

Market Design: Theory and Applications

eBay and Amazon

Instructors: Itay Fainmesser and Amy Greenwald

Fall 2011

Timing of transactions and their impact on markets

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- ▶ Today we revisit the theory that it is a dominant strategy to bid your true value in a sealed bid, second price auction with private values.
- ▶ It turns out that there are auctions that look like this theory should apply, but which are designed so that it doesn't, not just behaviorally, but even when players are ideally rational.

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 - ▶ More experienced bidders on eBay submit late bids more often than do less experienced bidders, while the effect of experience on Amazon goes in the opposite direction.
 - ▶ On eBay, there is more late bidding for antiques than for computers.
- ▶ But there's a limit to what we can conclude from field data, because of all the uncontrolled differences between who bids, what is sold, etc.

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- ▶ Auctions typically run for several days.
- ▶ eBay auctions have a fixed deadline.
- ▶ Amazon auctions are automatically extended for an additional 10 minutes from the time of the latest bid.

Late bidding in eBay auctions

- ▶ Many bidders submit multiple bids in the course of the auction (i.e. they submit and later raise the reservation price they authorize for proxy bidding on their behalf).
- ▶ A non-negligible fraction of bids are submitted in the closing seconds of the auction (a practice called “sniping”).


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IBM Thinkpad 600E PII-366/64MB/6G/24X/56K~A++

Item #302534742

[Computers Hardware Notebooks System IBM](#)

Currently \$1,556.00

Quantity 1

Time left 3 hours, 8 mins +

First bid \$0.01

of bids 20 ([bid history](#)) ([with emails](#))

Location Metro NYC

Country United States

[\(mail this auction to a friend\)](#)[\(request a gift alert\)](#)

Featured Category Auction

Started Apr-06-00 16:20:59 PDT

Ends Apr-11-00 16:20:59 PDT

Seller (Rating) [vincelee \(192\)](#) [\(view comments in seller's Feedback Profile\)](#) [\(view seller's other auctions\)](#) [\(ask seller a question\)](#)High bid [kb8ho \(0\)](#)

Payment Visa/MasterCard, Money Order/Cashiers Checks, Other, See item description for payment methods accepted

NEW! [Billpoint Online Payments](#)

Shipping Buyer pays fixed shipping charges, Seller ships internationally (worldwide), See item description for shipping charges



Bidding

IBM Thinkpad 600E PII-366/64MB/6G/24X/56K~A++ Item #302534742

Current bid: \$1,556.00
Bid increment: \$25.00

Your maximum bid:

(Minimum bid: \$1,581.00)

[Review bid](#)

eBay will bid incrementally on your behalf **up to your maximum bid**, which is kept secret from other eBay users. The eBay term for this is [proxy bidding](#).

Your bid is a contract - Place a bid only if you're serious about buying the item. If you are

How to Bid

1. [Register to bid](#) - if you haven't already. It's free!
2. [Learn about this seller](#) - read feedback comments left by others.
3. [Know the details](#) - read the item description and payment & shipping terms closely.
4. If you have questions - contact the seller [vincelee](#) before you bid.
5. Place your bid!

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How Bidding Works

(this process is called proxy bidding)

Let's say you find something on eBay that you want... You're willing to pay \$25.00 for it, but the current bid price is only \$2.25. You could take the long route and sit at your computer, outbidding each new bid until you reach \$25.00.

Luckily, there's a better way. Here's how it works:

1. Decide the **maximum** you're willing to pay and enter this amount.
2. eBay will now confidentially bid **up** to your maximum amount. In this way, you don't have to keep an eye on your auction as it unfolds.
3. If other bidders outbid your maximum at the end of the auction, you don't get the item. But otherwise, you're the winner--and the final price might even be less than the maximum you had been willing to spend!

Remember: eBay will use only as much of your maximum bid as is necessary to maintain your position as high bidder. Winning was never easier!

eBay Item Bid History - Netscape

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Bookmarks Location: <http://cgi.ebay.com/aw-cgi/eBay/SAPI.dll?ViewBid&item=302534742> What's Related

LEO English/Ger Axel Ockenfels Alka/Viola HOME Postbank Bankin Harvard Business HOLLI'S Plus Ele Axel Ockenfels HBS Intranet Graduate Econom

eBay Bid History for IBM Thinkpad 600E PII-366/64MB/6G/24X/56K~A++ (item #302534742)

If you have questions about this item, please contact the seller at the User ID provided below. Seller assumes all responsibility for listing this item.

Last bid for this item:	\$1,626.00
Date auction ends:	Apr-11-00 16:20:59 PDT
Date auction started:	Apr-06-00 16:20:59 PDT
Seller:	vincelee (192) ★
First bid at:	\$0.01
Number of bids made:	23 (may include multiple bids by same bidder)

Bidding History (in order of bid amount):

crjennens@aol.com (-1)	Last bid at: \$1,626.00
	Date of bid: Apr-11-00 16:20:59 PDT
dkatcher (0) 🍷	Last bid at: \$1,601.00
	Date of bid: Apr-11-00 16:04:15 PDT
kb8ho (0)	Last bid at: \$1,556.00
	Date of bid: Apr-09-00 11:17:33 PDT

23 bids but only 14 bidders

last bid came in at the last second



Place your eBayTM bids in the last few seconds of the auction — automatically!

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Important! Please make sure you have read the [Help](#) and [FAQ](#) before placing your bid. You should fully understand the risks of the bidding process, and [Fees](#) for auction wins of US\$25 or more.

Snipe Tip: Bid odd amounts like \$25.51 instead of just \$25.

eBay Item Number (or eBay Item URL)

1470287307

Your maximum bid amount

\$70.51

Quantity

1

Buffer (seconds)

7

Place my bid

Fees: All bids placed after Tuesday, May 29 00:01 PDT will be subject to payment if they are won for US\$25.00 or more. All wins of non-US\$ also require payment. Please see our [BidPoints](#) announcement.

