Problem Set for Empirical IO - Part II

TSE, Winter 2014

Empirical Auctions Foundations[1]

Due date: April 15, 2014. Send to mreguant@stanford.edu.

Preliminaries: Data Creation

1. Generate 1000 valuations $x \sim U[0,1]$.

2. For 500 of the valuations, split them into 125 4-bidder auctions. For each of these valuations, calculate the corresponding equilibrium bid.

   Note: Show that the equilibrium bid function in the case of uniform valuations is $b(x) = \frac{N-1}{N}x$.

3. For the other 500 valuations, split them into 100 5-bidder auctions. For each of these valuations, calculate the corresponding equilibrium bid.

Part I: LOV

Use the Laffont, Ossard and Vuong (1996) parametric approach to first price auctions. For this calculation, assume that you only observe the winning bid (highest bid). Follow the estimation steps from the lecture notes.

1. Use a Beta distribution to estimate the underlying valuation function. Plot the estimated distribution against the underlying distribution.

2. Use a Log-normal distribution to estimate the underlying valuation function. Plot the estimated distribution against the underlying distribution.

   Note: The original LOV calibrated the variance of the log-normal distribution. Can you estimate it in your application?

3. Discuss.

Part II: GPV

Implement the Guerre, Perrigne, and Vuong procedure for an IPV auction model using the same data as above.

1. For each bid b_i, compute the estimated valuation $\tilde{x}_i$ using the GPV equation:

$$\frac{1}{g(b_i)} = (N_i 1)\frac{x_i - b_i}{G(bi)}$$

$$\leftrightarrow x_i = b_i + \frac{G(b_i)}{(N_i 1)g(b_i)}$$

(where Ni denotes the number of bidders in the auction that the bid bi is from).

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[1]This problem set is based on a similar problem set by Prof. Matt Shum at Caltech.

In computing the G and g functions, use the Epanechnikov kernel:

$$K(u) = \frac{3}{4}(1 - u^2)\mathbf{1}(|u| \leq 1).$$

Try four different bandwidths $h \in \{0.5, 0.1, 0.05, 0.01\}$.

2. For each case, plot x vs. $\tilde{x}$. Can you comment on performance of the procedure for different bandwidth values?

3. Compute and plot the empirical CDFs for the estimated valuations $\tilde{x}_i$, separately for $N = 4$ and $N = 5$. Discuss.

Part III: GPV with only first bid

Repeat the GPV estimation, but now imagine that you only have data on the winning bid.

1. Adapt the GPV equation to depend only on the distribution of first bids, which is what is now observed in the data.

2. Compare the performance of the GPV approach using only winning bids to the GPV approach when all bids are observed.

3. Compare the performance the GPV approach using only winning bids to the LOV approach.