Why might an online auction get more revenue than an in-person one?

Evidence from North Dakota Mineral Auctions

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Brief Context

- Mineral rights are the right to drill for oil and gas in a particular location
- In 2012, the state of North Dakota began moving mineral auctions online
- Auctions are held on a quarterly basis, and there was a period when the auction venue alternated between being in person and online
- All North Dakota state land trusts mineral rights are auctioned in an ascending price (English) auction

Research Questions

1. Why do online auctions yield about 3 times the revenue as in person auctions?
   - Is it collusion or simply more bidders?
2. Is it the Bidder's private valuations (say different costs) or unobserved bidder-wide heterogeneity (say poor geology) that accounts for more of the unexplained variation in prices?

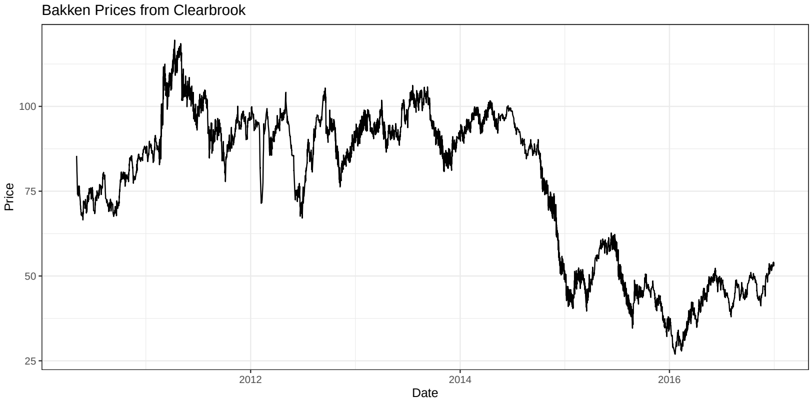
I plan to answer these questions by calibrating a structural model of bidder values using the bid data from the online auctions and using this to generate counterfactual results about the live auctions to test answers to question 1. A parameter of interest from the structural model may answer question 2.

Prior Literature

- Milgrom and Weber (1982) is a seminal auction theory paper providing bidding strategies in relevant auction types
- Bajari and Hortaçsu (2003) structurally models bidding in eBay book auctions (ascending English)
- Athey, Levin, and Seira (2011) structurally models timber auctions (first price sealed bid)
- Hernández, Quint, and Turansick (2019) develop a nonparametric structural modeling technqiue for English auctions with umobserved heterogeneity that I would like to use

Data

- Auction results from the State of North Dakota's land trust
- Scrape the sequence of bids from auction platform, EnergyNet
- Descriptive well data from DrillingInfo
- Daily spot prices for the Clearbrook pricing center from S&P Platts.



Value Model

We will use the following model of how bidder i might value tract t:

$$\ln(V_{it}) = v(X_t) + \theta_t + \varepsilon_{it}$$

where

- X_t is a collection of properties of the tract and the market, observable to both the bidders and the econometrician (parcel size, market price, productivity of nearby wells)
- $v(\cdot)$ is some function, we may say for simplicity that $v(x) = \beta x$ or we may estimate something like a spline in prices to capture non-linearity
- θ_t is a parcel fixed effect drwn from f_θ (umobserved heterogeneity)
- ε_{it} is drawn from some distribution F and is the bidder's private value shock of the parcel drawn from distribution f_ε
- The econometrician doesn't observe either θ_t or ε_{it}, want to recover distribution of both

Non-Parametric Estimation

The following closely follows the method outlined in Hernández, Quint, and Turansick (2019)

1. Use regression to estimate $V(\cdot)$
2. Estimate an entry model (Poisson process) with a participation shifter (preexisting adjacent leases)
3. Quasi-parametrically specify f_ε and f_θ
4. Use MLE to find a good parameterization of the entry model and value model

The big quantitative task here is MLE to perform nonparametric structural estimation.

Reduced form Revenue

Table 1: Regressing winning bid on online auction controlling for year and location as proxies for price and mineral quality

	Dependent variable:			
	Log(Winning Bid) in $/acre			
	(1)	(2)	(3)	(4)
online	0.862***	1.565***	0.591***	1.010***
	(0.174)	(0.179)	(0.122)	(0.110)
Year FE	No	Yes	No	Yes
Location FE	No	No	Yes	Yes
Observations	2,135	2,135	2,135	2,135
R^2	0.011	0.084	0.832	0.913
Adjusted R^2	0.011	0.082	0.810	0.898
Note:		$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$		

Reduced form Competitiveness

Table 2: Regressing indicator function for an uncontested auction on whether the auction was online.

	Dependent variable:	
	Transact at Min Bid	
	(1)	(2)
online	−0.024	−0.241***
	(0.015)	(0.040)
Constant	0.252***	
	(0.008)	
Year*Location FE	No	Yes
Observations	4,346	4,346
R^2	0.001	0.764
Adjusted R^2	0.0004	0.725
Note:	*p<0.1; **p<0.05; ***p<0.01	

Future Tasks

- Determine most plausible model(s) for recovering distribution of values.
- Generate counterfactuals for live auction winning bids under the specifications
    - Collusion rule (TBD)
    - Fewer bidders (we can estimate attendance at the open outcry auctions)

Predictions:

1. A reduction in number of bidders will be able to account for the difference between open outcry and online. I expect a plausible reduction of maybe 1-3 bidders could close the gap.
2. I expect there is more variance in the bids due to private values than unobserved heterogeneity in this tight shale setting where people don't do research to acquire better estimates of the underlying resource.