



# A strategic analysis of dual-channel supply chain design with price and delivery lead time considerations

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## ABSTRACT

This paper extends the work of Chiang et al. (2003) by investigating how price and delivery lead time decisions affect channel configuration strategy under either the manufacturer-owned or the decentralized mode. We show the choice of channel structure depends on customer acceptance of the online channel and the cost parameters, following a threshold policy in both forms of ownership. We prove that the strategic use of direct marketing to mitigate the double marginalization – the major finding in Chiang et al. (2003) – still holds even in this general situation; moreover, Pareto zone exists where both manufacturer and retailer outperform their counterparts in the traditional indirect channel-only case, thus indicating that mitigating double marginalization may bring mutual benefits. We also compare pricing and delivery lead time decisions between different forms of ownership or between different channel structures under the same form of ownership. The manufacturer adopts a “slow down deliver later” approach and speeds up delivery to serve customers with a higher sensitivity to delivery lead time when he owns the whole indirect channel, but chooses to “stay fast and brag about better services” and surprisingly slows down the speed of service when customers are more sensitive to delivery lead time due to the internal competition between two channels in the decentralized mode.

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## 1. Introduction

Rapid development of the Internet and related information technology has changed everyday life for consumers including their purchasing behavior, thus spurring manufacturers in various industries to consider selling products directly to consumers in addition to employing their traditional retail channels (NPD Group, 2004). For example, 68% of consumer goods manufacturers are planning to sell online (Forrester, 2000), and online retail sales comprised about 5.5% of all retail sales excluding travel in 2004 (Mangalindan, 2005). Against this trend, Levi Strauss & Co. has stopped selling its clothing online (Collet, 1999) and companies such as Xerox use the Web to demonstrate their product lines (Chiang et al., 2003) and avoid channel conflict. Whether the addition of a new direct channel leads to channel conflict has been the subject of strong debate. Some manufacturers such as Herman Miller Inc. (Keenan, 1999) try to convince retailers that the direct channel only attracts extra customer segments that

would not otherwise buy, while some trade groups such as the National Shoe Association and the National Sporting Goods Association suggest their members reduce or eliminate purchases from manufacturers that establish direct sales outlets (Tsay and Agrawal, 2004a).

Channel configuration strategy on whether to adopt the direct channel only, the traditional channel using intermediaries or a hybrid model comprising both channels is certainly affected by various factors. We address several important issues arising from such strategy choices such as: (1) customers' channel preference; (2) online service quality (participating in setting delivery standards for the e-retailer); (3) potential internal price competition between the two channels; and (4) ownership of the indirect channel.

Customer acceptance of the direct channel is different from customer acceptance of conventional retail stores due to the quality of website interactions with the e-retailer, delivery of the product, uncertainty about obtaining the correct item, etc. Empirical studies such as those of Liang and Huang (1998) and Kacen et al. (2002) provide evidence that acceptance of the direct channel is less than one for many product categories. In early studies, researchers assume that online service quality (especially delivery standards for the e-retailer) is exogenously set, and is included in customer acceptance of the direct channel. For example, Chiang et al. (2003) investigate how the price decision affects the channel configuration strategy alone.

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Due to time-based competition in business, e-retailers intend to offer competitive uniformed promised delivery lead (PDL) time along with the price (Liu et al., 2007) and customers affirm that the commitment to order fulfillment is a key element of website trust, which rules the Web in addition to price (Urban et al., 2000; Reichheld and Schefer, 2000). Maltz et al. (2004) report that e-retailers, such as Amazon.com, BestBuy.com, and Walmart.com, offer competitive PDLs. Shang and Liu (2011) emphasize the importance of determining the right PDL by an industry example that LeatherTECH gains the competitive advantage through reducing PDL to two weeks and receives a positive market response. Motivated by the important impact of price and delivery lead time on companies' profitability, researchers are active in investigating how to coordinate these two decisions recently (e.g. Liu et al., 2007; Zhao et al., 2012). Though Gupta et al. (2004) show that delivery lead time affects consumers' channel choices via empirical study, there is no research on how price and delivery lead time decisions jointly affect a company's channel configuration strategy. In this paper, we answer the research question analytically by decoupling the effect of delivery lead time from customer acceptance of the direct channel.

