from ***Capital Ideas: Selected Papers on Marketing*** *(December 2006), published by University of Chicago Graduate School of Business*

Strategic Bidding on eBay

Are Online Auction Sites a Buyer's or Seller's Market?

Research By **Robert Zeithammer**

What happens when the role of an auction changes from selling unique items at Sotheby's to driving large markets for consumer goods on eBay and other online auction sites?

EBay began as a Web site auctioning Pez dispensers and other collectibles, but today it deals in a broad array of mass-produced consumer goods and big-ticket items, including houses and cars.

In such consumer-good categories, nearly identical products are sold within minutes of each other. Since the ending times of the individual auctions are not synchronized, each productmarket evolves as a sequence. This allows bidders to focus on the auction ending soonest, while also accounting for the fact that there will be other auctions later. Upcoming auctions are announced several days in advance, so information about the products to be sold in future auctions is readily available.

"Having information about future auctions changes how bidders should behave," says University of Chicago Graduate School of Business professor Robert Zeithammer. "Bidders should take the entire known set of auctions into account. If they lose the current auction, they can still bid in future auctions selling similar products, whereas in the Sotheby's world, if I lose at an auction for a unique Renoir painting, I go home empty-handed and my bidding is over."

In the study "Forward-looking Bidding in Online Auctions," Zeithammer addresses how rational bidders should use information about future auctions. He then studies how the behavior of real eBay bidders compares to the theoretical predictions.

In economic terms, the bidders in Zeithammer's model are "forward-looking" because they consider the future rather than focusing only on today. The innovation in Zeithammer's model is that his bidders are also "forward-seeing," because they take specific information about their future opportunities into account.

The model predicts that rational forward-seeing bidders will reduce their bids when there are more products sold in the near future, and they will reduce bids even more

when the upcoming products are the same as the one being sold in the current auction.

"You shouldn't just look at one item and decide on the maximum you'll pay," says Zeithammer. "The more options you have and the better those options are for you, the more you should lowball your current bid. Be patient, and if you lose the auction, play again. On average you'll get the item you want for a lower price."

Using detailed data from eBay auctions for MP3 players and movies on DVD, Zeithammer finds that eBay bidders reduce their current bids when there are more upcoming auctions for substitutable items. In both product categories,bidders seem to take into account not only the general information like number of future products, but also the specifics of those future products.

Zeithammer estimates that this behavior results in prices that are 3 to 7 percent lower whenever the same item is available in the next five auctions, assuming the number of bidders per auction remains the same.

"EBay bidders are quite sophisticated and their behavior is consistent with theories of rational bidding," says Zeithammer.

In sequential auction markets like eBay, the burden of analysis (and the task of setting market prices) is on buyers, because they have to take sellers' inventory and competition from other buyers into account when forming their bids. As eBay expands into new markets and the number of auctions per hour increases, it becomes even more important for bidders to take their bidding options into consideration. On the flipside, sellers should be careful when formulating their own strategy, avoiding the sale of the same items back to back.

To Shade or Not to Shade

EBay lists auctions for a given item in a sequence ordered by ending time (the default order), and allows bidders to place known future auctions on their private watch list. Bidders determine their maximum bid for an item, and eBay automatically enters bids up to this maximum amount. Zeithammer modeled each individual auction as an instantaneous auction where all bidding occurs at the end. Most bidding on eBay does take place at the very end of each auction, not giving the competitive bidders time to react to each other’s bids.

"Between the beginning and end of an auction, a bidder can gather information about similar items and upcoming auctions," says Zeithammer. "There’s no reason to commit to a bid until the very end."

In Zeithammer's model, one auction ends before the next one starts, and several upcoming auctions are already known. The bidders are assumed to be both forward-looking in that they anticipate a future auction, and forward-seeing in that they know detailed information about products that will be sold in several future auctions. Auctions

ending in the next hour are highlighted in red, so the number of near-future products is easier to determine than the specific attributes of the items sold.

