

Sellers Competing for Buyers in Online Markets: Reserve Prices, Shill Bids, and Auction Fees*

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[Extended Abstract]

Online markets are becoming increasingly prevalent and extend to a wide variety of areas such as e-commerce, Grid computing, recommender systems, and sensor networks. To date, much of the existing research has focused on the design and operation of individual auctions or exchanges for allocating goods and services. In practice, however, similar items are typically offered by multiple independent sellers that compete for buyers and set their own terms and conditions (such as their reserve price and the type and duration of the auction) within an institution that mediates between buyers and sellers. Examples of such institutions include eBay, Amazon and Yahoo!, where at any point in time multiple concurrent auctions with different settings are selling similar objects, resulting in strong competition¹.

Given this competition, a key research question is how a seller should select their auction settings in order to best attract buyers and so increase their expected profits. In this paper, we consider this issue in terms of setting the seller's reserve price (since the role of the reserve price has received attention in both single isolated auctions and also in cases where sellers compete). In particular, we extend the existing analysis by considering how sellers may improve their profit by shill bidding (i.e., bidding within their own auction as a means of setting an implicit reserve price). We do so analytically in the case of two sellers, and then develop an evolutionary simulation to enable us to solve the general case of multiple sellers. Moreover, since shill bidding is generally undesirable (it undermines trust in the institution and decreases overall market efficiency), we then extend our evolutionary simulation to investigate how the institution can deter shill bidding through the use of appropriate auction fees.

In more detail, existing literature on competing sellers (e.g., see [1, 3, 5]) has shown that setting a reserve price has two opposing effects on the sellers' profits: on the one hand, a reserve price can increase a seller's expected profit since it guarantees a minimum price in case the item is sold. On the other hand, a reserve price deters potential buyers from participating, and thus the seller's expected profits decline. Now, in order to overcome the disadvantage of deterring buyers by setting a reserve price, a possible strategy for a seller is to shill or shill bid. Thus, the seller still attracts bidders to the auction by announcing a low reserve price, but submits a shill bid to protect their profit and ensure that they do not sell the item at too low a price. Shill bidding undermines a buyer's trust in the auction and can also have an adverse effect on market efficiency, since setting a reserve price allows the bidders to make informed decisions of which auction to attend. Although illegal in many countries, shill bidding is one of the most common forms of Internet auction fraud [4, 6]. Moreover, it is often hard to detect, especially in on-line auctions, where participants are relatively anonymous. Therefore, rather than punishing shill bidding directly, an institution can reduce the incentive to shill bid, and, at the same time, improve market efficiency, by introducing appropriate auction fees [6]. These are payments made by the seller to the institution for its services as a mediator.

*The complete version of this paper is published as [2].

¹To illustrate the scale of this competition, within eBay alone close to a thousand auctions for selling Apple's iPod nano were running worldwide at the time of writing.

In the full paper (see [2]), we investigate the above issues and in so doing, make the following contributions:

- We analytically describe the seller's equilibrium strategies for setting reserve prices for the two-seller case, and we advance the current state-of-the-art by finding Nash equilibria by iteratively discretising the search space. We show that, although no pure strategies exist when the sellers are symmetric, these can be found if production costs differ sufficiently between the two sellers.
- For the first time, we investigate shill bidding within a setting of competing sellers. To this end, we derive analytical expressions for the seller's expected utility when sellers shill bid. Using these expressions, we show that, without auction fees, a seller can considerably benefit by shill bidding when faced with competition.
- We introduce an evolutionary simulation technique that allows us to extend the analytical approach described above to the general case where an arbitrary number of sellers compete, and we benchmark this approach against our analytical results.
- Finally, we extend our evolutionary simulation, and use it to compare various types of auction fees. We evaluate the ability of different fees to deter shill bidding and quantify their impact on market efficiency. We show the novel results that within a market with competing sellers, auction fees based on the difference between the payment and the reserve price are more effective than the more commonly used auction fees with regards to deterring shill bidding and increasing market efficiency.

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