Late Bidding in Internet Auctions:

(Starting with field data, and moving on to experiments, with a little theory on the way)


Ariely, Dan, Axel Ockenfels, and Alvin E. Roth. “An Experimental Analysis of Late-Bidding in Internet Auctions” working paper, 2002.

Others have studied late bidding, among other things, using internet auction data, for a review on bidding in internet auctions see:


Overview:

An important issue in auction design concerns the rules for ending the auction. The internet auctions run by eBay and Amazon present a natural comparison.

Auctions on eBay have a fixed end time. Auctions on Amazon, which operate under similar rules, do not have a fixed end time, but continue past the scheduled end time until ten minutes have passed without a bid.

There is significantly more late bidding on eBay than on Amazon. Furthermore, 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 also 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. between eBay and Amazon. Controlled experiments help better understand these results.
The basic rules of Amazon and eBay auctions

- **Second price** auctions (bidders may submit their reservation price (also called a *proxy bid*); the resulting *bid* registers as the minimum increment above the previous high bid, and rises until it is reached, or until it exceeds the minimum increment over the next highest reservation price). The winning bidder is therefore the one who has submitted the highest reservation price, and the price he pays is the minimum increment over the second highest reservation price.

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

Item #302534742

Description

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

Current bid: $1,555.00
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 the winning bidder, you will enter into a legally binding contract to purchase the item from the seller.

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!

eBay purchases are insured.
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!
Bid history of completed auction

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.

<table>
<thead>
<tr>
<th>Last bid for this item:</th>
<th>$1,626.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date auction ends:</td>
<td>Apr-11-00 16:20:59 PDT</td>
</tr>
<tr>
<td>Date auction started:</td>
<td>Apr-06-00 16:20:59 PDT</td>
</tr>
<tr>
<td>Seller:</td>
<td>vincelee [192]</td>
</tr>
<tr>
<td>First bid at:</td>
<td>$0.01</td>
</tr>
<tr>
<td>Number of bids made:</td>
<td>23 (may include multiple bids by same bidder)</td>
</tr>
</tbody>
</table>

Bidding History (in order of bid amount):

<table>
<thead>
<tr>
<th><a href="mailto:crjennemu@aol.com">crjennemu@aol.com</a> [-1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last bid at: $1,626.00</td>
</tr>
<tr>
<td>Date of bid: Apr-11-00 16:20:59 PDT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>dskatcher [0] 🍋</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last bid at: $1,601.00</td>
</tr>
<tr>
<td>Date of bid: Apr-11-00 16:04:15 PDT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>xo6ho [0]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last bid at: $1,556.00</td>
</tr>
<tr>
<td>Date of bid: Apr-09-00 11:17:33 PDT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>buxiapo [0] 🍋</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last bid at: $1,550.01</td>
</tr>
<tr>
<td>Date of bid: Apr-10-00 11:37:19 PDT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>dk210 [2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last bid at: $1,400.00</td>
</tr>
</tbody>
</table>

23 bids but only 14 bidders

last bid came in at the last second
Another kind of bidding agent

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.

Your maximum bid amount

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 BidPrints 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.
# eBay Bid History for

**SC** RRR! SUPERB PAIR OF ROMAN BRONZE MACE!! (Item # 1470287307)

<table>
<thead>
<tr>
<th>Currently</th>
<th>$71.51</th>
<th>First bid</th>
<th>$49.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>1</td>
<td># of bids</td>
<td>6</td>
</tr>
<tr>
<td>Time left</td>
<td><strong>Auction has ended.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Started</td>
<td>Sep-30-01 14:43:10 PDT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ends</td>
<td>Oct-10-01 14:43:10 PDT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seller (Rating)</td>
<td>saruman.com (149) ★</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

## Bidding History (Highest bids first)

<table>
<thead>
<tr>
<th>User ID</th>
<th>Bid Amount</th>
<th>Date of Bid</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="mailto:jglass@dgei.com.au">jglass@dgei.com.au</a> (65) ★</td>
<td>$71.51</td>
<td>Oct-10-01 13:42:28 PDT</td>
</tr>
<tr>
<td>aer51 (24) ★</td>
<td>$70.51</td>
<td>Oct-10-01 14:43:06 PDT</td>
</tr>
<tr>
<td><a href="mailto:jglass@dgei.com.au">jglass@dgei.com.au</a> (65) ★</td>
<td>$61.00</td>
<td>Sep-30-01 17:21:15 PDT</td>
</tr>
<tr>
<td>victrius1 (70) ★</td>
<td>$56.01</td>
<td>Oct-10-01 14:42:48 PDT</td>
</tr>
<tr>
<td>jisc98357 (376) ★ mo</td>
<td>$52.00</td>
<td>Oct-08-01 15:05:47 PDT</td>
</tr>
<tr>
<td><a href="mailto:dslattene@aol.com">dslattene@aol.com</a> (61) ★</td>
<td>$50.00</td>
<td>Sep-30-01 21:47:30 PDT</td>
</tr>
</tbody>
</table>

