



Decision Support

Impact of an “online-to-store” channel on demand allocation, pricing and profitability

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ABSTRACT

The growth of e-commerce in the past decade has opened the door to a new and exciting opportunity for retailers to better target different segments of the customer population. In this paper, we develop an analytical framework to study the impact of an “online-to-store” channel on the demand allocations and profitability of a retailer who sells products to customers through multiple distribution channels. This new channel can help the retailer tap new customer segments and generate additional demand, but may also hurt the retailer by cannibalizing existing channels and increasing operating costs. The analytical model allows us to evaluate these fundamental tradeoffs and provide useful managerial insights regarding the specific product and market characteristics that are most conducive for increasing profitability. Our analysis provides some simple conditions under which adding an online-to-store channel would lead to higher profits for products that are only available online. If the product is also available in-store, the analysis becomes more complex. In this case, we performed numerical experiments to generate insights on when the OS channel should be used. Our results imply that the retailer needs to carefully select the set of products to be offered through the online-to-store channel.

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1. Introduction

Many retailers with both brick-and-mortar stores and an online presence are now allowing their customers to pick up online orders at brick-and-mortar stores. This allows retailers to leverage their existing physical assets to increase value and convenience for customers while at the same time increase fulfillment flexibility since retailers now offer an additional option in delivering online orders to customers. The online-to-store channel allows retailers to offer a larger variety of products compared to what customers can regularly access through the store channel, due to obvious space constraints. To make the online-to-store channel even more appealing, many retailers also offer dedicated parking spaces and express checkout lanes for online-to-store customers. This practice has gained considerable momentum, as evidenced by the fact that more and more retailers are now adopting this channel.

At the same time, the online-to-store channel will help remedy what a recent Wall Street Journal article (Bustillo & Fowler, 2009) considers as the Achilles heel of online channels: the costs and delays of shipping products to online customers. For products with a low

retail price, it is not uncommon for shipping expenses to be higher than the purchase price. To take full advantage of the OS channel's new found popularity, online retailer Amazon.com has plans to open its first brick-and-mortar store in New York City to allow customers to pick up online orders (Bedford, 2014).

The online-to-store channel combines many of the strengths of the online and store channels, including price reduction and fulfillment flexibility, but it also presents a number of implementation challenges. For example, the retailer needs to cover an additional handling cost in shipping the product from the warehouse to the selected store for customer pickup. Even if a product is available both online and in-store such that the retailer can utilize in-store inventory to satisfy an online purchase under the online-to-store channel, this strategy would still add to the retailer's cost in filling a customer's order, as an in-store item is generally more expensive due to the higher labor and storage costs associated with managing in-store inventory. Furthermore, it is unclear as to how this new channel would cannibalize sales from the existing store and online channels.

With these aforementioned implementation issues and associated handling costs, retailers need to carefully consider various factors and market characteristics in selecting the appropriate products to offer under the online-to-store channel. Otherwise, the addition of an online-to-store channel might not necessarily increase the overall profitability of the retailer. For instance, Walmart.com only offers

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its well-known Site-to-Store service for selected product categories and considers a number of important factors including profit margins, bulkiness of items, and the associated shipping costs in selecting these product categories¹. Hence, these considerations have motivated us to address the interesting question as to which types of products would be most compatible with an online-to-store channel.

Despite the increase in attention given to the online-to-store channel in the retail industry, there is a lack of theoretical research on the topic. Our research aims to fill this gap. In this paper, we provide an analytical framework that captures some essential operating characteristics of a retailer with multiple distribution channels and allows us to evaluate the potential benefits of adding an online-to-store channel to existing distribution channels. Our analysis strives to address the research question of how the addition of an online-to-store channel for a particular product would affect the allocation of customer demand among the multiple distribution channels and the optimal pricing strategy.

Specifically, we first consider a stylized model of a single retailer with two existing distribution channels: a store channel where customers can visit and buy a product at a retail store location, and an online channel where customers can make an online purchase using the store website and have the product shipped to some specified destination. We then evaluate the value of adding a third distribution channel that allows customers to purchase a product online and later pick up the product in a nearby store location.

To capture some key features of the operating environment, we allow customers to differ in two important dimensions. First, we allow customers to differ in their valuation of the product. Second, we allow customers to differ in their inconvenience factors incurred by a store visit. These inconvenience factors can involve the additional time required to visit the store, search for a particular item on the shelves, and expected wait at the checkout counters. We combine these inconvenience factors associated with a store visit for an individual customer into an *inconvenience cost*, which would depend upon the monetary value of time for the individual customer. For instance, a customer living farther away from the store would take longer to drive to the store, resulting in a higher inconvenience cost for a store visit.

