Application: e-commerce

Haihan Yu

Multi-agent Lab, Kyushu University

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eBay

How to run an auction on the Internet?

- Most important questions:

  - What price the highest bidder pays?

  - What information is posted about the current bidding?

- Most obvious choice is a first-price auction (in the form of an English **outcry** auction?).

  - Pay your bid if you win (easy to explain).

  - Post highest bid so far.

Issues

Such an auction makes sense only if bidders logged at the same time and follow in real-time the auction:

- Bidders want to bid just what is needed to win: a little bit above the current highest bid.
- We want to emulate the English auction.

In practice, people are not watching 24/7 the auction.

- Bidding one's valuation is not interesting (surplus $= 0$)
- Makes the game more complicate: how much underbid?
- Buyers not enticed to come back if surplus is too small.

More generally: running a first-price internet auction over an extended period of time is not a good way to emulate the English auction.

So let's do a 2nd price auction. But what price should we display?

- Suppose we display the highest bid.
- There are 2 bids so far: $1 and $100.
- My value is $50: I don't want to bid (I know I lose).
- Bidder with $100 wins, pays only $1: a disaster for the seller.

Solution adopted by eBay: display (something close) the 2nd highest bid.

We have the **California auction**:

- 2nd price auction: displayed price based on 2nd highest bid.
- dynamic auction: the auction takes time, you can revise you bid.

When placing a bid, eBay asks the **maximum bid**, and eBay will
bid on the bidder's behalf, using increments that work like ticking
prices:

Current price	Bid Increment
$0.01 − $0.99	$0.05
$1.00 − $4.99	$0.25
$5.00 − $24.99	$0.50
$25.00 − $99.99	$1.00
$100.00 − $249.99	$2.50
. . .	. . .
$50,000.00 and up	$100.00

Example:

- The current price on display is $10.00.
- I bid $30.00.
- The price goes to $10.50.

So, eBay works like a 2nd price auction:

- eBay bids (on my behalf) "just above" the highest price:

  the lowest bid I need to win.
- the previous highest price ($10.00) is in fact now the 2nd highest bid
- The new price is then the 2nd highest bid (+ the $0.50 increment).

- What if there is another bidder comes later and bids $40?

- eBay will automatically compute the outcome of the "bidding war" between me and the other bidder.

    - Up to $30 I continue to bid. At that price I stop (better said: eBay stops bidding on my behalf)

    - The last price is $31, i.e., my final bid of $30 + the increment of $1.

- Since everybody uses the proxy bidding, the auction is solved "immediately": as soon as I bid $30, the price jumps to $31.

    $31 =$ the lowest bid that the new bidder (with the $40 bid) needs to win.

▸ ebay

What eBay displays

- Time left before the end of the auction, shipping information, description of the item, etc.

- **Current bid**: the price the winner will pay (if there are no further bids).

  If no bid made yet then eBay shows the **starting bid** ($=$ minimal price set by seller).

- a frame where the bidder can place a bid, saying

  <div align="center">"Enter $\$X$ or more"</div>

  X is the **minimal bid**

Formulae

$$\text{Minimal bid} = \begin{cases} \text{starting bid} & \text{if first bid} \\ \text{current bid} + \text{increment} & \text{if not first bid} \end{cases}$$

What about the current bid? See what happens if a bid is made.

Notation: $b_2 = $ 2nd highest bid.

$$\text{New current bid} = \begin{cases} \text{starting bid} & \text{if first bid} \\ b_2 + \text{incr.} & \text{if } b_2 + \text{incr.} \leq \text{bid} \\ \text{bid} & \text{if } b_2 + \text{incr.} > \text{bid} \end{cases}$$

Wrap up:

- **General rule:**

  Current bid = (in general) second highest bid + increment.

- If (second highest bid + increment) > highest bid then eBay does **not** follow the general rule, but instead sets

  current bid = highest bid.

- Winner pays the current bid.

What is the 2nd highest bid?

eBay ranks bids first by amount (highest to lowest), then by date (earliest to latest)

Example

Bidder	Bid	Date
Alice	$50	10:00am
Bob	$40	10:10am
Chris	$50	10:20am

Rank of bids:

Date	Highest bid (bidder)	2nd highest bid (bidder)
10:00am	$50 (Alice)	—
10:11am	$50 (Alice)	$40 (Bob)
10:21am	$50 (Alice)	$50 (Chris)

Case 1: no bid made yet

Starting bid	Minimal bid
$10	$10

Alice makes a first bid, of $20.

Current bid	Minimal bid
$10	$10 + $0.50 = $10.50

Note: Whether Alice bids $20, $1,000 or $10 the table would be the same.

Current bid	Minimal bid	**Highest bid (Bob)**
$20	$20 + $0.50 = 20.50	**$30**
		(Not observed
		by other bidders!)

Chris posts a bid of $21. She becomes 2nd highest bidder.

Current bid	Minimal bid
$21 + $0.50 = 21.50 (Bob)	$21.50 + $0.50 = 22
↑	
Lowest bid Bob	
needs to win	

Case 2.1: some bids already made - new bid is highest

Current bid	Minimal bid	**Highest bid (Bob)**
$20	$20 + $0.50 = $20.50	**$30**
		(Not observed
		by other bidders!)

