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Effects of e-commerce channel entry in a two-echelon supply chain: A comparative analysis of single- and dual-channel distribution systems

Qihui Lu [a], Nan Liu [b,*]

[a] School of Business Administration, Zhejiang Gongshang University, Hangzhou 310018, China
[b] School of Management, Zhejiang University, Hangzhou 310058, China

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ABSTRACT

In this paper, we examine the effects of electronic commerce (e-commerce) channel entry on the profitability and behavior of manufacturers and physical retailers within a distribution system. We compare two distribution structures, namely, single and dual channel. In our dual-channel model, the new e-commerce channel is independent of the manufacturer and the physical retailer. Our findings indicate that for these kinds of channel structures, the dual-distribution channel may be unprofitable to the manufacturer, and that the physical retailer may benefit from e-commerce channel entry. We show that if e-channel efficiency is adequately low or the acceptance of the conventional channel is low, the e-commerce channel may dominate the distribution system; otherwise, the conventional channel may dominate. If the channel acceptance of a conventional channel is below a certain threshold, the manufacturer may benefit from e-channel entry; otherwise, the manufacturer is placed at a disadvantage. If the e-channel is sufficiently competitive, then using the e-channel becomes a useful strategy for the manufacturer. Finally, we show that the manufacturer may be worse off selling in a dual-channel distribution structure if e-channel efficiency is low. This observation is important because in adopting a less efficient new channel is disadvantageous to the manufacturer.

1. Introduction

The use of electronic commerce (e-commerce) by businesses in developed and developing countries has grown considerably in the last two decades. The high efficiency, low trade costs, and simplified transaction process involved in e-commerce have changed manufacturers' operations, business, management models, and trade models. Manufacturers in various industries that traditionally distribute their products through physical retailers currently use electronic retailers (e-tailers) or independent e-commerce platforms to sell their products. This type of multi-channel distribution system is becoming increasingly popular. Nevertheless, the e-commerce channel (e-channel) may place such manufacturers in competition with their existing physical retailers (Tsay and Agrawal, 2004).

This paper is motivated by our investigation of a number of e-commerce Web sites in China and the United States. The number of small e-tailers has recently grown rapidly. For instance, more than 20,000 e-commerce Web sites were established in China by the end of 2013. Taobao.com, the largest e-commerce Web site in China, had approximately six million online stores at the end of 2013. The competition among e-tailers on Taobao.com is extremely stiff, which has relatively lowered the profit margin in this e-commerce channel. However, different products undergo different states of competition in the e-commerce channel, which may require different pricing strategies for manufacturers, physical retailers, and e-tailers. Despite these trends, numerous customers still prefer traditional channels. Thus, a manufacturer introducing an e-commerce channel that competes with its conventional channel depends on the channel preference of customers and on the performance of the e-channel. This paper aims to provide rigorous insight into the following issues: how e-commerce channel entry affects the manufacturer and the physical retailer's payoff, and who benefits from e-commerce channel entry.

Previous research on multi-channel systems has focused on the effects of e-commerce channel introduction on various channel structures. The equilibrium solutions in various channel structures indicate that e-channel entry does not always reduce retail prices or improve consumer welfare. Channel structure is a critical contributor to these results. Chiang et al. (2003) argued that the manufacturer can benefit from introducing a direct channel if such a channel is a viable threat that draws consumers away from physical retailers. However, the direct channel may not always be detrimental to the retailer because it is accompanied by a wholesale price reduction. Thus, direct

* Corresponding author. Tel./fax: +86 571 8820 6827.
E-mail address: nliu@zju.edu.cn (N. Liu).

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marketing is used for strategic channel control purposes by the manufacturer. The e-channel considered in our paper is a distribution channel and therefore different from a direct electronic channel from which the manufacturer sells products directly to customers and over which it exercises full control. In our model, e-tailers are not strategic on the retail price and the product is sold with a fixed margin. This average profit margin reflects the industry status of the e-commerce platform. Therefore, our paper is quite different in structure from those dealing with dual-channel (one retailer and one direct channel) issues, such as the paper by Chiang et al. (2003).

Studies have indicated that the effects of e-channel introduction substantially vary across channel structures and market environments (Yoo and Lee, 2011). A number of studies analyzed the case of an independent physical store retailer facing new competition from the direct e-channel of a manufacturer (Balasubramanian, 1998; Liu and Zhang, 2006). Cattani et al. (2006) argued that the direct e-channel of a manufacturer can be viewed as a mechanism for segmenting the market in a manner that benefits both the manufacturer and the retailer. Cai (2010) indicated that parameters such as base demand, operational costs, and substitutability have implications on the preference of the supplier and retailer while adding a new channel to the traditional single-channel supply chain. After analyzing three channel options (direct channel, manufacturer-owned channel, and independent channel) and two consumer segments (a retail-captive segment and a hybrid segment), Khoujia et al. (2010) demonstrated that the most critical factor in channel selection in a vertically integrated supply chain is the variable cost per unit of products sold using the direct versus the retail channels.