Once you place a bid: Your bid becomes **permanent 5 minutes before the specified bidding time**. This means that an edit or cancel in the last 5 minutes will be ignored. A bid placed on eSnipe should always be considered a real bid on eBay, as there is always the chance that you may not be able to connect to remove your bid.

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eBay Bid History for
***SC* RRR! SUPERB PAIR OF ROMAN BRONZE MACE!! (Item # [1470287307](#))**

Currently	\$71.51	First bid	\$49.00
Quantity	1	# of bids	6
Time left	Auction has ended.		
Started	Sep-30-01 14:43:10 PDT		
Ends	Oct-10-01 14:43:10 PDT		
Seller (Rating)	saruman.com (149) ★		

[View page with email addresses](#) (Accessible by Seller only) [Learn more.](#)

Bidding History (Highest bids first)

User ID	Bid Amount	Date of Bid
jglass@dcj.com.au (65) ★	\$71.51	Oct-10-01 13:42:28 PDT
aer51 (24) ★	\$70.51	Oct-10-01 14:43:06 PDT
jglass@dcj.com.au (65) ★	\$61.00	Sep-30-01 17:21:15 PDT
victruvius1 (70) ★	\$56.01	Oct-10-01 14:42:48 PDT
jpisc98357 (376) ★ me	\$52.00	Oct-08-01 15:05:47 PDT
rlslettene@aol.com (61) ★	\$50.00	Sep-30-01 21:47:30 PDT

Remember that earlier bids of the same amount take precedence.

Document: Done

Start

5:44 PM

eBay item 506328272 (Ends Dec-01-00 18:08:38 PST) - esnipe.com - complete online sniping site - Nets...

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Bookmarks Location: 6328272&r=0&t=0&showTutorial=0&ed=975722918&indexURL=0&rd=1 What's Related

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item view

esnipe.com - complete online sniping site

Item #506328272

[Computers](#) [Domain Names](#) [General](#) [Everything Else](#) [Businesses for Sale](#)

Bidding is closed for this item

	Currently	\$35,877.77	First bid	\$20,000.00
	Quantity	1	# of bids	8 bid history
	Time left	Auction has ended.	Location	
	Started	Nov-21-00 18:08:38 PST	Country	USA
	Ends	Dec-01-00 18:08:38 PST		mail this auction to a friend
	Seller (Rating)	esnipe (5)		request a gift alert
		(to seller)	view comments in seller's Feedback Profile view seller's other auctions ask seller a question	
		(to bidder)		
	High bid	tomcam (16) ★		

Document: Done

eBay Item Bid History - Netscape

File Edit View Go Communicator Help

eBay Bid History for
esnipe.com - complete online sniping site (Item #506328272)

Currently	\$35,877.77	First bid	\$20,000.00
Quantity	1	# of bids	8
Time left	Auction has ended.		
Started	Nov-21-00 18:08:38 PST		
Ends	Dec-01-00 18:08:38 PST		
Seller (Rating)	esnipe (5)		

[View page with winning bidder\(s\) email address](#) (Accessible by Seller only) [Learn more.](#)

Bidding History (Highest bids first)

User ID	Bid Amount	Date of Bid
tomcam (16) ★	\$35,877.77	Dec-01-00 18:08:24 PST
vroom42 (18) ★	\$35,777.77	Dec-01-00 18:08:34 PST
reedsturtevant (233) ★	\$35,158.67	Dec-01-00 18:07:47 PST
gr8meta4 (0)	\$32,500.00	Dec-01-00 18:07:20 PST
dglawrence (8)	\$25,200.00	Dec-01-00 18:07:42 PST
tomcam (16) ★	\$25,000.00	Dec-01-00 18:05:24 PST
cpalmer (1214) ★	\$23,011.00	Dec-01-00 10:34:01 PST
dglawrence (8)	\$20,100.00	Dec-01-00 17:52:56 PST

Document: Done

Selling esnipe.com

- ▶ 8 bids by 6 bidders.
- ▶ No bids before the 10th and final day.
- ▶ The price rose by more than \$10,000 in the last minute, during which time 4 of the 8 bids were placed.

The dangers of last-minute bidding

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"THE DANGERS OF LAST MINUTE BIDDING: Almost without fail after an auction has closed we receive emails from bidders who claim they were attempting to place a bid and were unable to get into eBay. There is nothing we can do to help bidders who were "locked out" while trying to place a "last minute" bid. All we can do in this regard is to urge you to place your bids early."

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- ▶ AuctionWatch.com's view (1999)

"There are inherent risks in sniping. If you wait too long to bid, the auction could close before your bid is processed. If your maximum doesn't beat the current high bidder, you won't have a second chance to up the ante. And don't overlook the fact that you could be in the company of other snipers who are ready to snipe your snipe. It happens all the time."

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- ▶ If all bids on eBay were “sniped,” eBay would essentially be converted into a sealed bid auction, one with some uncertainty about whether bids would go through.
 - ▶ eBay could always capture all of esnipe's market by providing that facility on eBay, perhaps without the last minute uncertainty.)

It is helpful to model eBay as a continuous time auction followed by a last-minute sealed bid auction. Early bids are transmitted with certainty, but there is time for other bids to respond. Late bids come too late for other bidders to respond, but run the risk that they will not be successfully transmitted themselves.

A strategic model of the eBay environment

- ▶ n bidders.
- ▶ Minimum initial bid m and smallest increment s .
- ▶ The “current price” (or “high bid”) in an auction with at least two bidders is in general equal to the minimum increment over the second highest submitted bidders’ reservation price. There are two exceptions to this rule.
 1. If more than one bidder submitted the highest reservation price, the bidder who submitted her bid first is the high bidder at a price equal to the reservation price.
 2. Second, if the current high bidder submits a new, higher bid, the current price is not raised, although the number of bids increases.
- ▶ Each submitted reservation price must exceed both the current high bid and the bidder’s last submitted reservation price.