Carol posts a bid of $35. She becomes highest bidder, Bob becomes the 2nd highest bidder.

Current bid	Minimal bid
$35 + $1 = $36 (Carol)	$36 + $1 = $37
↑	
Lowest bid Carol	
needs to win	

Current bid	Minimal bid	**Highest bid (John)**
$40	$40 + \$1 = \$41$	**$50**
		(Not observed
		by other bidders!)

Erin posts a bid of $49.87. She becomes 2nd highest bidder.

Current bid	Minimal bid
$50 (John)	$50 + \$1 = \$51$
↑	

2nd highest bid + incr.
$= \$50.87 > \text{bid}_{\text{John}}$

Current bid	Minimal bid	**Highest bid (John)**
$40	$40 + $1 = $41	**$50**
		(Not observed
		by other bidders!)

Erika posts a bid of $50.03. She becomes highest bidder, John becomes the 2nd highest bidder.

Current bid	Minimal bid
$50.03 (Erika)	$50.03 + $1 = $51.03
↑	

2nd highest bid + incr.
= $51 > $\text{bid}_{\text{Erika}}$

Current bid	Minimal bid	**Highest bid (Frank)**
$110	$110 + $2.50 = $112.50	**$150**
		(Not observed
		by other bidders!)

Gina posts a bid of $150, **after Frank** She becomes 2nd highest bidder.

Current bid	Minimal bid
$150 (Frank)	$150 + $2.50 = $152.50

$\uparrow$

2nd highest bid by Gina

but $\text{bid}_{\text{Gina}} + incr. > \text{bid}_{\text{Frank}}$

$\Rightarrow$ 2nd highest bid = Gina's bid

Bidding several times?

- 2nd-price auction: dominant strategy to bid one's valuation.

- But with eBay bidders can change their bids. . . and they indeed do so:

    - They don't understand the bidding proxy system: they don't bid their valuation.

    - They change their estimates of their valuations: common if interdependent valuations (see section about sniping)

Bidder 1	Bidder 2	Displayed price	comment
		$1.00	Starting price
$20.00		$1.25	Bidder 1 wins
	$40.00	$20.50	Bidder 2 wins
$21.00		$21.50	Bidder 2 wins
$22.00		$22.50	Bidder 2 wins
$23.00		$23.50	Bidder 2 wins
$31.00		$32.00	Bidder 2 wins
$35.00		$36.00	Bidder 2 wins

Bidder 1 may believe someone is having a bidding war with her.

- So bidders can quickly end up thinking eBay is just an auction room like Sotheby's, i.e., forgetting about the proxy bidding.

- if auction deadline is close, bidders can engage in a pursuit by bidding only small increments, and get more frantic as the deadline approches.

Many people believe that eBay is akin to a first-price auction: I pay my bid (if I win). It comes from bidders' behavior: bidders bid the minimal amount.

- item for sale, current highest bid = $10.

- eBay displays:
    - Current bid: $10
    - Minimal bid: $10.50

- Janis bids $10.50 (what most people do)

- Suppose she wins (with that bid). So she pays $10.50.

    ⇒ She believes she pays her bid.

- Actually, she paid second highest bid + increment.

- Had she bid $500, she would still pay $10.50.

Bid sniping (last minute bidding)

From Roth and Ockenfels (Amer. Econ. Review, 2002)

From 1999 to 2006 Amazon had an auction Website (like eBay).

Auctions on Amazon worked very much like eBay:

- English ascending auction
- Proxy bidding
- So theoretically it's a 2nd price auction

However. . .

- on eBay: The auction has a hard deadline
- on Amazon: If there's a bid in the last 10 minutes, the deadline is extended for an additional 10 minutes.

Main issue with late bidding is that the bid may not be successfully transmitted.

- Buyers complain that their bid was not processed.

- Lower revenue for sellers.

Proxy bidding aimed at protecting bidders against late bidders: Submitting one's true valuation is an insurance against snipers.

Late bidding is good

- May face inexperienced bidders who bid by small increments:

  - If I bid early the "incremental bidder" (inexperienced) will overbid, we may end up with a high price.

  - If I bid late, the bid war doesn't last long
    $\Rightarrow$ lower final price

  - Last minute bidding: The incremental bidder doesn't have time to respond.
    Can win the auction at the incremental bidder's low initial bid.

- A seller may also use **shill bidders** to bid against (real) bidders.
  Bidding late is a way to protect from such (dishonest) behavior.

Should observe more late bidding on eBay than on Amazon.

With interdependent/common values late bidding has a double rationale:

- More time to gather information from the other bids

- Avoid giving information to the other bidders.

  Particularly relevant for bidders who are identified as "experts."

Ability to bid without providing information to the other bidders (or information that can be used) is lower on Amazon.
$\Rightarrow$ Should observe more late bidding on eBay than on Amazon.
But if bidding late a **strategic** choice, we should not observe any difference between eBay and Amazon.

