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Entry mode selection and its impact on an incumbent supply chain coordination

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ABSTRACT

This paper considers a supply chain where a manufacturer sells its product through a retailer. In such a market, a potential entrant can make a substitute product by imitating the incumbent's product and then sells it to the common market with one of three alternative entry modes: (i) selling through the incumbent's retailer, (ii) selling through another independent retailer, or (iii) selling directly to consumers. Faced with the entrant's entry, the manufacturer has managed to offer a value-added service to add to its product's value at a cost. We investigate the entrant's optimal entry mode when the manufacturer offers profit-sharing contracts to the retailer and when it does not, and discuss the impact of the potential invader's entry on the incumbent firms' performances. The results show that: (1) the entrant sells directly to consumers when faced with weak value competition, and sells through another retailer against fierce value competition. (2) If the value competition is relatively fierce and the efficiency of the value-added service is relatively high as well, the incumbent firms can benefit from the new entry. (3) A profit-sharing contract, as a coordination policy, can fully coordinate the incumbent supply chain no matter whether there exists a potential entrant or not, yet the entry can affect the distribution of the profits between the incumbent manufacturer and retailer.

1. Introduction

1.1. Motivation and background

As we all know, in traditional supply chains, participants are independent firms. They often maximize their own profits individually, which leads to the inefficiency of supply chains, i.e., double marginalization. In order to remove the negative effects of double marginalization, many researchers proposed coordination mechanisms, such as quantity discounts (Li and Liu, 2006), credit option (Chaharsooghi and Heydari, 2010), buy-back/return (Pasternack, 1985; Taylor, 2002), revenue sharing (Cachon and Lariviere, 2005) and profit sharing (Jaber and Osman, 2006), etc. However, they ignored the effects of a potential entrant on incumbent members in supply chains. In practice, with the rapid development of advanced technology, the entry/exit of firms is very common in traditional supply chains. For example, the semiconductor industry consists of incumbent U.S. firms (e.g., Intel and Motorola) and entrant Japanese and Korean firms (Fujitsu, NEC, Samsung and Toshiba) (Cho et al., 1998). Thus, two questions arise naturally: (1) What is the optimal entry mode for a potential entrant when the incumbent manufacturer offers/does not offer the incumbent retailer a profit-sharing contract? (2) How does the entry of the entrant affect the incumbent firms' optimal decisions? To the best of our knowledge, the existing literature does not answer the questions mentioned above. This paper will shed light on these issues.

This paper considers an incumbent supply chain consisting of a high-tech manufacturer and a retailer. The high-tech manufacturer sells its product to the end market through the retailer. In such a market, there exists a potential low-tech entrant. By imitating the high-tech manufacturer's product, the low-tech entrant can make a partially substitute product, and then sell its product to the same market. In order to alleviate the entry threat, the high-tech manufacturer can use a value-added service to add its product's value at a cost. Suppose that the entrant may choose one of three alternative entry modes to enter the end market. In the first mode the entrant sells through the incumbent retailer, in the second it sells through another independent retailer, and in the third it sells directly. We investigate the optimal entry mode for the entrant both when the incumbent manufacturer offers and does not offer

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the incumbent retailer a profit-sharing contract. Our study suggests that the entrant prefers selling directly to consumers if the value competition is not relatively fierce, otherwise, the entrant prefers selling through another independent retailer. Furthermore, we discuss the influence of the entry on the incumbent firms' performances and the incumbent supply chain coordination. The results show that both the incumbent manufacturer and retailer can benefit from the entry of a potential entrant when the value-added service efficiency is relatively high and the value competition is relatively fierce. Our analytical result also shows that a profit-sharing contract can fully coordinate the incumbent supply chain no matter whether there exist entrants or not.

1.2. Literature review

In the past three decades, researchers paid much attention to supply chain management. Readers can refer to excellent surveys for the literature in the field of supply chain management (e.g., Leng and Parlar, 2005; Li and Wang, 2007; Tuomikangas and Kaipia, 2014). Among these existing researches, most discussed the two-echelon supply chain, where a manufacturer sells a product to the end consumers through a retailer. Moreover, in many researches, the manufacturer is usually assumed to be a dominator, i.e., the manufacturer implements the "manufacturer-Stackelberg" ([*mS*]) game (e.g., Wang, 2002; Zhou et al., 2008; Li et al., 2014). However, most of the researches ignored the effects of a potential new entry on supply chain management. This paper studies the selection of entry modes and pricing/value-added-service issues of a two-echelon supply chain with the potential entry in a [*mS*] game.