A strategic model of the eBay environment (cont.)

- ▶ A player can bid at times $t \in [0, 1) \cup \{1\}$.
- ▶ A player has time to react before the end of the auction to another player's bid at time $t' < 1$, but the reaction cannot be instantaneous, it must be strictly after time t' , at an earliest time t_n , such that $t' < t_n < 1$.
- ▶ At $t = 1$, everyone knows the bid history prior to t , and has time to make exactly one more bid, without knowing what other last minute bids are being placed simultaneously.
- ▶ If two bids are submitted simultaneously at the same instant t , then they are randomly ordered, and each has equal probability of being received first.
- ▶ At time $t = 1$, the probability that a bid is successfully transmitted is $p < 1$ (before that, $p = 1$).

(In an Amazon auction, in contrast, a successful bid at time $t = 1$ extends the auction, and other bidders can respond.)

Private value eBay auctions

In a (pure) private value auction, each bidder j has a true willingness to pay, v_j , distributed according to some known, bounded distribution F . A bidder who wins the auction at price h earns $v_j - h$, a bidder who does not win earns 0. At $t = 0$ each player j knows her own v_j .

Unlike the case of a sealed-bid second-price auction, a bidder in this continuous-time second-price auction does not have any dominant strategy, even in the case of pure private values.

Theorem

A bidder in the continuous-time second-price private value auction does not have any dominant strategies.

Proof.

WLOG consider the case of two bidders. It is sufficient to show that bidder j with value $v_j > m + s$ has no strategy that is a best reply to every strategy of the other bidder, i .

Suppose i 's strategy is to bid the minimum bid m at $t = 0$ and then not to bid further at any information set at which he remains the high bidder, but to bid B (with $B > v_j + s$) whenever he learns that he is not the high bidder. □

j 's best reply is not to bid at any time $t < 1$ (which would provoke a counterbid of B , and cause j to win at most zero), and to bid v_j at time $t = 1$ (at which time the other bidder does not bid, since he does not learn that he is no longer the high bidder until the game is over). The payoff to j from this strategy is $p \cdot (v_j - m - s) > 0$, and it is easy to see that no other bid at time $t = 1$ could yield j a larger payoff. (Other bids at $t = 1$, while weakly dominated, would yield the same payoff against i 's strategy, and would also be best replies.)

Now suppose instead player i 's strategy is not to bid at any time. Then a strategy for player j that calls for bidding only at $t = 1$ will have expected payoff $p \cdot (v_j - m) < v_j - m$, i.e. less than the from the strategy of bidding v_j at $t = 0$ (or at any $t < 1$, at which the bid will be transmitted with certainty instead of with probability $p < 1$).

No best reply to i 's second strategy is among player j 's best replies to i 's first strategy, so j has no dominant strategy.

Possible strategic reasons for bidding late on eBay

1. Best response to naïve, “English auction” behavior:

“Another bidding tactic is sentry bidding—placing a bid and then keeping close watch on it for the duration of the auction. If others try to outbid you, you can quickly place a counter-bid to regain your high bidder status. [...] This could lead to an all-out bidding war, so be clear on how much you’re willing to spend for an item and how closely you can monitor the auction. And beware of the last-second snipe from your worthy opponent.”¹

Bidding very near the end of the auction would give the sentry bidder insufficient time to respond, so a sniper competing with a sentry bidder might win the auction at the sentry bidder’s initial, low bid. In contrast, bidding one’s true value early in the auction, when a sentry bidder is present, would win the auction only if one’s true value were higher than the sentry bidder’s, and in that case would have to pay the sentry bidder’s true value.

¹<http://www.auctionwatch.com/awdaily/tipsandtactics/buy-bid.html>, 2000

Possible strategic reasons for bidding late on eBay

2. Defense against dishonest sellers ('shill bidding')

Possible strategic reasons for bidding late on eBay

3. Common value auctions: e.g. concealment of expertise:

If an auction is common-value, bidders can get information from others' bids that causes them to revise their willingness to pay. In general, late bids motivated by information about common values arise either so that bidders can incorporate into their bids the information they have gathered from the earlier bids of others, or so bidders can avoid giving information to others through their own early bids. In an auction with a fixed deadline, a sharp form of this latter cause of late bidding may arise when there is asymmetric information, and some players are better informed than others.

Possible strategic reasons for bidding late on eBay

3. Common value auctions: e.g. concealment of expertise (cont.):

“The greatest advantage of sniping is it affords you anonymity among the other bidders. If you’re a long-time bidder, others who bid on the same items as you will recognize your user ID. Some might even “ride your coattails,” performing site searches on what you’re bidding on, then perhaps bidding against you. If you choose to snipe, the other bidders won’t know where you’ll strike next, and that can mean more wins and frequently better prices for you.”

[<http://www.auctionwatch.com/awdaily/tipsandtactics/buy-bid2.html>,
1999]

Possible strategic reasons for bidding late on eBay

4. Implicit collusion among the bidders (at equilibrium even in a private value auction):

There exist a multiplicity of equilibria, including of course equilibria at which each player i bids his true value at $t = 0$. At the other extreme, there are also equilibria at which no player bids his true value until the last moment.

Theorem

There can exist equilibria in which bidders do not bid their true values until the last moment, $t = 1$, at which time there is only probability $p < 1$ that the bid will be transmitted.

- ▶ The intuition behind last-minute bidding at equilibrium in a private value auction will be that there is an incentive not to bid too high when there is still time for other bidders to react, to avoid a bidding war that will raise the expected final transaction price. (Off the equilibrium path, early bidding causes a price war, at which all bidders bid their true value early enough so that bids go through with certainty.)
- ▶ Mutual delay until the last minute can raise the expected profit of all bidders, because of the positive probability that another bidder's last-minute bid will not be successfully transmitted.

