

O.R. Applications

# Introduction of a second channel: Implications for pricing and profits

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## Abstract

In this paper we study the optimal pricing strategies when a product is sold on two channels such as the Internet and a traditional channel. We assume a stylized deterministic demand model where the demand on a channel depends on prices, degree of substitution across channels and the overall market potential. We first study four prevalent pricing strategies which differ in the degree of autonomy for the Internet channel. For a monopoly, we provide theoretical bounds for these pricing strategies. We also analyze the duopoly case where an incumbent mixed retailer faces competition with a pure retailer and characterize price equilibria. Finally, through a computational study, we explore the behavior (price and profits) under different parameters and consumer preferences for the alternative channels.

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## 1. Introduction

The Internet has provided a new avenue to sell products to consumers. While it provides an opportunity to attract more customers and improve sales by attracting customers who would have otherwise not bought the product, it could also threaten existing channel relationships through possible cannibalization. In this paper, we study the pricing strategies for a retailer which sells a product through two channels. For example, a retailer such as Best Buy that was primarily selling products through the traditional channel, decides to sell products through the Internet channel as well. In such a setting, it is important for the firm to provide the right control and pricing across the two channels. The introduction of an Internet channel poses two important questions – the degree of independence of the Internet channel and the pricing of goods across the two channels. Retailers that have faced this issue in the last few years have taken different courses of action. For example, Best Buy, an electronics retailer, was quite slow to adopt the Internet channel. However, on adoption Best Buy decided to treat the customers of the online and physical stores in an identical manner [33]. On the other hand, Barnes and Noble, a book retailer, decided to create an independent unit for Internet operations that essentially competed with the traditional retail store.

Our motivation for this research came from multiple different sources. (1) A survey by Ernst and Young reported that nearly two-thirds of companies price products identically for their online and offline operations [15]. This enabled the firm to capture a share of the Internet friendly customers. The survey also indicated that the majority of customers expect to find lower prices online. This is further validated by the empirical findings of researchers. Brynjolfsson and Smith [7] indicate that prices of books and CD's were 9–16% lower on the Internet than in traditional stores. Further, the prices charged by pure e-tailers and e-tailers with traditional channels may be different. Tang and Xing [31] find that the price charged by

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Table 1  
Price chart (as of date: October 6 2005)

Category	Product	Amazon.com (\$)	BarnesNoble.com (\$)	BN local store (\$)
BOOK	The World is Flat	16	16.5	19.25
	Devinci Code	14.5	14.97	17.47
	Introduction to Probability Model	89.95	89.95	89.95
	A Course in Game Theory	35	35	35
	A Million Little Pieces	8.97	10.46	11.96
DVD	Why Harry Met Sally	11.21	11.45	14.99
	The Matrix	14.97	17.98	19.99
	The Sound of Music	18.89	21.58	26.99
HOME		Amazon.com	BELK	
	Full Ultimate Memory Foam Mattress Topper	129.95	130	
	King Ultimate Memory Foam Mattress Topper	189.95	170	
	Corning French White 12-pc Bake and Serve Set	39.99	49.99	
	Hamilton Beach Iced Tea Maker	24.99	19.99	
	Shaper Image Air Purifier Ionic Breeze 3.0	249.99	249.99	
Euro-pro Sewing Machine Shark	99.99	99.99		

pure e-tailers for DVD titles is 14% lower than those charged by e-tailers with traditional channels. Ancarani and Shankar [1] develop hypotheses on how prices and price dispersion compare among pure-play Internet, bricks-and-mortar, and bricks-and-clicks retailers and test them through an empirical analysis. Their results, based on an analysis of 13,270 price quotes, show that when posted prices are considered, traditional retailers have the highest prices, followed by multichannel retailers, and pure-play e-tailers. (2) In a recent research, Cattani et al. [9] study four prevalent pricing strategies for a monopolist under varying degree of autonomy for the Internet channel and find through a detailed computational study that an identical pricing strategy may indeed be very close to the optimal. (3) We did our own survey of the pricing of a small subset of popular products. As shown in Table 1, the actual pricing strategy for these items shows a wide dispersion. For example, some products are priced identical by competitors (like Introduction to Probability Model and A Course in Game Theory) whereas for some others the price on the Internet channel offered by a firm that has both a traditional and Internet channel are higher than those offered by a pure Internet player (like World is Flat or Devinci Code). For products sold by two pure competing players, we find that prices could either be higher or lower (like Corning Set and Hamilton Beach Tea Maker). The above pieces of evidence motivated us to explore the possibility of theoretical bounds and optimal pricing in monopoly and duopoly environments with retailers having pure and mixed channels.

As opposed to the micro-level demand model considered in Cattani et al. [9], in this paper we use a stylized linear demand function that depends on price of the product in the channels as well as on the degree of substitutability across the two channels. First, we analyze a monopolistic retailer who opens a new Internet channel and consider four pricing strategies with different degrees of autonomy for the Internet channel. We theoretically show that under mild conditions using the web price to optimize the joint profit (while holding the traditional price) is at most 4% from the optimal. If the costs across the two channels are identical then this bound is at most 3% away from optimal and, the profit under the identical pricing is at most 4% away from optimal. Next, we consider the case where the Internet channel is introduced by a different firm, and show the existence of a unique Nash equilibrium for the cases where the incumbent has a pure traditional channel or a combination of Internet and traditional channel. We develop conditions under which internet price of the firm with both channels is greater or less than the price of the pure e-tailer. Through a limited computational study, we explore the behavior (price and profits) of the above models under different parameters and consumer preference for the alternative channels. Finally, we validate our results for a variant of the demand model that has also been well studied in literature. In the process we provide managerial insights on the following questions (1) how sub-optimal are some of the prevalent pricing policies? (2) What happens to optimal prices and profits when a new channel is introduced under monopoly and competition? (3) When do mixed channel firms price goods above the pure firm?

The rest of paper is organized as follows. In Section 2, we discuss relevant literature. In Section 3, we study the monopolistic setting under four different pricing strategies. In Section 4, we study duopoly with a new entrant. We study a variant of the demand model in Section 5 and conclude in Section 6.

## 2. Related literature and our contribution

In the last few years, researchers have begun to study issues related to electronic supply chains (see Swaminathan and Tayur [30]). Cattani et al. [8] provide a comprehensive review of models which deal with coordination of traditional and Internet channels under monopoly. Tsay and Agarwal [32] provide a complete review of the same issues under competition in the multi-channels.

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