias of the members of a supply chain and found that the order quantities received by the retailers

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were greater or less than the decisions determined by perfect rationality. Benziou et al. [9] also proved that the fairness concerns of members are generally related to the social preferences in the supply chain. Rabin [10] first introduced fairness into non-cooperative game theory and found that when people seek to maximize their own profit, they also care about the profit shares of others and whether they are treated unfairly. Cui et al. [11] introduced the fairness concerns of members into the coordination of the supply chain and obtained interesting results. Recently, fairness concerns have been studied by many researchers. In the present study, we are interested in studying pricing and profit equilibrium problems based on game theory when the retailer exhibits behavior characterized by fairness concerns in dual-channel supply chains.

Given channel encroachment by manufacturers, more retailers are aware that they can attract customers by providing value-added services, where the advantage of the retail channel is that retailers have direct contact with customers. Thus, the retailer can expand sales volume by providing value-added services to customers, such as immediate customer support, a returns service, technical and shopping assistance, and maintenance, as well as other services that may increase customer utility. Empirical studies have demonstrated that service quality is a crucial factor that affects the choice of channel by customers (Devaraj et al. [12], Rohm and Swaminathan [13]). In the present study, we limit the services to those that cannot be provided or partially provided by the direct channel, e.g., the expectation of immediate possession, social interactions experienced during shopping, and shopping as a recreational experience (Hu and Li [14]).

We construct a dual-channel supply chain comprising a manufacturer and a retailer. We assume that the manufacturer produces a single product and sells the product through a traditional retail channel and a direct channel. The retailer has fairness concerns and provides value-added services to customers. We use the Stackelberg game to model the problem because many manufacturers in the electronics industry and computer industry (e.g., IBM and Apple) have the ability to open a direct channel with sufficient capital investment (Pinkerton [15]), as well as the power to set wholesale price. However, retailers must follow the manufacturer's strategy and accept the wholesale price, but they then determine a price and value-added services are provided in addition to the product. Thus, the manufacturer is the leader and the retailer is the follower in this setting. We explore the equilibrium solutions in two scenarios. In the first, value-added services are provided by the retail channel, and in the second, both fairness concerns and value-added services are present in a dual-channel supply chain. We address the following research questions. How does the additional investment in value-added services in a dual-channel supply chain affect the pricing strategies and profits in a vertically integrated system and a decentralized system? What are the effects of the retailer's fairness concerns and customer loyalty to the retail channel on the decisions made by the two members in a dual-channel supply chain? We analyze the incentives for the retailer to invest in value-added services to compete with the manufacturer's direct channel and conclude that after an increase in customer loyalty to the traditional retail channel, the retailer will increase the traditional channel price, whereas the manufacturer will reduce the wholesale price to foster equitable results in the retail channel; thus, the channel efficiency will increase. However, as the degree of retailer concerns for fairness increases, the manufacturer's profit decreases and the retailer's profit increases gradually, so the channel efficiency will decrease. Therefore, the supply chain cannot be coordinated with a constant wholesale price when the retailer provides value-added services and exhibits concerns for fairness.

This study makes two significant contributions to our understanding of supply chain management. First, we extend the results of previous studies by addressing value-added service decisions and member fairness concerns in supply chains. The value-added services and fairness concerns of retailers have been studied many times, but these two factors have never been studied simultaneously. In this study, we consider the retailer's value-added services and behavior regarding fairness concerns using the Stackelberg game. The decision problems are much more complex, but they are closer to reality. Some studies have focused on the decision problems in supply chains where the members have fairness concerns, but few have addressed these problems in dual-channel supply chains where the members have fairness concerns. Based on the competitive scenario with two channels, we examine the influence of the retailer's fairness concerns on the decisions of the two members and the whole supply chain, thereby demonstrating that their decisions deviate from those under perfect rationality.

The remainder of this paper is organized as follows. Related research is described in Section 2. In Section 3, we explain the supply chain structure and the demand functions in a dual channel supply chain. In Section 4, we discuss the pricing and retail services policies when the value-added services in the retail channel are considered for the centralized and decentralized cases. In Section 5, we analyze the equilibrium strategies for the dual-channel supply chain and the effects on pricing and profits (or utilities) for the two members due to the retailer's value-added services and fairness concerns. We conclude by presenting the equilibrium results and suggesting directions for future research in Section 6. All of the proofs are provided in Appendix A.

2. Related literature

Two areas of research are closely related to our study: dual-channel supply chains with value-added services and supply chain coordination with fairness concerns. The former can be divided into three broad categories. In the first, value-added services are only offered in the traditional retail channels. In the second, services are addressed for electronic channels, especially with respect to delivery services. In the last, the interaction between the services in the two channels is addressed under the condition that both channels provide services. In the present study, we focus on the first category.

Important results have been obtained in studies of value-added services in dual-channel supply chains. For example, Yao et al. [16] applied the Stackelberg and Bertrand game models to study pricing strategies in a mix of traditional retail channels