All these strategic reasons to bid late despite the risk that your bid won't go through are eliminated or substantially attenuated in an auction with automatic extension.

But, in addition to the possible strategic reasons for bidding late on eBay (but not on Amazon), there are possible non-strategic reasons for bidding late, on both eBay and Amazon. (i.e. reasons not affected by the strategic effects of the rule for ending the auction)

1. Procrastination
2. Search engines bring up old auctions first
3. Desire to retain flexibility to bid in other auctions (e.g. offering the same item)

We can try to sort out some of these different strategic and non-strategic hypotheses by comparing eBay and Amazon data.

Hypotheses about the causes of late bidding

	Hypothesis	Predicted contribution to late bidding
Strategic hypotheses	a. <i>Rational response to naïve English auction behavior or to shill bidders</i> : bidders bid late to avoid bidding wars with incremental bidders	All three strategic hypotheses suggest more late bidding on eBay than on Amazon, with a bigger effect for more experienced bidders.
	b. <i>Collusive equilibrium</i> : bidders bid late to avoid bidding wars with other like-minded bidders.	
	c. <i>Informed bidders protecting their information</i> : e.g. late bidding by “expert/dealers.”	Plus (via part c) more late bidding in categories in which expertise is important than in categories in which it is not.
Non-strategic hypotheses	Bidders bid late because they procrastinate, or because of naïve behavior, or because they don’t like to leave bids “hanging,” or because search engines present soon-to-expire auctions first, etc.	No difference between eBay and Amazon.

Description of the data

- ▶ Amazon and eBay publicly provide data about the bid history.
- ▶ The research used data in the categories “Computers” and “Antiques”.
 - ▶ Computers (‘private value auctions’): information about the retail price of most items is in general easily available. The difference between the retail price and each bidder’s willingness to pay, however, is private information.
 - ▶ Antiques (‘common value auctions’): retail prices are usually not available and the value of an item is often ambiguous and sometimes require experts to appraise. As a consequence, the number and amounts of bids of others are likely to carry valuable information about the item’s value.

The data set consists of randomly selected auctions that were completed between October 1999 and January 2000 and that met certain criteria.

1. At least two bidders
2. Auctions with a hidden reserve price only if the reserve price was met.
3. No Dutch-, Private-, “10% off 1st bidder”-, or “Take-it-price”-auctions

In total, 480 randomly selected auctions with 2279 bidders.

- ▶ 120 eBay-Computers with 740 bidders
- ▶ 120 Amazon-Computers with 595 bidders
- ▶ 120 eBay-Antiques with 604 bidders
- ▶ 120 Amazon-Antiques with 340 bidders

Variables:

- ▶ number of bids
- ▶ number of bidders
- ▶ reserve price (y/n)
- ▶ “timing” of bidders’ last bids
- ▶ bidders’ “feedback numbers”

Timing

- ▶ For each bidder - downloaded the data about how many seconds before the deadline the last bid was submitted if the bid came in within the last 12 hours of the auction time.
- ▶ For each last bid in Amazon - computed the number of seconds before a 'hypothetical' deadline.
- ▶ This hypothetical deadline is defined as the current actual deadline at the time of bidding under the assumption that the bid in hand and all subsequent bids were not submitted.
 - ▶ Suppose, for example, a bid comes in two minutes before the initial deadline. Then, the auction is extended by 8 minutes. The bid shows up in our data, however, as 120 seconds, respectively.

Feedback number

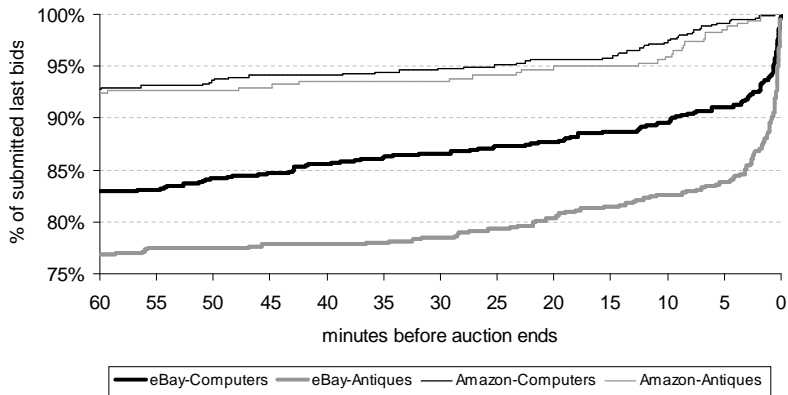
In eBay, buyers and sellers have the opportunity to give each other a positive feedback (+1), a neutral feedback (0), or a negative feedback (− 1) along with a brief comment.

- ▶ The cumulative total of positive and negative feedbacks is what we call the “feedback number” in eBay.

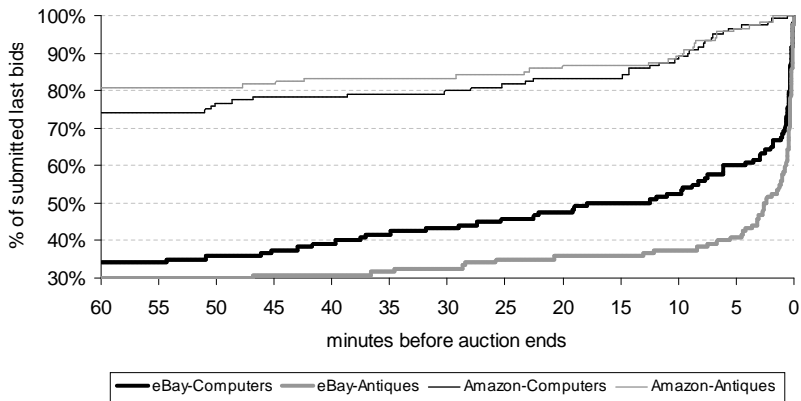
In Amazon, buyers and sellers are allowed to post 1-5 star ratings about one another.

