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Supplier encroachment in competitive supply chains

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ABSTRACT

With the development of e-commerce, wholesale suppliers have opportunities to establish their own direct channels, competing with their retailing channels. It is often referred to as supplier encroachment. While many papers have analyzed encroachment of a monopolistic supplier, none of them study supplier encroachment in competitive supply chains. We first study the case with two non-identical supply chains, and then analyze the case with multiple identical supply chains. We show that, in both cases, the number of the encroaching suppliers in equilibrium decreases monotonically as the operational disadvantages of the suppliers become more significant. We find that there may exist the prisoner's dilemma phenomenon for the suppliers. Furthermore, encroachment may lead to the "lose–lose" outcome for the suppliers and the retailers. We also explore the efficiency of the suppliers, the retailers and the whole system under encroachment relative to the non-encroachment situation.

1. Introduction

Nowadays, with the development of e-commerce, other than using a single channel (through retailers) to sell products, many manufacturers and wholesale suppliers, e.g., Hewlett Packard, Epson, Lenovo, establish their own direct channels (Nasireti, 1998; Janah, 1999; Xiong et al., 2012). Thus, there arises competition between the two channels, which is often referred to as "supplier encroachment" (Arya et al., 2007). Recently, many studies have analyzed encroachment of a monopolistic supplier (Hendershott and Zhang, 2006; Liu and Zhang, 2006; Arya et al., 2007; Tsay and Agrawal, 2004; Chiang et al., 2003). Although a monopolistic supplier with complete information always benefits from encroachment, the retailers may suffer from supplier encroachment (Hendershott and Zhang, 2006; Liu and Zhang, 2006) or benefit from it (Arya et al., 2007; Tsay and Agrawal, 2004; Chiang et al., 2003). To the best of our knowledge, Mizuno (2012) is the only paper studying supplier encroachment with competitive suppliers who wholesale homogenous goods to multiple identical retailers.

In reality, there is often more than one supply chain for most kinds of products. For instance, in the PC (Personal Computer) market, the famous brands include Hewlett Packard, Dell, Lenovo, etc., products of which can be viewed as substitutable. The suppliers often wholesale products to exclusive retailers, through which the products are sold to customers. Thus, the supply chains compete with each other.

Although many papers study supplier encroachment problem, none of them investigate supplier encroachment in competitive supply chains. This paper investigates the supplier encroachment in competitive supply chains. We consider a model of n ($n \geq 2$) vertical supply chains, each composed of a supplier and an exclusive retailer. The exclusive retailers only sell the product of their suppliers. This kind of model fits several industries such as soft drink (McGuire and Staelin, 1983) and clothing, where exclusive dealership is not uncommon. There are also many papers that study the chain-to-chain competition (McGuire and Staelin, 1983; Coughlan, 1985; Moorthy, 1988; Wu and Chen, 2003; Wu et al., 2009; Anderson and Bao, 2010; Ai et al., 2012).

We will first study the case with two non-identical supply chains (referred to as non-identical system for short) and then investigate the case with n ($n \geq 2$) identical supply chains (referred to as identical system for short). We show that, in both cases, the number of the encroaching suppliers in equilibrium decreases monotonically as the operational disadvantages of the suppliers become more significant. We find that there may exist the prisoner's dilemma phenomenon for the suppliers. Furthermore, encroachment may lead to the "lose–lose" outcome for the suppliers and the retailers. We also explore the efficiency of the suppliers, the retailers and the whole system under encroachment relative to the non-encroachment situation.

The remainder of the paper is organized as follows. Section 2 provides the literature review. Section 3 describes the key elements of

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the basic model and introduces notation. Section 4 studies supplier encroachment in the non-identical system. Section 5 investigates supplier encroachment in the identical system. Section 6 concludes the paper. The proofs of the propositions and lemmas are collected in Appendix.

2. Literature review

This paper focuses on supplier encroachment in competitive supply chains. Thus, related literature includes supplier encroachment and chain-to-chain competition.

