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Simultaneous use of auctions and posted prices

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ABSTRACT

I consider a model in which several identical objects are sold simultaneously via an auction and a posted price mechanism. The model explains several empirical regularities regarding bidding behavior in eBay auctions such as the finding that some bidders bid multiple times over the course of the auction, and that bidders tend to bid with greater frequency near the end of the auction than the beginning. I also show that sellers prefer to simultaneously use auctions and posted prices than to use either mechanism individually.

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1. Introduction

In modern times, prospective buyers of an object often have the opportunity to try to win the object in an online auction while the object is simultaneously available at a posted price. Major companies such as CompUSA, IBM, and Sam's Club have auctioned off objects on auction websites while simultaneously offering buyers the option of purchasing the same items at posted prices. Similarly, several dedicated eBay merchants simultaneously use auctions and posted prices in their businesses (Einav et al., 2013).

There are two empirical regularities about bidding behavior in eBay auctions that are difficult to explain under standard models of auctions. First, bidders bid more frequently near the end of the auction than they do at the beginning of the auction (Ariely et al., 2005; Bajari and Hortaçsu, 2003; Ockenfels and Roth, 2006; Roth and Ockenfels, 2002; Steiglitz, 2007; Wilcox, 2000). This finding remains true even after one controls for the tendency of some bidders to engage in a practice known as "sniping", in which a bidder submits a bid at the absolute last minute of the auction.[1] Second, it is common for bidders to bid multiple times in eBay auctions. For instance, Bajari and Hortaçsu (2003) note that the average bidder makes two proxy bids in eBay auctions, and Ockenfels and Roth (2006) find that the average number of bids made by a bidder is 1.89.

This paper proposes a model of simultaneous auctions and posted prices that accounts for all of the empirical regularities described above. I consider a model in which identical objects are sold simultaneously via an auction and a posted price mechanism. Buyers may purchase at the posted price at any time, and if they do, they immediately obtain an object at that price. However, if a buyer enters the auction, then the buyer can never hope to obtain an object at the auction until the

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[1] For example, Bajari and Hortaçsu (2003) note that while 25% of winning bids on eBay are submitted in the final eight minutes, over half of all bids are submitted after 90% of the auction duration has passed, indicating that the bidders bid more frequently in the last 10% of the auction even if one ignores the last-minute bidding. Ockenfels and Roth (2006) also note that the rate at which bidders bid in the last hour exceeds the rate at which they bid throughout the rest of the auction on Amazon where sniping is not possible because placing a last-minute bid automatically extends the length of the auction.

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auction ends. Throughout I assume that buyers never demand more than one object, and buyers who value an object for more than its price would prefer to receive an object as quickly as possible.

I consider two possible ways that the seller running the auction may choose to operate the auction. In the first scenario, the seller running the auction never reveals any information about any bids that have taken place until the end of the auction. In the second scenario, the seller always reveals the current value of the price bidders in the auction would have to pay if there is no more bidding before the end of the auction. I assume throughout that buyers who are potentially interested in buying an object arrive according to a Poisson process, and any buyers who arrive have values for an object that are independent and identically distributed draws from some distribution.

Regardless of whether the seller reveals information about bids that have taken place, the equilibrium strategies for the buyers have the same overall form. Individuals whose values for an object are lower than the reserve price never attempt to buy an object at either the auction or the posted price. Prospective buyers with values between the auction reserve price and the posted price all enter the auction and bid their values. And buyers who have values for an object greater than the posted price sometimes choose to bid in the auction but sometimes choose to buy at the posted price. These buyers are more willing to bid in the auction if they have lower values for an object (because such a buyer would not be able to achieve much profit at the posted price) or if they arrive closer to the end of the auction (since then there is less cost to waiting until the end of the auction).

The equilibria in these settings generate predictions that are consistent with the two empirical observations described in the second paragraph of this manuscript. Buyers will bid more frequently near the end of the auction, and if the seller reveals information about the current second-highest bid, then buyers often have an incentive to place multiple bids over the course of the auction. The first of these results holds because more buyers with values greater than the posted price will enter the auction near the end of the auction, and the second of these results holds because buyers with values greater than the posted price are willing to bid more near the end of the auction than the beginning, so they may be willing to revise their bids near the end of the auction if another bidder outbid their initial bid.

Since high valuation buyers purchase at the posted price, but low valuation buyers purchase at the auction, simultaneously running auctions and posted prices effectively provides a way to price discriminate between high and low-value buyers. I show in the paper that regardless of whether the seller reveals information about bids that have taken place, the seller can achieve greater revenue by simultaneously selling objects via auctions and posted prices than by only using auctions or only posted prices. I also argue that this result will hold even if the seller may offer multiple shipping options or make use of sequential auctions.

There has been relatively little work that analyzes what happens when buyers can simultaneously buy an object via an auction or a posted price. The only other such papers that I am aware of are Caldentey and Vulcano (2007), Etzion and Moore (2013), Etzion et al. (2006), and Sun (2008). My paper differs from these papers in several ways. My paper is the first to analyze equilibrium strategies in a setting in which the seller running the auction reveals information about bids that have taken place over the course of the auction.[2] As a result, I am also able to show how the equilibrium strategies in such a setting are consistent with empirical bidding behavior in eBay auctions. Finally, in the framework I consider I am able to present analytic results that indicate that a seller can always do better by simultaneously selling objects via auctions and posted prices, but these papers do not.[3]

Celis et al. (2014) further present an analysis of a randomized mechanism that they call “buy-it-now or take-a-chance” in which bidders have the option of first buying an object at a posted price, and if nobody buys the object at a posted price, the object is then sold at random to one of the top d bidders. My paper differs from this work in that I explicitly consider an underlying dynamic model in which potential buyers arrive over time, and as a result I am able to account for empirical regularities in eBay auctions that relate to the dynamic nature of this auction.

In addition to the above papers, there has also been work that compares the use of auctions with the use of posted prices in a variety of settings (Hammond, 2010, 2013; Julien et al., 2002; Kultti, 1999; Wang, 1993, 1998; Vakrat and Seidmann, 1999; van Ryzin and Vulcano, 2004; Vulcano et al., 2002; Zeithammer and Liu, 2008), work on optimal selling mechanisms when buyers arrive dynamically (Board and Skrzypacz, 2014; Vulcano et al., 2002), and work on models of eBay auctions and related markets (Ackerberg et al., 2006; Ambrus et al., 2014; Bajari and Hortaçsu, 2003; Chen et al., 2013; Hidvegi et al., 2006; Peters and Severinov, 2006; Ockenfels and Roth, 2006; Roth and Ockenfels, 2002). Finally, there has also been work on sequential search mechanisms when it is costly for buyers and sellers to interact that illustrates that it can be optimal to first see if there is an agent willing to complete a transaction at a particular price and then complete the transaction with the agent willing to accept the most favorable price possible if no agent accepted the initial offer (Ehrman and Peters, 1994; McAfee and McMillan, 1988). However, these papers do not analyze models where buyers must simultaneously consider whether to buy an object at an auction or a posted price. As such, my paper analyzes a very different model than these papers.

[2] The only previous paper that considers a model in which the seller running the auction reveals information about bids that have taken place over the course of the auction is Etzion and Moore (2013), but this paper does not derive any analytic results about equilibrium strategies and instead solely focuses on conducting simulations under various heuristics bidders might adopt under such mechanisms.

[3] This result also contrasts with Riley and Zeckhauser (1983), which finds circumstances under which always committing to a posted price is optimal.

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