Remember that earlier bids of the same amount take precedence.
The founder of esnipe decided to sell it…
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

eBay.com’s view (1999)
“Bid Sniping (last minute bidding)
eBay always recommends bidding the absolute maximum that one is willing to pay for an item early in the auction...”

A seller’s view (Axis Mundi, 1999)
“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.”

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.”
Note that in an isolated *independent private value* auction, it would be a *dominant* strategy for bidders in a second-price sealed-bid auction to submit their maximum willingness-to-pay. But these aren’t sealed bid auctions.

Note also that if all bids on eBay were “sniping bids,” eBay would essentially be converted into a sealed bid auction, one with some uncertainty about whether bids would go through. (Although 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  
(without bidder valuations yet)

- $n$ bidders, $N = \{1, K, n\}$
- 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.
  - 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.
  - Second, if the current high bidder submits a new, higher bid, the current price is not raised, although the number of bids is incremented.
- Each submitted reservation price must exceed both the current high bid and the bidder’s last submitted reservation price.

- **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 $p(v_j - m - s) > 0$, 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.)

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 $p(v_j - m) < v_j - m$, 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 (but not on Amazon)

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.”


Bidding very near the end of the auction would give the sentry bidder (incremental 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.
Late bidding as best response to incremental bidding

If *richardb2* had bid later, he would have saved $2,405.00
2. Defense against dishonest sellers (‘shill bidding’)

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.

“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.”

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 $v_i$ 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.)

And 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.

Thus at such an equilibrium, expected bidder profits will be higher (and seller revenue lower) than at the equilibrium at which everyone bids true values early.

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). However, eBay as the much bigger auction house, will have more parallel auctions, which means bidders may be more motivated to delay bidding so as to not commit early on to a specific auction...

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

*Other reasons for differences in late bidding between Amazon and eBay?*

*Can there be strategic reasons to bid late in Amazon as well?*
## Hypotheses about the causes of late bidding

<table>
<thead>
<tr>
<th>Strategic hypotheses</th>
<th>Hypothesis</th>
<th>Predicted contribution to late bidding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. <em>Rational response to naïve English auction behavior or to shill bidders:</em> bidders bid late to avoid bidding wars with incremental bidders</td>
<td>All three strategic hypotheses suggest more late bidding on eBay than on Amazon, with a bigger effect for more experienced bidders. Plus (via part c) more late bidding in categories in which expertise is important than in categories in which it is not.</td>
</tr>
<tr>
<td></td>
<td>b. <em>Collusive equilibrium:</em> bidders bid late to avoid bidding wars with other like-minded bidders.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. <em>Informed bidders protecting their information:</em> e.g. late bidding by “expert/dealers.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-strategic</td>
<td>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.</td>
<td>No difference between eBay and Amazon. <em>In fact, eBay as the bigger auction house, may warrant more late bidding because of a preference for flexibility across auctions, not strategic bidding behavior within an auction.</em></td>
</tr>
<tr>
<td>hypotheses</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comparisons of eBay and Amazon

A natural comparison arises because of differences in the auction rules of two large auction houses, eBay and Amazon. This allows a preliminary test of naïve versus sophisticated bidding explanations of observed bidding behavior.

Description of the data

- Amazon and eBay publicly provide data about the bid history.
- 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.

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

Σ

In total, Roth and Ockenfels randomly selected 480 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: how many seconds before the deadline was the last bid submitted, if the bid came in within the last 12 hours of the auction time.

- For each last bid in Amazon, they 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 however, shows up as 120 seconds before the deadline.

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 RO call the “feedback number” in eBay.

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

- The cumulative number of ratings are referred to as the “feedback number” in Amazon.
Late bidding
Cumulative distribution of bidders’ last bids over time

Cumulative distribution of auctions’ last bids over time
### When are the last bids submitted?