A firm that intends to establish a dual-channel supply chain has to address the important issue of vertical and horizontal competition in the dual channel. A series of articles has been written on dual-channel supply chain coordination. For instance, Boyaci (2005) pointed out that some common contracts, such as buy-back, rebate, and revenue sharing, cannot coordinate a dual-channel supply chain mainly because of the vertical and the horizontal competition in both channels. However, a penalty contract or compensation-commission contract can coordinate the supply chain. Cai et al. (2009) analyzed the impact of a price discount contract and pricing scheme on the dual-channel supply chain and reported that the simple price discount contract can improve the performance of both the supplier and the retailer. Xu et al. (2014) investigated the impact of setting up a dual-channel supply chain coordinating contract when the supply chain agents are risk averse in a mean-variance model and proposed the two-way revenue-sharing contract, which can coordinate the dual-channel supply chain and ensure that both supply chain members achieve a win–win situation.

A considerable number of studies have examined other issues regarding multi-channel supply chains in e-commerce or direct sales. Swaminathan and Tayur (2003) provided an overview of relevant analytical models concerning the supply chain management of e-businesses, focusing on supply chain issues, such as visibility, supplier relationships, distribution and pricing, customization, and real-time decision technologies that have risen to importance with the prevalence of e-business. Internet-based supply chains have made the management of multiple distribution channels a key area of supply chain research. A systematic overview of managerial planning tasks and corresponding quantitative models in a multi-channel environment was provided by Agatza et al. (2008), who highlighted that sales and operational decisions are becoming more tightly intertwined as delivery and after-sales services become key components of product offering. Thus, a constant trade-off between process integration and separation across multiple channels is the key point in the design of a multi-channel distribution system. Numerous studies have indicated that prices, profits, demand, and consumer welfare are influenced by channel structures, cost of participants, and consumer preferences. For instance, Jeffers and Nault (2011) demonstrated that prices, profit, and consumer welfare in a multi-channel retail system critically depend on the specifications of the goods, disutility, and shipping costs versus transportation costs and competition among retailers.

Lu and Liu (2013) recently examined pricing games in a distribution system in which a supplier sells a common product through a conventional channel (physical retailer) and an e-commerce channel (e-tailers), focusing on the dual-channel system model. In contrast, in this paper, we consider the effects of e-commerce channel entry on the performance of members by comparing single- and dual-channel systems. Compared with previous studies that considered each channel member as capable of setting a profit-maximizing price, the main contribution of our study is that by performing a comparative analysis of single- and dual-channel systems in a two-echelon supply chain, our study could potentially help a manufacturer decide whether or not to open an e-channel. Conducting scenario analysis in relation to channel acceptance by customers and e-channel efficiency allows us to develop a regime in which both members (the manufacturer and the retailer) can benefit from the e-channel entry. We consider a case in which only the manufacturer and the physical retailer set their prices, and the retail price in the e-commerce channel is determined by a predetermined margin.

The remainder of this paper is organized as follows. We introduce our analytical model in Section 2. We analyze the single

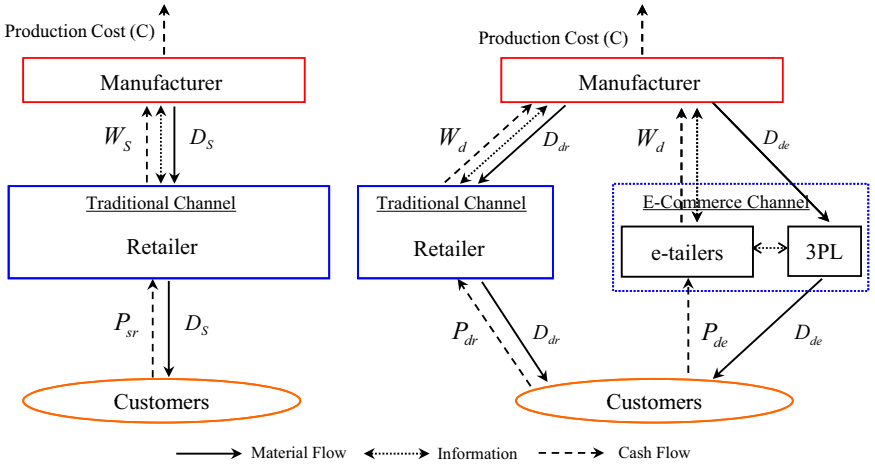

Fig. 1. Single-channel and dual-channel distribution systems.