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## “Bricks vs. Clicks”: The impact of manufacturer encroachment with a dealer leasing and selling of durable goods

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## ABSTRACT

In durable goods markets, many brand name manufacturers, including IBM, HP, Epson, and Lenovo, have adopted dual-channel supply chains to market their products. There is scant literature, however, addressing the product durability and its impact on players' optimal strategies in a dual-channel supply chain. To fill this void, we consider a two-period dual-channel model in which a manufacturer sells a durable product directly through both a manufacturer-owned e-channel and an independent dealer who adopts a mix of selling and leasing to consumers. Our results show that the manufacturer begins encroaching into the market in Period 1, but the dealer starts withdrawing from the retail channel in Period 2. Moreover, as the direct selling cost decreases, the equilibrium quantities and wholesale prices become quite angular and often nonmonotonic. Among other results, we find that both the dealer and the supply chain may benefit from the manufacturer's encroachment. Our results also indicate that both the market structure and the nature of competition have an important impact on the player's (dealer's) optimal choice of leasing and selling.

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### 1. Introduction

In recent years, following the development of the Internet and information technology and the growth of third party logistics providers (Tsay and Agrawal, 2004), a growing number of manufacturers have found it attractive to supplement their preexisting retail channels with an e-channel. This tendency is particularly noticeable in the market for durable goods. For example, many brand name manufacturers, including IBM (Narisetti, 1998), HP (Janah, 1999), Epson, and Lenovo, have adopted dual channels to market their products. Yet, despite these emerging trends, little literature on the dual-channel supply chain pays attention to the issue of product durability and its impact on the interactions between manufacturer and dealer. We therefore develop a two-period dual-channel model to analyze the problem of marketing durable goods and address certain strategic issues associated with leasing and selling. To our knowledge, this paper is the first to consider the problem of durable goods marketing in a dual-channel supply chain.

Our channel model captures three characteristics salient in many of today's durable goods markets.<sup>1</sup> First, because the manufacturer sells the products to customers through both a manufacturer-owned e-channel and an independent retail channel, customers can purchase the product through either channel. Second, in channels of distribution for durable products, intermediaries (dealers) have an additional degree of freedom beyond what they have in channels for nondurables; that is, manufacturers typically sell their products to dealers who then either sell or lease them to consumers (Bhaskaran and Gilbert, 2009). Third, on a manufacturer-owned e-channel, a leasing strategy may be ruled out for practical reasons. For instance, renters may abuse product leases via an e-channel because no effective supervisory mechanism is in place.

Although there is a considerable body of research on dual-channel supply chains (see, e.g., Tsay and Agrawal, 2004; Arya

<sup>1</sup> The main motivation for our research comes from practices in the market for such office equipments as printers and copiers as well as our discussions with a major printer manufacturer, HP. Customers wishing to purchase an HP printer (e.g., the Designjet T1200 PostScript Version Printer) can either buy it through an e-channel ([www.shopping.hp.com](http://www.shopping.hp.com)) or buy or lease it from a local dealer. We also see this type of practice by Epson (<http://www.epson.com>), Lenovo (<http://www.lenovo.com.cn>), and BenQ (<http://shop.benq.us>).

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et al., 2007; Chen et al., 2008), the literature in this area traditionally assumes that the dealer can be exogenously defined as a selling agency. We allow the dealer to choose whether to lease or sell durable goods to consumers. Moreover, most of these studies concentrate on nondurable goods. We, in contrast, develop a two-period dual-channel model focused on the problem of marketing durable goods. Our overall contribution is therefore twofold. First, our model incorporates both product durability and the direct selling cost in a dual-channel supply chain and analyzes how such factors are important in shaping both parties' policies and determining their profit. Second, although the question of whether a firm should lease or sell its products has been well studied in the literature on durable goods, little is known about which strategy dominates when the downstream agent (dealer) faces encroachment from the upstream agent (manufacturer), we examine how manufacturer encroachment impacts the dealer's decisions on selling vs. leasing.

We begin by studying the optimal strategy for a single-channel model in which no e-channel is open and all products are sold or leased only through an independent dealer. Our key finding is that the presence of the dealer introduces vertical competition that leads to the classic double marginalization problem. In addition, the optimal strategy for a dealer in a single-channel model is not to sell but to lease all his products. That is, since leasing allows the monopolist (dealer) to avoid the time inconsistency problem, the dealer is better off leasing products in Period 1. However, compared to a selling strategy, dealer leasing worsens the adverse effects of double marginalization, which lowers both the manufacturer's profit and the total supply chain profit.