Hypothesis about late bidding (summary)

Hypothesis	Predicted observation
Strategic hypothesis – Avoid war agains incremental bidders – Protecting one's information	More late bidding on eBay than Amazon
Non-strategic hypothesis – Procrastination – Search engines first present soon-to-expire auctions – Bidders unaware of proxy bidding – Valuation increases (endowment effect) – Bidders don't like bids hanging	No difference between Amazon & eBay

Data analysis

Roth and Ockenfels used data from eBay and Amazon in "**Computers**" and "**Antiques**" categories.

- Computers: private values.
  - retail prices are easily available.
  - bidder's valuations are unobserved. Bids convey little information.

- Antiques: interdependent values.
  - retail prices more difficult to obtain.
  - Valuations are noisy. expert's opinion is sometimes required. Bids are likely to convey information.

- Auctions between Oct. 1999 and Jan. 2000

    - Computers: selected monitors and laptops.

    - Antiques: no selection.

- Auction data only included if

    - At least two bidders

    - reserve price met whenever there was a hidden price.

For each combination Computers/Antiques & Amazon/eBay 120 auctions:

	Computers	Antiques
Amazon	595 bidders	340 bidders
eBay	740 bidders	604 bidders

- bidders' ratings also collected
- Ratings differ between Amazon (1–5 star) and eBay (± 1), but can serve as approximate measure of experience.

For each bid, number of seconds before the end of the auction:

- For eBay unambiguous.
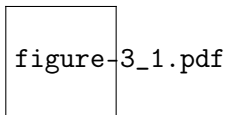- For Amazon: number of seconds before **hypothetical** deadline.

    Example: Auction set to end at 11:00am.
    - Bidder A bids at 10:55am. So new deadline at 11:10am.
    - Bidder B bids at 11:09am. So new deadline at 11:20am.
    - No further bid.

    For data analysis:
    - Bidder A's bid: 5 minutes before the end
    - Bidder B's bid: 1 minute before the end

Cumulative distribution of auctions' last bids

- **Percentage of auctions w/ bid in last 5 minutes:**

	Computers	Antiques
Amazon	3%	3%
eBay	40%	59%

  (similar pattern when looking at last minute and last 10 seconds).
- on eBay bidders bid later in Antiques than in Computers.
- Significant differences for:
  - more late bidding in eBay than Amazon for Computers
  - more late bidding in eBay than Amazon for Antiques
  - more late bidding in eBay-Antiques than eBay-computers

  (Amazon-Antique $\approx$ Amazon-Computer).
- Experienced bidders bid significantly later on eBay.

- For eBay: late bidding significantly more pronounced for antiques (where expertise matters)

- in a survey, bidders explicitly say that late bidding is

  - to avoid bidding wars (and keep the price down)

  - to avoid sharing information with other bidders.

Conclusion: Auction design influences behavior
Hard deadline gives incentive to bid late.

Stronger effect with:

- experienced bidders

- interdependent values (bids are informative).

The seller can put a **reserve price**, which is the minimal price for which the good can be sold.

- Reserve price $\neq$ start price
  - low start price to encourage bidding
- The reserve price can be public.
  - Signal to bidders that the item is valuable
- Secret reserve price
  - becomes equivalent to a "shill bid." Whenever someone bids below, it is outbid.
  - Can trigger a bidding war with the bidders.

- First item sold on eBay: Sept. 1995, a broken laser pointer, sold for $14.83

- By 2002 eBay has hosted for $15 billon of transactions.

- More registred users than the UK population.

- Today: only 20% of sales involve auctions.

- 2000: eBay introduces "hybrid auctions":

  - Regular auction

  - Auction can be circumvented by clicking on "**By it Now**"

  - Study shows that high "By it Now" price boosts the final auction price (bidders think the object is valuable).

- Professional sellers set minimal bid to the "By it Now" price, making the auction irrelevent.

- 2002: eBay allows sellers to post objects at fixed prices, without auction.

- Analysis by Einav, Farronato, Levin and Sundaresan (2017): Between 2005 and 2009, share of auctions dropped by 33%:
  - 2.5% greater presence of mass-produced goods
  - 2.8% presence of professional sellers.
  - 27.7% = ?

Findings

- Few bidders use the "proxy bidding"

- Most buyers adjust their bids from time to time (30% of bidders submit more than one bid).

- Open the way for snipping, but make auctions a hassle.

- Makes the auction "labor intensive" shopping method, it needs attention. Users prefer "fast methods".

- Objects sold through an auction get a discount of about 8%: the "cost" of shopping, searching.

Take-away

- the eBay auction is, at its core, a **second-price** auction.

- bidding is made via a **proxy**: eBay bids on behalf of the voters.

- Unlike the Vickrey auction, the eBay auction is also **dynamic**: bidders can update their bids.

- Truthful bidding is not a dominant strategy on eBay.

- Sniping (late minute bidding) is an important part of eBay's auction.

- Sniping essentially occurs because of **hard deadlines**.

- Sniping less likely to occur when valuations are private (as opposed to interdependent or common values).

- Use of auctions on eBay is declining, the use of posted price (buy it now!) increases.