The literature on the entry issue can be classified into two categories. One is about single-echelon models and the other is about two-echelon ones. The single-echelon models usually considered such a situation where a single monopolized incumbent occupies a market and then a new entrant is planning to enter the market. In these models, many deterrence strategies were presented from the incumbent's perspective, such as pricing (Hauser and Wernerfelt, 1988; Haynes and Thompson, 2013), advertising (Ishigaki, 2000; Konigbauer, 2007; Sun, 2014), investing on R&D of new technologies (Lukach et al., 2007; Erkala and Piccininb, 2010), and using location as a signal of cost (Boyer et al., 2003; Datta and Sudhir, 2012). The other single-echelon studies on the entry issue are quite different from each other. For example, Seade (1980) studied the effects of entry on the profits of incumbent firms and on the output of supply chain. Aoyagi (1996) established a long-run multi-period model in which an incumbent firm may change ownership in each period. He discussed the role of the changing ownership of a long-run firm facing a sequence of potential entrants. Arping and Diaw (2008) studied the effect of sunk cost on an incumbent firm when facing the possibility of liquidating assets and exiting the market. Additionally, a few papers considered multiple incumbents. For instance, Bagwell and Ramey (1991) considered pricing strategy for multiple incumbents facing an entry. Ashiya (2000) studied the decision problem of an incumbent firm that faces two entrants: a weak one and a strong one.

There are only a few two-echelon models that considered a new entry. Schultz (1999) studied entry into a market with two incumbents, where one prefers but the other dislikes entry. Xiao and Qi (2010) developed an adverse selection model for a two-echelon supply chain with one supplier, one retailer, and a potential outside entrant. They investigated how the incumbent supplier can strategically maximize its profit by a wholesale pricing policy when facing a potential entrant in an uncertain demand environment. Zhou et al. (2015) considered the problem of pricing and alliance selection for a dominant retailer with a potential upstream entry. They showed that the dominant retailer should ally with the one who has a relatively strong competitive ability but compete against the other who has a relatively weak competitive ability if the price competition between two upstream players is relatively fierce; otherwise, he/she should ally with both upstream members. Liu and Zhang (2006) developed a two-echelon model with entry, where a retailer can implement personalized pricing and a manufacturer can leverage both personalized pricing and entry into a direct channel. They explored whether the retailer can benefit from personalized pricing, and how the manufacturer's personalized pricing or entry into a direct channel affects the allocation of channel profits. Tyagi (1996, 1999) considered a two-echelon supply chain where n incumbent retailers buy a product from an incumbent supplier and then sell the product to consumers. He discussed the effects of downstream entry on upstream pricing, and showed that the supplier's pricing policy is invariant to a new downstream entry under an iso-elastic inverse demand function. However, Koulamas and Kyparisis (2010) showed that this result is reversed when a new downstream entry affects downstream efficiency. Corbett and Karmarkar (2001) extended Tyagi's model by considering multiple suppliers. Mukherjee et al. (2004) considered a model with a single firm in the upstream market and a duopoly in the downstream market with one incumbent firm and one entrant. They showed that entry in the end market reduces input price and increases the incumbent's profit if the entrant's technology is sufficiently inferior to that of the incumbent under both quantity and price competition. Kong et al. (2013) developed a two-echelon supply chain model, where an incumbent supplier leaks the incumbent retailer's order information to a potential entrant. Rezapour et al. (2014) developed a two-echelon model for designing an entrant supply chain in the presence of a pre-existing competing supply chain where demand is elastic with respect to price and distance. Their model was further extended by Rezapour and Farahani (2014) for designing the network structure of a competitive supply chain with anticipating variable prices and service levels competition in markets under stochastic price and service level dependent elastic demands. Different from the existing two-echelon models that considered a new entry, this paper mainly discusses how the entrant should choose the entry mode when he/she competes against the incumbent manufacturer in product value. Moreover, we study how an entry affects the coordination of the incumbent supply chain. Additionally, our paper is also different from the literature related to channel selection, most of which studied whether the supplier benefits from adding a new direct channel to the traditional single-channel supply chain (e.g., Cai, 2010; Li et al., 2014).

The remainder of this paper is organized as follows. The model description and benchmark model are presented in Section 2. Section 3 discusses the optimal strategies for the three members under different entry modes and the entrant's optimal entry mode selection, given that there is not a profit-sharing contract between the two incumbents. The corresponding issues with the profit-sharing contract are discussed in Section 4. Discussion and implications are presented in Section 5. Conclusions are included in Section 6.

2. Model description and benchmark

Consider a two-echelon supply chain where an incumbent high-tech manufacturer (hereafter "*Manu*") sells a product (hereafter "product m") through an incumbent retailer (hereafter "*Reta*"). In such a market, there exists a potential low-tech entrant (hereafter "*Entr*"). Imitating product m, *Entr* can produce a product (hereafter "product e"), which is a substitute for product m. In reality, after many high-tech manufacturers, such as Apple, IBM and Samsung, design and sell their products, some low-tech