- ▶ We refer to the cumulative number of ratings as the “feedback number” in Amazon.

Cumulative distribution of bidders' last bids over time



Cumulative distribution of auctions' last bids over time



When are the last bids submitted?

	bidder level		auction level	
	eBay	Amazon	eBay	Amazon
last hour	20 %	7 %	68 %	23 %
10 minutes	14 %	3 %	55 %	11 %
5 minutes	13 %	1 %	50%	3 %
1 minute	8 %	0.1 %	37 %	0.4 %
10 seconds	2 %	0 %	12 %	0 %

Furthermore, more experience causes eBay bidders to bid later, but causes Amazon bidders to bid earlier.

Explanatory variables	All bidders' last bids		Auctions' last bids	
	<i>Run 1</i>	<i>Run 2</i>	<i>Run 3</i>	<i>Run 4</i>
	coeff. (p-value)	coeff. (p-value)	coeff. (p-value)	coeff. (p-value)
<i>Constant</i>	-1.567 (0.000)	-1.420 (0.000)	-1.407 (0.000)	-1.205 (0.000)
<i>eBay</i> (= 1 if eBay and 0 if Amazon)	0.773 (0.000)		1.140 (0.000)	
<i>Computers</i> (= 1 if Computers and 0 if Antiques)	-0.187 (0.021)		-0.261 (0.063)	
<i>Feedback#</i>	0.001 (0.012)		0.003 (0.017)	
<i>#bidders</i>	-0.036 (0.003)		0.074 (0.001)	
<i>eBay*Computers</i>		0.441 (0.046)		0.644 (0.040)
<i>(1 - eBay)*Computers</i>		-0.264 (0.168)		-0.268 (0.284)
<i>eBay*(1 - Computers)</i>		0.653 (0.002)		.995 (0.001)
<i>eBay*Feedback#</i>		0.001 (0.008)		0.003 (0.015)
<i>(1 - eBay)*Feedback#</i>		-0.034 (0.059)		-0.035 (0.095)
<i>eBay*#bidders</i>		-0.039 (0.003)		0.071 (0.007)
<i>(1 - eBay)*#bidders</i>		-0.026 (0.401)		0.068 (0.124)
Log-likelihood	-650.6	-646.4	-239.9	-236.8
Number of observations	2279	2279	480	480

Notes: The dependent variable is 1 for bidders whose last bid came in the last 10 minutes before the (in Amazon: 'hypothetical') deadline and 0 otherwise. The table reports maximum likelihood probit coefficient estimates (and p-values). *Feedback#* = actual feedback number + 1 in order to avoid identification problems in Runs 2 and 4.

Probit-estimates for late bidding in eBay and Amazon

Survey

“Hi: We are economists studying bidding on eBay (and sometimes eBay bidder ourselves, as aer51 and aockenfels). We are particularly interested in late bidding, and we are writing to you because we noticed that you have been successful at bidding in the last moment of an auction you participated in. . .

[1] Do you sometimes plan, early in an auction, to submit a bid at the last minute? If so, why? (Or do you bid as the spirit moves you throughout the auction, and only bid at the last minute if you are outbid near the end?)

[2] Do you bid by hand, or do you use bidding software? If by hand, do you simply use the eBay bidder screens, or do you do something more elaborate, like open multiple windows so that you can follow the bidding while preparing a bid?

[3] When bidding late, about what percentage of the time would you say it happened that you started to make a bid, but the auction closed before your bid was received?

[4] When you have planned to bid late, about what percentage of the time would you say it happened that something came up, so that you were not able to submit a bid as you planned? (We are thinking here of something that prevented you from being available, or from remembering to bid, not the case in which the price had already risen above what you were willing to pay.)

[5] On average, would you say you submit only one bid per auction; no more than two bids, or more than two bids?

[6] Do you have a good idea, early in the auction, of the maximum you would be willing to pay, or do you often adjust what you are willing to pay based on the bids you see by other bidders? In this respect, are some other particular bidders especially influential, or is it just the general price level and number of bidders that influences your bid?

[7] About what percentage of the time, when you are not the high bidder in an auction, do you regret that you did not bid higher? And in about what percentage of the auctions in which you are the high bidder do you regret having bid as high as you did?

[8] Is there anything else about your bidding experience that you think it would be helpful for us to know, as we try to understand what's going on?

Findings

- ▶ A large majority of responders (91 percent) confirm that late bidding is typically part of their early planned bidding strategy (Question 1, $N = 65$).
- ▶ Among the 49 bidders who verbally explain why they are bidding late, almost two thirds (65 percent) unambiguously express that they try to avoid a “bidding war” or to keep the price down.
- ▶ Some experienced Antiques-bidders (about 10 percent of all responders, mostly with high feedback numbers) explicitly state that late bidding enables them to avoid sharing valuable information with other bidders.
(At the same time, some bidders say that they are sometimes influenced by the bids and the bidding activity of others, although 88 percent of the late bidders in our survey say that they have a clear idea, early in the auction, about what they are willing to pay (Question 6, $N = 65$).

- ▶ Some indications of naïve late bidding. A few bidders (less than 10 percent, mostly with zero feedback number) appear to confuse eBay with an English auction. Also, some bidders sometimes felt regret about not being the high bidder or for being the high bidder (Question 7). The median response for those who gave a quantitative estimation for how often this happened is, however, 0 percent in either case ($N = 48$ and 46, respectively).
- ▶ Although most bidders never use sniping software (93 percent, Question 2, $N = 67$), many operate with several open windows and synchronize their computer clock with eBay time in order to improve their late bidding performance.