<table>
<thead>
<tr>
<th></th>
<th>bidder level</th>
<th>auction level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>eBay</td>
<td>Amazon</td>
</tr>
<tr>
<td>last hour</td>
<td>20 %</td>
<td>7 %</td>
</tr>
<tr>
<td>10 minutes</td>
<td>14 %</td>
<td>3 %</td>
</tr>
<tr>
<td>5 minutes</td>
<td>13 %</td>
<td>1 %</td>
</tr>
<tr>
<td>1 minute</td>
<td>8 %</td>
<td>0.1 %</td>
</tr>
<tr>
<td>10 seconds</td>
<td>2 %</td>
<td>0 %</td>
</tr>
</tbody>
</table>

Furthermore, more experience causes eBay bidders to bid later, but causes Amazon bidders to bid earlier.
<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>All bidders’ last bids</th>
<th>Auctions’ last bids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Run 1</td>
<td>Run 2</td>
</tr>
<tr>
<td></td>
<td>coeff. (p-value)</td>
<td>coeff. (p-value)</td>
</tr>
<tr>
<td>Constant</td>
<td>– 1.567 (0.000)</td>
<td>– 1.420 (0.000)</td>
</tr>
<tr>
<td>eBay</td>
<td>0.773 (0.000)</td>
<td>1.140 (0.000)</td>
</tr>
<tr>
<td>(= 1 if eBay and 0 if Amazon)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computers</td>
<td>– 0.187 (0.021)</td>
<td>– 0.261 (0.063)</td>
</tr>
<tr>
<td>(= 1 if Computers and 0 if Antiques)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feedback#</td>
<td>0.001 (0.012)</td>
<td>0.003 (0.017)</td>
</tr>
<tr>
<td>#bidders</td>
<td>– 0.036 (0.003)</td>
<td>0.074 (0.001)</td>
</tr>
<tr>
<td>eBay*Computers</td>
<td>0.441 (0.046)</td>
<td>0.644 (0.040)</td>
</tr>
<tr>
<td>(1 – eBay)*Computers</td>
<td>– 0.264 (0.168)</td>
<td>– 0.268 (0.284)</td>
</tr>
<tr>
<td>eBay*(1 – Computers)</td>
<td>0.653 (0.002)</td>
<td>.995 (0.001)</td>
</tr>
<tr>
<td>eBay*Feedback#</td>
<td>0.001 (0.008)</td>
<td>0.003 (0.015)</td>
</tr>
<tr>
<td>(1 – eBay)*Feedback#</td>
<td>– 0.034 (0.059)</td>
<td>– 0.035 (0.095)</td>
</tr>
<tr>
<td>eBay*#bidders</td>
<td>– 0.039 (0.003)</td>
<td>0.071 (0.007)</td>
</tr>
<tr>
<td>(1 – eBay)*#bidders</td>
<td>– 0.026 (0.401)</td>
<td>0.068 (0.124)</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>– 650.6</td>
<td>– 646.4</td>
</tr>
<tr>
<td>Number of observations</td>
<td>2279</td>
<td>2279</td>
</tr>
</tbody>
</table>

**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?
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.

In addition, 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, \(N = 65\)).

We also find 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 naiveté or other non-rational cause, particularly since the evidence suggests that it is reduced with experience.
Additional, strategic reason for late bidding on Amazon:

- Bidders may be held up, and not be able to observe the auction in the last minutes.
- Assume that monitoring an auction is costly (watching these Amazon auctions in the end is quite boring: as we have seen, often not much happens…)

In order for there to be no strategic reasons to bid late in Amazon, all auctions have to be watched in the end. If, however, nothing ever happens in the last minutes, it is not profitable to watch the auction. That suggests there will be some mixed equilibria, with some auctions being watched, some not, and hence some chance to submit a bid that triggers no response.

