

Dual mechanism for an online retailer [☆]

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Received 29 August 2005; accepted 29 March 2006

Available online 30 October 2006

Abstract

While posted price and auction have typically been seen as alternatives to each other, we observe Web stores selling a product at a posted price and simultaneously running auctions for the identical product, a phenomenon that has not been studied fully. In this article, we study a dual mechanism, where an online retailer combines the two conventional mechanisms (posted price and auction) for multiple units of a product. We demonstrate that the dual mechanism can be used to achieve market segmentation when customers discount the expected utility of auctions. We characterize the customer's decision rule and formulate a retailer's profit function under the dual mechanism. Finally, we compare the performance of three selling mechanisms (posted price, auction, and dual) through computational experiments.

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Keywords: Online retailing; Online auctions; Price discrimination; Inventory management

1. Introduction

Online auctions have proliferated with the wide adoption of Information Technology. While live auctions have existed for a long time, their utilization has been limited by high setup costs and the difficulty of getting all possible customers to the same place at the same time. Since the Internet lowers setup costs significantly and provides an easy way of bringing many sellers and buyers together, the use of auctions has grown rapidly (e.g., eBay.com, Yahoo Auction, uBid.com, PriceLine.com, Auctions.SamsClub.com, etc.). Many companies have been using online auctions to sell off surplus goods, to dispose of used equipment, and to post requests for purchase. For example, Wilder (1999) reported that more than 10,000 companies have posted, sold, or bought goods on the Tradeout.com site, which focuses solely on auctioning surplus goods.

Posted price and auction-based pricing mechanisms have typically been seen as alternatives, but the simultaneous use of these mechanisms (by a single firm and for the same product) has grown with the

[☆] The author is grateful for valuable comments on earlier drafts of this work from Hemant K. Bhargava, Kalyan Chatterjee, Jack C. Hayya, Susan H. Xu, and conference participants at INFORMS CIST 2002, INFORMS ICS 2003, and AMCIS 2004. The author acknowledges partial funding in support of this work from the Center for Supply Chain Research at Pennsylvania State University. Finally, the author notes that this paper has been substantially improved with guidance from the review team.

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commercialization and widespread use of the Internet. Internet-based pricing technologies give firms a fairly low-cost means to provide and customize information about prices and related factors, such as delivery times. In some cases, the seller uses the two mechanisms jointly but only to move two separate classes of goods (e.g., in-fashion clothing vs. out-of-style clothing), which is easily explained as a case of quality-based price discrimination. Our focus in this article is on examining the *Dual Mechanism*: the simultaneous use of a posted pricing scheme and a multi-unit auction. Examples of such practice include Dell Computer and IBM, both manufacturers and direct sellers of computer equipment, and uBid, which is an online reseller. In addition, there are many small online retailers on eBay.com that offer a posted price with immediate delivery and simultaneous auctions.

Mehta and Lee (1999) found empirical evidence that some winners of Internet auctions actually bought products at higher prices than posted prices, which can be partly explained by imperfect information (i.e., some customers do not know that they can buy the product from another store at a lower posted price). Thus, if there are many customers with imperfect information, an online retailer has an incentive to offer the product at both markets separately. However, the retailers in our examples are not exploring possible gains from imperfect information, because they display a link and statement that inform customers of the co-existence of posted prices and auctions. Therefore, this dual selling mechanism cannot be fully explained so far by the existing literature, which typically assumes that the two pure markets are separated.

Taking into account customers' strategic behavior, we address the following research questions: *If the retailer implements a dual mechanism, how do customers behave and decide upon their purchasing decision? What are the features of a dual mechanism? Can it be optimal to sell products only in a pure market? and is it possible that an optimal strategy is to sell products in both a posted-price and an auction market?* To answer these questions, we study the three selling mechanisms: pure posted price, pure auction, and dual mechanism. When an online retailer chooses the pure posted price, she needs to decide the optimal posted price and inventory replenishment cycle (by implication, the order quantity). If she chooses the pure auction, the number of products and the duration of the auction need to be determined. For the dual mechanism, the retailer has to optimize all these decisions jointly.

One purpose in this paper is to explain how this dual mechanism affects the complex interplay that the seller faces between revenues and costs. The intuition is that when customers discount the expected utility of auctions, then the simultaneous offering of these two mechanisms can help the firm exploit heterogeneity in discounted utility and separate high-type and low-type buyers. Moreover, the distinctive aspect of our analysis is that we take into account the inventory structure and costs of the seller. Thus, our article develops analytical models to study several questions related to the simultaneous use of posted prices and auctions. Our analysis seeks both to develop closed-form solutions and insights, and, when the model is not tractable, to develop managerial insights through systematic and comprehensive computational experiments.

The rest of the paper is organized as follows. In Section 2, we discuss the related literature. Section 3 defines the retailer's problem and demonstrates the two pure mechanisms. In Section 4, we examine the customer's choice between posted price and auction, the optimal bidding strategy, and the features of a dual mechanism. In Section 5, we discuss managerial insights from our computational experiments, and Section 6 concludes our discussion and presents future research directions.

2. Literature review

Since live auctions have existed for a long time, many researchers have studied optimal auction designs for risk-neutral bidders with independent private or common values, the optimal strategies for participating bidders, and the efficiency of various auction mechanisms (see, e.g., Myerson, 1981; Riley and Samuelson, 1981; Milgrom and Weber, 1982; Maskin and Riley, 1985; McAfee and McMillan, 1987). Since these researchers focused on pure auction mechanisms, the corresponding literature did not provide an explanation of the co-existence of the two pure mechanisms.

There are a few interesting papers related to the performance of market mechanisms. Wang (1993) studied two popular selling mechanisms: posted-price selling and auctions. In his model, there are one seller and many buyers, and the seller can meet a buyer with an exogenously-given probability. Under the assumption of independent private-value and Poisson customer arrivals, he compared the two mechanisms' expected profit with a

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