Dynamic Structural Models

5. Dynamic Auctions

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Dynamic Auctions

- Start with classic ascending auction (also called *English auction*):
  - Auction starts.
  - Bidders publicly reveal new bids ("open-cry")
  - Auction ends when bidding stops.
- This is a *dynamic* auction: bidding takes place over time.
  - Contrasts with sealed-bid auctions.

Frictionless bidding

- If bidders can continuously and perfectly monitor the auction, strategic equivalence between English and second-price sealed bid auctions.
  - Second-price sealed bid: unique dominant strategy of bidding one's valuation.
  - Frictionless English auction: creep one's bid up in very tiny increment until the price passes one's valuation.
- If we're satisfied that bidding is frictionless, we can use the sealed-bid model to estimate a dynamic auction.
  - We can test for frictions if all bids are observed: if a "jump bid" wins the auction, strong evidence of bidding frictions.

Estimation with frictionless bidding

- Without frictions, ascending auctions can be estimated "as-if" it were a sealed-bid auction.
- Often, the data available is the *number of bidders* and the *transaction price* (or winning bid).
- Each bidder bids his/her own valuation, so the data contain the second-highest valuation in each auction.
- Formally, we observe the distribution of the second-highest order statistic.

Estimation with frictionless bidding

- Independent Private Values, bidder value distribution is $F_V(w)$.
- Suppose we observe the distribution of the second-highest valuation, which we denote $H^{(N)}(w)$ (probability that the transaction price is lower than w).

$$H^{(N)}(w) = \sum_{j=N-1}^{N} \binom{N}{j} F_V(w)^j \Big[1-F_V(w)\Big]^{N-j} = NF_V(w)^{N-1}\Big[1-F_V(w)\Big]+F_V(w)^N$$

  - $NF_V(w)^{N-1}[1 - F_V(w)]$ = Prob. exactly one bidder has value above w.
  - $F_V(w)^N$ = Prob. all bidders have value below w.
- This equation is monotonic in $F_V(w) \Rightarrow$ model is identified.

Ascending Auctions with Bidding Frictions

- Not all auctions will satisfy the frictionless bidding assumption.
- Barkley, Groeger, and Miller (2021) document money left on the table (i.e., winning "jump bids") in auctions for financial products.
- Rationalizing jump bids: bidders have random opportunities to place bids governed by distribution G.
  - With positive probability, no chance to place another bid if current bid is surpassed.
  - Jump bids guard against chance of losing due to missing another bid opportunity.