We will see, that this additional hypothesis, the authors did not take into account, will be also left out of the experimental design

(Most likely we don’t control or address additional possible hypotheses away with our experimental design, if we didn’t think of these beforehand. This is why a big part of the success of our experiments will depend on the thoughts that went into the design. However, no experimental design will allow us to control for every possible explanation, so we have to pick the one we care about the most.)
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 auction house 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 many other differences.
Experimental Design

<table>
<thead>
<tr>
<th>Auction type</th>
<th>Number of stage 1 periods</th>
<th>Number of stage 2 periods</th>
<th>Probability of stage 2 period to register</th>
</tr>
</thead>
<tbody>
<tr>
<td>sealed bid</td>
<td>0</td>
<td>1</td>
<td>100%</td>
</tr>
<tr>
<td>eBay1</td>
<td>Depends on bidders</td>
<td>1</td>
<td>100%</td>
</tr>
<tr>
<td>Ebay.8</td>
<td>Depends on bidders</td>
<td>1</td>
<td>80%</td>
</tr>
<tr>
<td>Amazon</td>
<td>Depends on bidders</td>
<td>Depends on bidders</td>
<td>80%</td>
</tr>
</tbody>
</table>

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 (I think in increments of 1 cent). 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. (if the other bidder did not bid, the auction was won at a bid of 1)
**eBay.8**

**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.

**eBay1**

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.
Amazon

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.)

30 groups of 6 participants each (8 in each of Amazon, eBay.8 and eBay1, and 6 in sealed bid). Random rematching, for 20 rounds, however, programming error in rounds 19,20 of eBay.8, hence only report data for rounds 1-18 (but others look similar).

Program used Ztree.
Notice that the experiment Ariely, Ockenfels and Roth design doesn’t look exactly like eBay or Amazon. (And if they had wanted to use exactly those interfaces, they could have done so by e.g. putting artificial commodities for sale on eBay and Amazon.)

Instead, they create

- A discrete environment (instead of continuous time)
- Only (exactly) two bidders per auction
- Artificial commodities
- Purely private (artificial) goods

This allows to record bids that don’t make it.
Frequency of Sniping: Stage 2-bids (in Amazon: first stage 2) per bidder and 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.
Frequency of early bidding: Stage 1 bids per bidder and auction

That is, the increase in stage 2 bids is not just an increase in general bidding activity in the eBay treatments.
Share of bids submitted by current high bidder

In eBay 1 almost 50% of stage 2 bids are from the high bidder, that is stage 2 bids are (almost) equally likely to come from the high bidder and the current low bidder.

In general, it appears that more so in the eBay than in the Amazon treatments, do bidders plan stage 2 bids, independently whether they are the high bidder or not.
We now turn to examine the *magnitude* of early and late bids: Average increase of proxy bid (conditioned on bidding) over current minimum bid.
Average increase of proxy bid (conditioned on bidding) over current minimum bid
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
Figure 7. Average efficiency

Median revenues
What we learn from the experimental data:
- The difference in ending rules between Amazon and eBay is sufficient to cause the bidding patterns observed in the field.

Knowing the results from the experiment only we could not be confident, that we would observe the same effect on the internet. In the lab, people are already sitting in the experiment, maybe they wouldn’t bid late otherwise (they may have better things to do, than wait and log on in the last minutes to bid on an auction).

What we learned from the field data:
- Late bidding is an important phenomenon.
- Several potential reasons could lead to differences in late bidding between Amazon and eBay: These auction houses differ in
  - ending rules,
  - size,
  - number of auctions ending at the same time
  - potential self selection issues of bidders, sellers, items…

The fact that the difference in ending rules produces the pattern of bidding behavior in the field, does not mean that some of these other differences do not also contribute to differences in bidding behavior.

Seeing the phenomenon both in the field and in the lab can give us some indication of its robustness. The rules of the auctions influence the timing of transactions, and hence the final outcome of the auction.
Some methodological thoughts:

**Eclectic Methodology**

To investigate late bidding on eBay, and it’s reasons, we have seen theory, field data, surveys, laboratory experiments…

- The experiments are designed to answer particular questions that we can’t answer as well with field data.
- However, without the field data, the results from the experiment would be less interesting, we could not be sure that the auction ending rules alone have an effect on bidding behavior.
Which questions remain?

- It seems that a fixed-deadline auction of a *private value* good may 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…)

- Why did we not see a big effect in the Ariely, Ockenfels and Roth experiement? Can we think of a different design that may have provide us with clearer results?

- Does the auction with a fixed deadline attract sufficiently more bidders to overcome this?

- What about *common value* goods? Does an open deadline deter experts from bidding, as they may not benefit from their expertise? Will sellers prefer a fixed deadline to attract more experts?

- In the competition across auction houses, what is the importance of the ending rule? Differences in revenues? Distribution of possible profits? Differences in entertainment value?