Regarding price competition, Ernst & Young (2001) show that two-thirds of companies price products identically for their online and offline operations, while participants in the music and software industries intend to charge lower prices in their online channels (Cattani et al., 2006). In this paper, we characterize what constitutes the optimal price decision, especially when taken together with the delivery lead time decision. In terms of ownership, the manufacturer may own the whole indirect channel or the channel may be decentralized with independent retailers. Khouja et al. (2010) cite examples in which Devoe® and Duron® have adopted an exclusive manufacturer-owned retail channel, Dell uses an exclusive direct internet channel, Bose Corporation, among others, utilizes a manufacturer-owned hybrid channel, and Sony BMG Music has chosen to employ the decentralized hybrid mode. Incentives to open the direct channel under different forms of ownership are not the same as the manufacturer wanting to attract a larger customer base, segment customers and take advantage of lower direct channel costs, etc., in the integrated channel and seeking to mitigate double marginalization through competition between the direct and indirect channels in the decentralized mode.

We take all these issues into consideration and characterize channel configuration strategy when the price and delivery lead time of the online channel are endogenously determined. We show that a manufacturer who owns the indirect channel may adopt any channel structure (indirect channel only, direct channel only or dual channel), while a manufacturer who adopts the decentralized mode may adopt either the indirect channel only or the dual channel. The determination of channel structure depends on customer acceptance of the online channel and the cost parameters, following a threshold policy in both forms of ownership. We observe that the direct channel is used as an instrument to threaten the independent retailer and mitigate double marginalization with no sales actually being made in the decentralized mode. We also compare the pricing and delivery lead time decisions between different forms of ownership or different channel structures under the same form of ownership and gain related management insights. One important observation is that the choice between two types of delivery lead time standards – “slow down deliver later” and “stay fast and brag about better services” suggested by Maltz et al. (2004) – relies on ownership of the indirect channel. Specifically, the former is adopted in the centralized mode and the latter is employed in the decentralized mode. Moreover, when customers become more sensitive to delivery lead time, the manufacturer speeds up its service when

it owns the whole indirect channel, but surprisingly delays delivery after gaming with the independent retailer in the decentralized mode.

The remainder of our paper is organized as follows. Section 2 discusses the related literature. Section 3 introduces our modeling assumptions and demonstrates the base model where the manufacturer can choose only one channel. We present channel configuration strategy under different forms of ownership in Section 4 and discuss the management insights that arise. Section 5 summarizes our key results and presents our conclusions. All relevant proofs are relegated to the Appendix for clarity of exposition.

## 2. Literature review

There are two streams of research closely related to our channel configuration model. One selects the best channel structure together with marketing or operational decisions, the other investigates similar decisions in a given hybrid mode combining both indirect and direct channels. Table 1 highlights different decisions variables in related papers.

For the first stream of literature, a comprehensive review of related literature can be found in the studies of Cattani et al. (2004) and Tsay and Agrawal (2004b). Among these studies, Chiang et al. (2003) determine the optimal channel configuration strategy when the price decision is endogenously determined in either the centralized or decentralized mode. Hendershott and Zhang (2006) assume that customers search for private prices of intermediaries with different transaction costs, and Khouja et al. (2010) assume that customers are either retail-captive or willing to use either the direct or retail channel. Cai (2010) considers the channel selection decision with or without coordination. All these papers consider only the pricing decision but do not take the delivery lead time decision into consideration. Other researchers investigate how different decisions affect channel preferences.

**Table 1**  
Related literature.

Research papers	Channel configuration		Decision variables		
	Channel selection	Given hybrid mode	Price	Time	Others
Chiang et al. (2003)	✓		✓		
Hendershott and Zhang (2006)	✓		✓		
Khouja et al. (2010)	✓		✓		
Cai (2010)	✓		✓		
Rhee and Park (2000)	✓		✓		✓
Tsay and Agrawal (2004a)	✓		✓		✓
Dumrongsiri et al. (2008)	✓		✓		✓
Kumar and Ruan (2006)	✓		✓		✓
Yao and Liu (2005)		✓	✓		
Fruchter and Tapiero (2005)		✓	✓		
Cattani et al. (2006)		✓	✓		
Huang and Swaminathan (2009)		✓	✓		
Chiang and Monahan (2005)		✓			✓
Chiang (2010)		✓			✓
Mukhopadhyay et al. (2008)		✓	✓		✓
Chen et al. (2008)		✓		✓	✓
Hua et al. (2010)		✓	✓	✓	
Our paper	✓		✓	✓	

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