- ▶ Nevertheless, when bidding late, 86 percent of all bidders report that it happened at least once to them that they started to make a bid, but the auction was closed before the bid was received (Question 3, $N = 65$).
- ▶ 90 percent of all bidders say that sometimes, even though they planned to bid late, something came up that prevented them from being available at the end of the auction so that they could not submit a bid as planned (Question 4, $N = 63$). (Most bidders gave a quantitative estimation about how often this happened to them. The median response is 10 percent for both, Question 3 ($N = 43$) and Question 4 ($N = 52$), respectively.)

The survey suggests that late bidding is most often part of a planned strategy, even though bidders know that there is a risk in bidding late. At the same time, the survey reveals some heterogeneity in why later bidders bid late, including 'bidding war'-, and 'expertise'-explanations, and, to a lesser extent, non-strategic explanations.

Conclusions from the field data

Multiple and late bidding can have multiple causes.

- ▶ The clear difference in the amount of late bidding on eBay and Amazon is strong evidence that rational strategic considerations play a significant role, because eBay's hard close gives more reason to bid late in private value auctions, in common value auctions, and against naïve incremental bidders. This evidence that rational considerations are at work is strengthened by the observation that the difference is even clearer among more experienced bidders.

- ▶ The difference between the amount of late bidding for computers and for antiques suggests that the bidders respond to the additional strategic incentives for late bidding in markets in which expertise plays a role in appraising values.
- ▶ The substantial amount of late bidding observed on Amazon, (even though substantially less than on eBay) suggests that there are also non-strategic causes of late bidding, possibly due to naivete or other non-rational cause, particularly since the evidence suggests that it is reduced with experience.

The need for experiments

Interpretation of the field data is complicated by the fact that there are differences between eBay and Amazon other than their ending rules.

- ▶ eBay has many more items for sale than Amazon, and many more bidders.
- ▶ buyers and sellers decide in which auctions to participate, so there may be differences between the seller and buyer characteristics and the objects for sale on eBay and Amazon.

The “feedback ratings” are imperfect proxies for experience.

- ▶ They only reflect the number of completed transactions, but not auctions in which the bidder was not the high bidder.
- ▶ Also, more experienced buyers on eBay may not only have more experience with the strategic aspects of the auction, they may have other differences, e.g. they may also have more expertise concerning the goods for sale.

Laboratory experiments will allow us to look at the difference in auction closing rules while controlling away all other differences.

Experimental Design

Auction type	Number of stage 1 periods	Number of stage 2 periods	Probability of stage 2 period to register
sealed bid	0	1	100%
eBay1	Depends on bidders	1	100%
Ebay.8	Depends on bidders	1	80%
Amazon	Depends on bidders	Depends on bidders	80%

There were two bidders in each auction. Each bidder in each auction was assigned a private value independently drawn from a uniform distribution between \$6 and \$10. A winner of an auction received his private value minus the final price, and a loser received nothing for that auction.

The minimum bid in all auctions was \$1.00, and the smallest bid increment was \$0.25.

Stage 1 is divided into discrete periods. In each period, each trader has an opportunity to make a bid (simultaneously). At the end of each period, the high bidder and current price (minimum increment over second highest bid) are displayed to all. Stage 1 ends (only) after a period at which no player makes a bid.

Stage 2 of the eBay.8 auctions consists of a single period. The bidders have the opportunity to submit one (last) bid; it has probability $p = 0.8$ of being successfully transmitted.

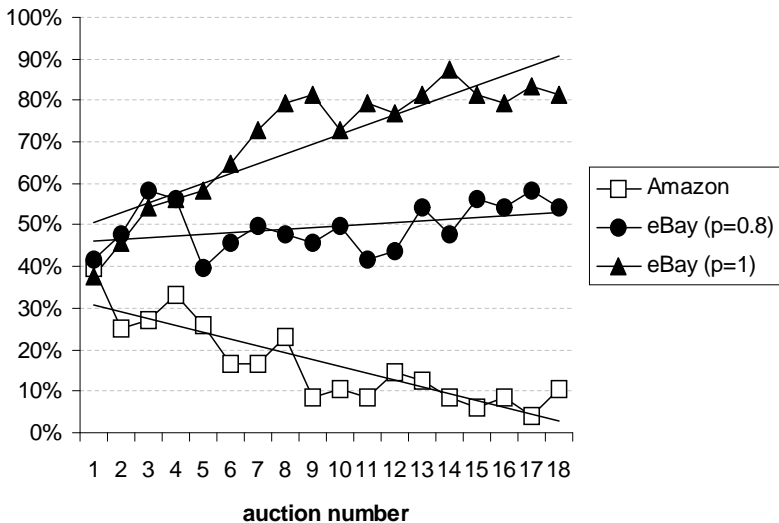
In the eBay1 condition, the probability that a bid made in stage 2 will be transmitted successfully is $p = 1$, i.e. stage 2 bids are transmitted with certainty. So in this condition, stage 2 is a conventional sealed bid second price auction.

In the Amazon condition, stage 1 is followed by stage 2, as in the eBay conditions, but after a successfully submitted stage 2 bid, stage 1 starts again (and is followed by stage 2 again, etc.). The probability that a stage 2 bid will be successfully transmitted is $p = 0.8$. Thus in the Amazon condition, the risk of bidding late is the same as in the eBay.8 condition, but a successful stage 2 bid causes the auction to be extended.

Sealed bid

In the sealed bid condition, the auction begins with stage 2 (with $p = 1$), and ends immediately after, so that each bidder has the opportunity to submit only a single bid, and must do so without knowing the bids of the other bidder. (While the sealed bid auction obviously cannot yield any data on the timing of bids, it provides a benchmark against which the revenues in different auctions can be measured.)