The literature on supplier encroachment has been dedicated to determine whether a supplier should add a direct channel to its existing retail channel. Chiang et al. (2003) conceptualize customer acceptance of a direct channel and show that direct marketing may not always be detrimental to the retailer because it brings with a wholesale price reduction. Moreover, direct marketing increases the flow of profit through the retail channel and helps the supplier improve overall profitability by reducing the degree of double marginalization. In the model of Tsay and Agrawal (2004), the supplier and the retailer decide on the sales effort in their respective channels, assuming that the sales effort in one channel exerts a positive externality on the demand in the other channel. They show that the addition of a direct channel alongside a retail channel is not necessarily detrimental to the retailer. In fact, the supplier will reduce the wholesale price to retain some of the retailer's sales effort, and in some cases, this can make both parties better off. Hendershott and Zhang (2006) establish a model in which an upstream firm can sell products to heterogeneous consumers engaging in time-consuming search through direct channel and intermediaries. Direct online channel may be more or less convenient and involves costly returns if the goods fit consumers poorly. They find that dual channel marketing facilitates price discrimination, and encroachment of the upstream firm increases consumer surplus at the expense of the profits of the intermediaries. Liu and Zhang (2006) show that a downstream retailer is worse off when an upstream supplier enters the market. The retailer can deter the supplier from entering the market by acquiring personalized pricing. Arya et al. (2007) identify circumstances under which a retailer benefits from a monopolistic supplier's encroachment. They find that if the operational cost of the direct channel is within a certain range, the supplier encroaches, and the retailers can benefit from encroachment even when encroachment admits no synergies and does not facilitate product differentiation or price discrimination. Li et al. (2013) extend the study of supplier encroachment to the environment with asymmetric information where the retailer is better informed of the maket size than the supplier. They find that the launch of the supplier's direct channel can result in costly signaling behavior of the retailer, in which the retailer reduces his order quantity when the market size is small. Such a downward order distortion can amplify double marginalization. As a result, in addition to the "win–win" and "win–lose" outcomes for the supplier and the retailer, supplier encroachment can also lead to "lose–lose" and "lose–win" outcomes. In order to investigate the product-market characteristics that influence the optimality of complementing an existing retail channel with a direct online channel, Kumar and Ruan (2006) contemplate a market with a single strategic supplier (focal supplier) selling products through a single strategic retailer. Consumers in the market are either brand loyal or store loyal. The retailer carries products of the focal supplier as well as a competing supplier, and provides retail support which impacts the demand for the suppliers' products. Xiong et al. (2012) study the impact of supplier encroachment in the dual goods market. Besides, many other papers study supplier encroachment (Cattani et al., 2006; Rhee and Park, 2000; Yoo and Lee, 2011). All the above papers assume the supplier to be a monopolist in the supply side.

To the best of our knowledge, Mizuno (2012) is the only one studying supplier encroachment with competitive suppliers. S/he studies the encroachment decisions of two identical suppliers wholesaling homogenous goods to multiple identical retailers and examines how the number of the retailers affects the profits of the suppliers and the retailers. An oligopolistic wholesale market and a market with non-homogenous goods are also briefly discussed. S/he shows that as the number of retailers increases, the number of encroaching suppliers decreases. And since an increase in the number of retailers may drive the direct-selling suppliers from the retail market, it may raise the retailers' profits and reduce social welfare. The main differences between our paper and Mizuno (2012) are as follows. First, the structures of the supply chains are different. In Mizuno (2012), two identical suppliers wholesale homogenous goods to multiple retailers, i.e., the retailers carry products of both suppliers. While in our model, the suppliers sell products through exclusive retailers. Second, Mizuno (2012) only investigates the encroachment decisions of two identical suppliers while we not only study the case with two non-identical suppliers but also study the case with n $(n \geq 2)$ identical suppliers. Third, Mizuno (2012) does not differentiate the retail channels of the retailers from the direct channels of the suppliers while we incorporate a factor which is the operational cost of the direct channel to distinguish the direct channel from the retail channel. Finally, we investigate the impact of encroachment on the profits of the suppliers, the retailers and the whole system while Mizuno (2012) does not consider this problem.

Beyond the above, extensive papers suppose that the suppliers establish their own direct channels and study the dual channel management (Seifert et al., 2006; Chen et al., 2008, 2012; Cai et al., 2009; Chiang, 2010; Geng and Mallik, 2007; Dumrongsiri et al., 2008; Dan et al., 2012; Xu et al., 2014). Xu et al. (2014) investigate a dual-channel supply chain when the supply chain agents are risk averse, and propose a contract called the two-way revenue sharing contract to coordinate the dual-channel supply chain. Xie et al. (2014) study production capacity planning and allocation decisions of a supplier when it sells its product via an independent service provider and a direct selling market. All the previous literature assumes that the direct channel is owned by the suppliers. Lu and Liu (2015) examine the effects of e-commerce channel entry on the profitability and behavior of suppliers and physical retailers within a distribution system, where the new e-commerce channel is independent of the supplier and the physical retailer.

The literature on chain-to-chain competition dates back to McGuire and Staelin (1983) which investigates the effect of product substitutability on distribution structures in the context of two competing suppliers, each selling his products through an exclusive retailer. The retailers may be either a franchised outlet or a factory store. With a deterministic linear demand function, they find that when the level of competitive substitutability is high, the suppliers will be more likely to use decentralized distribution systems to avoid ruinous price competition between the suppliers. Following McGuire and Staelin (1983), many papers have explored the circumstances in which the above result holds, such as Coughlan (1985) and Moorthy (1988). Anderson and Bao (2010) extend the work of McGuire and Staelin (1983) to a more general situation when there are multiple supply chains with substitutable products competing in the market. Wu et al. (2009) investigate the equilibrium behavior of two competing supply chains in the presence of demand uncertainty. They consider the joint pricing and quantity decisions and competition under three possible supply chain structures: vertical integration, supplier's Stackelberg, and bargaining on the wholesale price over a single or