We first characterize the demand allocation among the various distribution channels using consumer utility theory. Using these demand characterizations, we then proceed to analyze the impact on the retailer's profit. By comparing the results for any particular product between the two cases with and without the online-to-store channel, we can evaluate the impact of adding an online-to-store channel on the optimal pricing, total demand and total profit of the retailer.

In our model, we allow the online and store prices for the product to be different, as it is common in practice that a retailer could offer discounts on online orders. We analyze various scenarios under which the online price and/or store price can be fixed or optimized. For products that are available online only, we show that the addition of an OS channel would always increase the optimal online price. However, for products that are available both online and in store, we show that the optimal online price can increase or decrease, depending on specific model parameters. To gain additional insights, we performed a comprehensive set of numerical experiments. Our numerical results provide specific operating environments under which the optimal online price would increase due to the addition of the online-to-store channel. Our numerical results further provide specific operating environments under which adding the online-to-store channel would increase the total demand of the retailer.

For products that are available only online, we also provide some simple conditions under which it is profitable for the retailer to offer

the product under the online-to-store channel. However, if the product is also available in store, the potential benefits of the online-to-store channel become less clear due to the fact that this online-to-store channel incurs an additional fulfillment cost, due to, e.g., the need to prepare products for express checkout lanes, and it cannibalizes sales in both the store and online channels. This fulfillment cost would include the costs of sourcing the product, shipping the product from the warehouse to the retail store, and managing the product on the store shelves before it is eventually sold to the customer. Indeed, our analysis shows that the retailer's profit would increase only under very specific operating environments. Consequently, the retailer needs to carefully evaluate the underlying operating environment and product characteristics so as to select the appropriate set of products to be offered through the online-to-store channel.

The rest of the paper is organized as follows. We provide a literature review in Section 2. We describe our modeling framework and characterize the demand allocation among the multiple distribution channels in Section 3. In Section 4, we analyze the impact of adding the online-to-store channel for products that are available online only. In Section 5, we extend our analysis for products that are available both online and in-store. Finally, we summarize our results and provide some suggestions for further extensions in Section 6. All proofs are given in the Appendix.

2. Literature review

Multi-channel coordination has received considerable attention in both marketing and operations. One stream of this literature looks at whether or not a manufacturer should introduce a direct channel – either online, physical, or mail-order – to compete with an existing independent retailer that typically sells through the physical channel. For example, Tsay and Agrawal (2004a) consider a model in which a manufacturer can choose among three alternative channel strategies: “direct sales only” with no retailer involved, “retailer only” and “both direct sales and retail sales.” They differentiate the direct and retail channels in terms of the amount of sales effort required and show that the direct channel can benefit both channel members if the manufacturer adjusts its wholesale price accordingly. Cattani, Gilland, Heese, and Swaminathan (2006) further consider the case where customers are heterogeneous in their efforts to purchase the product. The authors show that under certain conditions, the manufacturer, the retailer and the customers can all benefit from an equal price strategy. See also Bell, Wang, and Padmanabhan (2003), Chiang, Chhajed, and Hess (2003), Kumar and Ruan (2006), Hendershott and Zhang (2006), and Bernstein, Song, and Zheng (2009) for similar modeling frameworks. All of the above papers involve both vertical (between the manufacturer and the retailer) and horizontal (between multiple sales channels) competition. Tsay and Agrawal (2004b) and Cattani, Gilland, Swaminathan, and Boston (2004) provide some excellent surveys.

Another stream of relevant research deals with horizontal competition among retailers who utilize different channel strategies to sell their products. This stream of research focuses on whether a retailer should introduce a multi-channel strategy, e.g., by opening an online channel in addition to its physical store (or vice versa) to compete with other retailers; e.g., see Bernstein, Song, and Zheng (2008). Agatz, Fleischmann, and van Nunen (2008) provide a recent review in this area. Another area of focus is the price competition between an online retailer and a brick-and-mortar retailer; e.g., see Druehl and Porteus (2006).

Our research contributes to the above two streams of literature in two important aspects. First, we consider two dimensions of customer heterogeneity in our modeling framework with respect to the product valuation and the inconvenience costs associated with a store visit. Cattani et al. (2006) defines customer heterogeneity with respect to the amount of purchasing effort required for a store visit. Our

¹ Private communications.

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