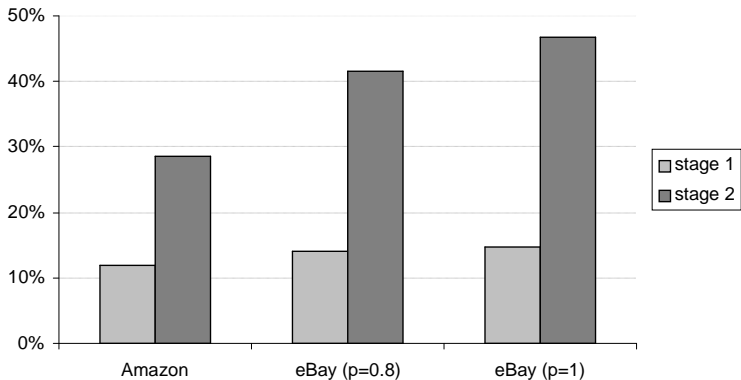
Frequency of Sniping: Stage 2-bids (in Amazon: first stage 2) per auction



The experimental results reproduce the main internet observations:

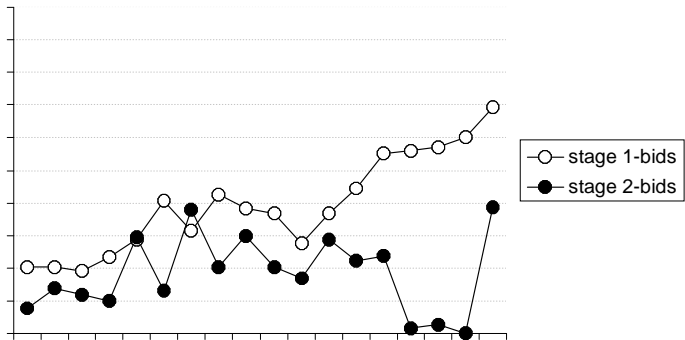
- ▶ There is more late bidding in the fixed-deadline (eBay) conditions than in the automatic extension (Amazon) condition.
- ▶ Furthermore, as bidders gain experience, they are more likely to bid late in the eBay conditions, and less likely to bid late in the Amazon condition.

Share of bids submitted by current high bidder

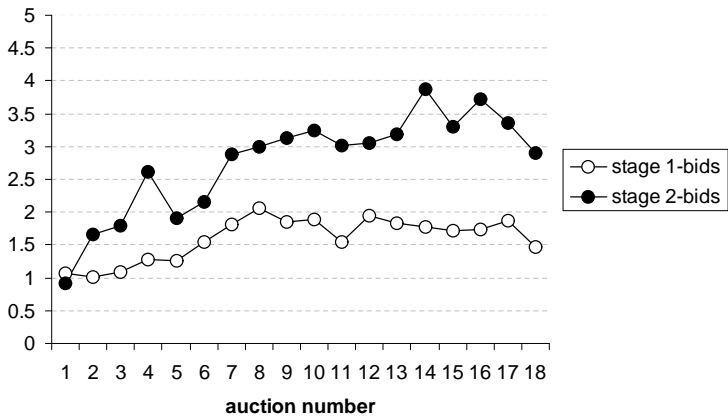


We now turn to examine the magnitude of early and late bids:
Average increase of proxy bid (conditioned on bidding) over
current minimum bid.