Each bidder has a personal "valuation" of the product-the maximum price they are willing to pay. Zeithammer argues that bidding exactly this valuation would be too high, because it would expose the bidder to winning immediately, and foregoing future opportunities to obtain a better price for the same item. Instead, Zeithammer suggests that bidders should bid far less than their valuations-a strategy referred to as "shading." Rational bidders shade their bids down in sequential auctions because winning involves not only the monetary cost of paying for the item, but an additional opportunity cost arising from not participating in future auctions for the same good. Because of the shading phenomenon, bids are always negatively biased measures of the bidders' true value of items.

The key prediction of the theory of "forward-seeing" bidding is that bidders should shade more when there are more items coming up for auction within the next hour, and when more of those items are personally desirable to the bidders. Thus, shading should increase or decrease as a function of the specific items sold in upcoming auctions.

Real-World Bidding Strategies

How much detail about future auctions do real eBay bidders use? To address this question, Zeithammer measured the relationship between current bids, types of upcoming objects, and the ending times of upcoming auctions. In the most sophisticated version of Zeithammer's model, each bidder examines future auctions closely, and bases his or her bidding strategy on timing as well as types of objects coming up for sale.

Zeithammer finds that the behavior of eBay bidders most closely matches this "most sophisticated" model of bidding behavior, in which bidders consider not only the overall number of upcoming products, but also their own personal preferences for the specific products listed.

EBay provided Zeithammer with data on auctions for MP3 players and movies on DVD. Each dataset contained all submitted bids in each recorded auction, and information about each listing. The data included all proxy bids made, including the winning bid. The MP3 player dataset included all auctions for the top 30 models of MP3 players during a four month period in early 2001. The DVD dataset incorporated all auctions for 30 popular movie titles in October 2002.

The data analysis focused on prices (second-highest bids) and highest bids rather than all recorded bids, because it is only possible to observe a bid on eBay if it is higher than all other bids already submitted, and the top two bids are always observed. A key element of the analysis was determining how prices for an item changed as a function of the next five auctions in the sequence, which involved recreating the order of items that bidders observed at any given time. The most important control-variable was the number of bidders per auction, because more auctions typically result in fewer bidders per auction and hence lower prices. Therefore, the statistical model estimates the effect

of more auctions on prices while keeping the number of bidders per auction the same.

Zeithammer found that in both datasets, bidders seemed to engage in at least one form of forward-seeing bidding. In the DVD dataset, if the same title was offered in the next five auctions, bids were lower. The average eBay price of DVDs was about $10 at the time of the study. Having the same movie offered in the immediately next auction led to price drops of approximately 72 cents, and availability anywhere in the next five auctions led to a 31 cent decrease (controlling for the number of bidders).

Bidding on MP3 players also was consistent with theory. A doubling of the number of auctions ending in the next hour resulted in prices dropping by approximately 2 percent. The specific information about upcoming players' brands and models had a more substantial effect on the bids for high-end MP3 players: for MP3 players that cost roughly $180, having the same brand and model available within the next five auctions reduced prices by $8 (4.4 percent) on average, and by $10 (5.6 percent) when the same product was immediately available in the next auction. Delaying the next auction of the same product by a mere hour increased the bid price by more than $2.

As for how these findings affect eBay sellers, Zeithammer notes, "Sellers would ideally like to sell as many items as possible, but the more items they list, the more prices will drop per item; not only will there be fewer bidders per auction, but all bidders will bid less than they would in the absence of the additional items. Sellers should therefore space their auctions apart and not sell the same item back to back."

Do Buyers Have Too Much Information?

"It's not particularly shocking that bidders take the future into account and lower their bids when future items are more desirable," says Zeithammer. "What's surprising is that bidders are very sensitive to details about the future-the specific brands and models offered, as well as the time until the next sale. This is good news for eBay and for the market as a whole."

Prices moving in the predicted direction as people bid more or less on specific items indicates that the market clears at the correct prices.

Zeithammer's findings may have an impact on seller strategies, raising the question of whether the inter-auction competition found on eBay limits the potential of sequential auctions as trading institutions. Sellers were assumed to be nonstrategic throughout the paper, but allowing for strategic selling may in turn change the bidder's strategy. Zeithammer is working on another paper that examines strategic selling.

"It's important to consider how an auction is designed in the first place," notes Zeithammer. "Given the implications for sellers, eBay should think about how comparable they want items to be, and whether or not it's a good idea for bidders to be able to see auctions for all identical products."