We next examine how both parties' strategies change as the manufacturer encroaches into the market; specifically, we develop a dual-channel model in which the manufacturer sells products through both a manufacturer-owned e-channel and through an independent dealer who adopts a mixed selling and leasing strategy. We find that the manufacturer begins encroaching into the market in Period 1, but the dealer starts withdrawing from the retail channel in Period 2. In addition, as the direct selling cost decreases, the equilibrium quantities and wholesale prices become quite angular and often nonmonotonic.

We conclude by comparing the equilibrium outcomes of both parties under both the single-channel and dual-channel models. We find that both the dealer and the supply chain may benefit from manufacturer encroachment, a result that is partially consistent with that reported by Arya et al. (2007). However, whereas their finding applies "when the retailer's downstream cost advantage is sufficiently pronounced or when it is sufficiently limited" (p. 655), we find that even when the dealer's downstream cost advantage is moderate, the encroachment can also increase the supply chain profit. Our findings also suggest that both the market structure and the nature of the competition have an important impact on the dealer's optimal choice of leasing and selling.

The remainder of this paper is organized as follows. Section 2 reviews the related literature and explains our contributions in more detail. Section 3 describes the key elements of our basic model and introduces notations. Section 4 outlines two models—the single-channel and the dual-channel model—and reports our main findings. Section 5 concludes the paper.

## 2. Related research

Because the manufacturer is both a supplier and a competitor of the dealer, a dual-channel supply chain contains two main types of channel competition: vertical competition and horizontal competition (see Fig. 1).

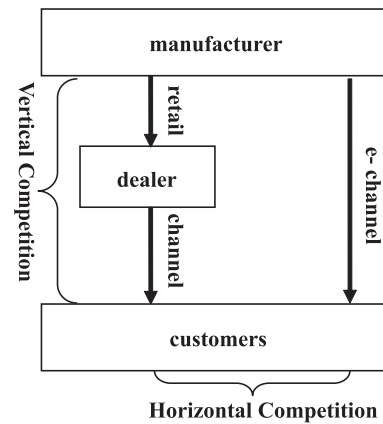


Fig. 1. Two types of competition in a dual-channel supply chain.

Vertical competition induces double marginalization (Spengler, 1950): all channel members independently seek to maximize their own profit, resulting in higher retail prices and lower sales quantities and profits than in a vertically integrated channel. Many remedies for such double marginalization have been proposed in the traditional supply chain literature. For example, Caldieraro and Coughlan (2007), in a study of spiffs and channel coordination, claim that in a monopolistic environment, spiffs improve manufacturer profits, while Jeuland and Shugan (2008) report that coordination can result in all channel members receiving larger profits. Other studies investigate channel conflict and coordination (Boyaci, 2005; Cachon and Lariviere, 2005; Li and Wang, 2007; Cai, 2010; Yan, 2011). In contrast to these studies, however, in our model, the dealer determines not only the number of units to buy but also whether to lease or sell them to consumers.

A considerable body of research also exists on horizontal competition in the dual-channel supply chain. For example, an earlier study by Balasubramanian (1998) adopts a strategic viewpoint to examine competition in a multiple-channel environment and analyzes the use of market coverage as a lever to control it. Later, Yao and Liu (2005) address price competition between the two channels using Bertrand and Stackelberg game models. Webb and Lambe (2007) then investigate the conflict internal to the supplier firm among the groups and individuals responsible for managing the various channels. Subsequently, Chen et al. (2008) incorporate a consumer channel choice model and study service competition in a dual-channel supply chain. Meanwhile, Agatz et al. (2008) provide a systematic overview of managerial planning tasks and corresponding quantitative models and address the specific supply chain management issues of Internet fulfillment in a multi-channel environment. Recently, Hua et al. (2010) employs a two-stage optimization technique and a Stackelberg game to examine the optimal decisions on delivery lead time and prices in both a centralized and a decentralized dual-channel supply chain. All these papers conclude that when a manufacturer adopts a direct selling strategy, manufacturer encroachment will reduce the dealer's profit and result in "channel conflict".

Fortunately, there are a few notable exceptions to this latter consensus. For example, Chiang et al. (2003) demonstrate that Pareto gains may arise when a manufacturer threatens to establish a direct distribution channel. Likewise, Tsay and Agrawal (2004) show that the addition of a direct channel alongside a reseller channel is not necessarily detrimental to the reseller. Arya et al. (2007) further demonstrate that the retailer can benefit from encroachment even when it admits no synergies and facilitates neither product differentiation nor price discrimination. In a more recent study, Chun et al. (2011) show that, under certain

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