"Level-*k* Auctions: Can a Non-Equilibrium Model of Strategic Thinking

Explain the Winner's Curse and Overbidding in Private-Value Auctions?,"

Supplementary material: Replicability Instructions for the Data Analysis

This document provides the initial-response data from the four treatments analyzed in the paper, as well as instructions and Matlab files for replicating the econometric analysis.

A. Data Sets

As explained in Section 5 of the paper, we use four data sets: KL First-Price Common-Value Auction (from Garvin and Kagel (1994)), KL Second-Price Common-Value Auction (from Kagel, Levin and Harstad (1995) as reprinted in Kagel and Levin (2002)), AK Second-Price Common-Value Auction (from Avery and Kagel (1997), and GHP First-Price Independent Private-Value Auction (from Goeree, Holt, and Palfrey (2002). As also explained in Section 5, we focus on subjects' initial responses, defined as each subject's first five bids (normally with different realized signal values) after the practice rounds.

With the authors' permission, we reproduce here the KL First and Second-Price and AK Second-Price initial-response data as used in the paper, which have not been previously published (though they have been freely available to researchers on request). GHP data was published on the *Journal of Economic Theory* website for Supplementary Materials (http://www.nyu.edu/jet/supplementary.html).

KL First-Price

The data for the KL first-price common-value auction are in the Matlab m-file document DataKLF5.m. This document produces a 255x7 matrix, where the rows refer to the 5 initial bids for each of the 51 subjects and columns refer to the following variables:
First Column: Data Set identifier: "1".
Second Column: Number of players in each auction.
Third Column: Precision of the signal.
Fourth Column: Lower limit of the value range.
Fifth Column: Upper limit of the value range.
Sixth Column: Signal received.
Seventh Column: Bid submitted.

KL Second-Price

The data for the KL second-price common-value auction are in the Matlab m-file document DataKLS5.m. This document produces a 140x7 matrix, where the rows refer to the 5 initial bids for each of the 28 subjects and columns refer to the following variables:
First Column: Data Set identifier: "2".
Second Column: Number of players in each auction.
Third Column: Precision of the signal.
Fourth Column: Lower limit of the value range.
Fifth Column: Upper limit of the value range.
Sixth Column: Signal received.
Seventh Column: Bid submitted.

AK Second-Price

The data for the AK second-price common-value auction are in the Matlab m-file document DataAK5.m. This document produces a 115x7 matrix, where the rows refer to the 5 initial bids for each of the 23 subjects and columns refer to the following variables:
First Column: Data Set identifier: "4".
Second Column: --.
Third Column: --.
Fourth Column: --.
Fifth Column: --.
Sixth Column: Signal received.
Seventh Column: Bid submitted.

Columns 2 to 5 do not apply in this treatment since there was no variability in the number of players, the range of the values or the precision of the signals.

GHP First-Price

The data for GHP's first-price independent private-value auctions are in the Matlab m-file document DataGHP5.m. This document produces a 400x4 matrix, where the rows refer to the 5 initial bids for each of the 23 subjects and columns refer to the following variables:
First Column: Session number, where "1" and "2" refer to Low-Value and High-Value Sessions respectively.
Second Column: Number of players.
Third Column: Signal received.
Fourth Column: Bid submitted.

B. Data Analysis:

We computed maximum likelihood estimates for each datasets using Matlab m-files as follows. The computation can be described in three steps; first, define the logit decision rules for all possible types, then, define the likelihood function for different models and finally, use a maximization routine to maximize the likelihood function.

Step 1: Logit Decision Rules for all types:

(a) For Common-Value Auctions:
probRL1.m, probRL2.m, probTL1.m, probTL2.m, probEQ.m, probCEQ.m: Given input variables described in the data m-files (mentioned above) and the logit precision parameter (lambda) the output yielded are the choice probabilities for different decision rules (*Random Level*-1 and *Level*-2, *Truthful Level*-1 and *Level*-2, *Equilibrium* and *Cursed Equilibrium*).

(b) For the Independent-Private-Value Auction:
probRL1ipv.m, probRL2ipv.m, probTL1ipv.m, probTL2ipv.m, probEQipv.m, QREipv.m: Given input variables described in the above-mentioned data m-files and the logit precision parameter (lambda), the outputs yielded are the choice probabilities for the different decision rules for the GHP independent-private-value auction (*Random Level*-1 and *Level*-2, *Truthful Level*-1 and *Level*-2, *Equilibrium*, and *Quantal Response Equilibrium*).

Step 2: Define the log-likelihood function:

LLAuction1.m, LLAuction1CURSED.m, LLAuctionInd1.m: They define the log-likelihood function for the different models (Level-k plus Equilibrium types and Cursed Types) and different precision specifications (constant precision, type-specific precision, and subject-specific specifications). The inputs are the parameters to be estimated for each model and the output is the log-likelihood function. These programs are specific to KL First-Price. The log-likelihood m-files for the other treatments are straightforward adaptations of these m-files.

Step 3: use a maximization routine:

minAuction1.m: This uses the fmincon routine to find the maximum likelihood estimates. This program is specific to KL First-Price. The m-files for the other treatments are straightforward adaptations of these m-files.