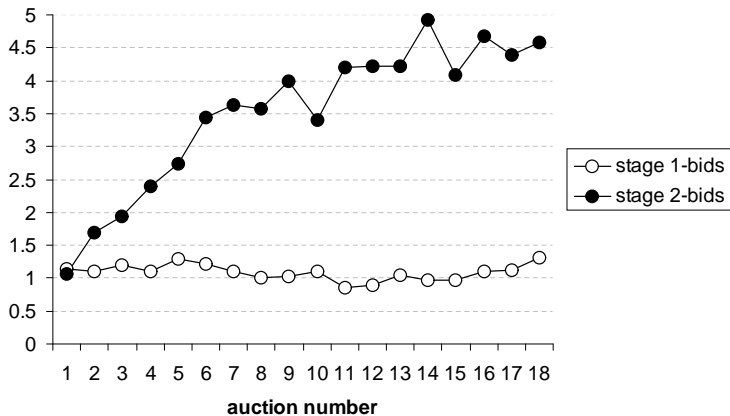
Amazon



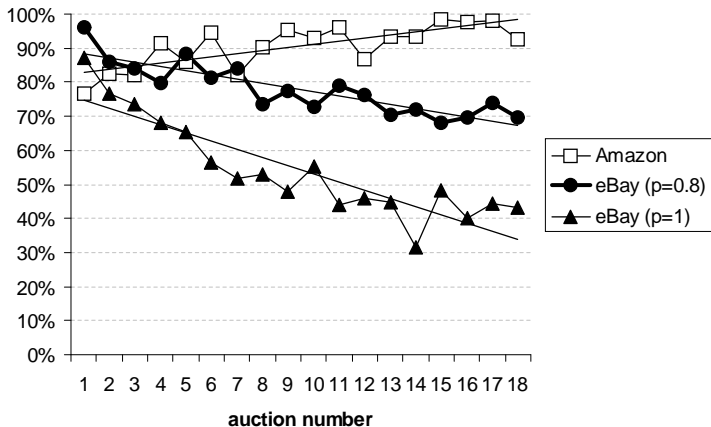
eBay.8



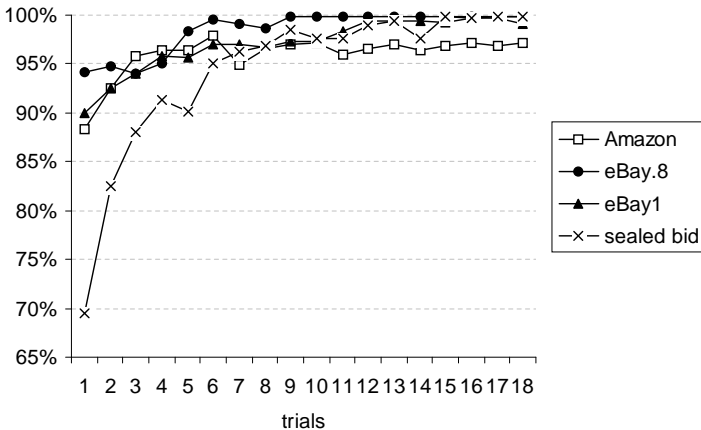
eBay1



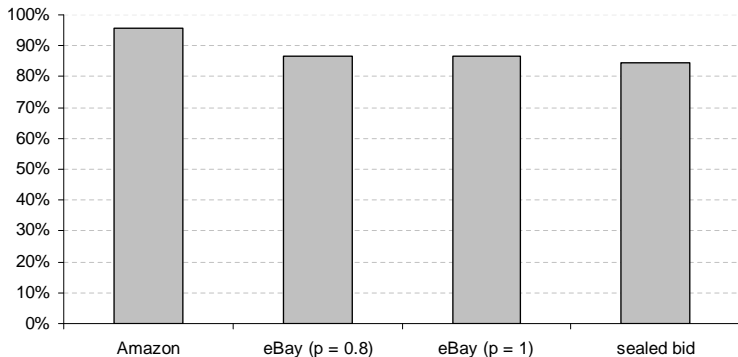
Price Discovery: Final stage 1-price (in Amazon: first stage 1) as percentage of final price



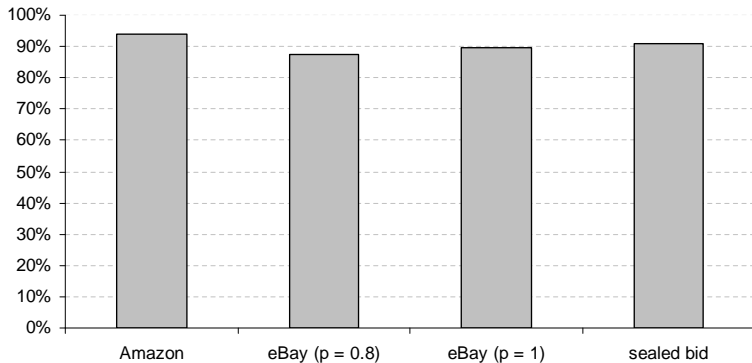
Median of final bids (including lost stage 2-bids) as a percentage of value



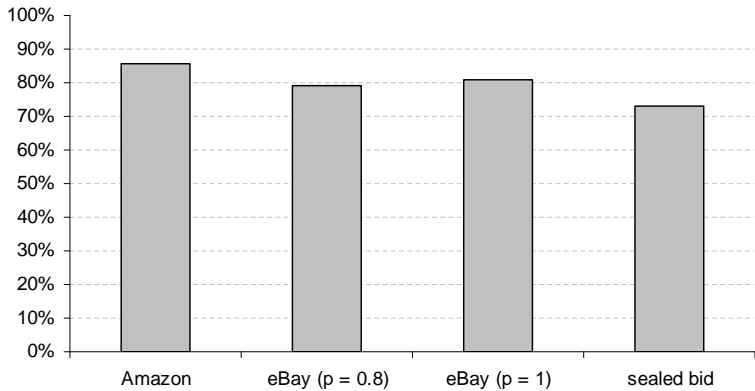
Average revenues relative to second price - all trials



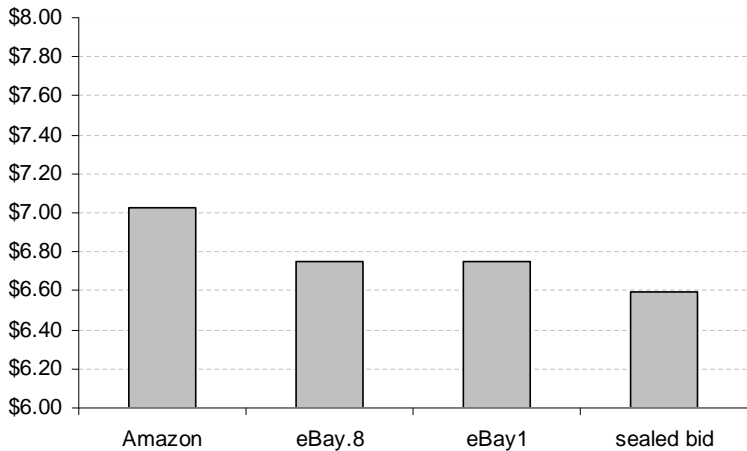
Average revenues relative to second price - last 8 trials



Average efficiency



Median revenues



Further Design questions raised by the results

- ▶ Does a fixed-deadline auction of a private value good raise less revenue than one with the same number of bidders in which bidding is extended until no one wants to bid anymore? (Because when many bidders plan to bid at the last minute, some don't make it?)
- ▶ Could the increased entertainment value of a fixed deadline attract sufficiently many bidders to overcome this?
- ▶ Does fixed-deadline auction of a common-value good attract more sellers of high quality objects than one in which bidding is extended until no one wants to bid anymore? (Because the latter deters experts from bidding?)

Some final, methodological thoughts

Eclectic Methodology

- ▶ We use theory, field data, surveys, laboratory experiments. . .

Timing of Transactions is important

- ▶ As a profession, economists study the price of transactions much more than we study their time and place, but timing is an important strategic variable. In some markets, the entire organization of the market reflects attempts to control strategic behavior related to timing.

Design, learning, and prediction - Market design is about understanding markets both when they are new and when they are old, i.e. both when players are inexperienced and when they are experienced. So, the design tools that we are most in need of are theories of learning that can predict behavior in novel environments.

Details matter - but there may be general theories about which details matter.