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Does regret matter in first-price auctions?

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HIGHLIGHTS

- We test for the predictions of anticipated regret in first-price auctions.
- One human bids against three computers with pre-specified bidding strategies.
- Subjects randomly assigned to one of the two treatments.
- Treatment effects attributed to anticipated regret are not observed.

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ABSTRACT

"Overbidding" with respect to risk-neutral Nash predictions in first-price auction experiments has been consistently reported in the literature. One possible explanation for overbidding is that participants in these experiments may try to avoid regret induced by the knowledge of winning bids in case they do not win these auctions. Such considerations may drive bidders to bid aggressively in first-price auctions. We test whether differences in how auction outcomes are revealed produces systematic differences in bidding. In our design, where individuals bid against pre-programmed computers, differences in revelation of winning bids, does not produce significant treatment differences. Our results are in contrast to previous experiments, which report systematic treatment differences based on whether winning bids are revealed or not.

1. Introduction

Numerous experiments report bidding in excess of risk-neutral-Nash predictions (henceforth overbidding) in first-price (henceforth FP) auctions (Kagel, 1995). Besides risk aversion, alternative explanations for overbidding have been offered including anticipated regret (Filiz-Ozbay and Ozbay, 2007, henceforth FO). Some of these explanations, such as "level-*k*" decision-making (Crawford and Iriberri, 2007) and spiteful preferences, are relevant only in auctions against human bidders (games), whereas explanations such as anticipated regret are relevant for both games and single-agent decision problems. Previous experiments have tested the effects of anticipated regret in games. Given the effects of feedback and repeated exposure in auction settings (Ockenfels and Selten, 2005; Neugebauer and Selten, 2006), we believe that the evidence in FO which is based on one-shot environment, as compared to the evidence in Engelbrecht-Wiggans and Katok (2007, 2008) (henceforth EWK) which is based on a repeated game design, becomes the centerpiece of the existing evidence supporting anticipated regret in auctions. In this paper, we test the predictions based on anticipated regret in single-agent decision problems which provides a cleaner environment for testing regret effects, since explanations based on interpersonal comparisons-"level-*k*" thinking, spitefulness, joy of winning or ambiguity aversion

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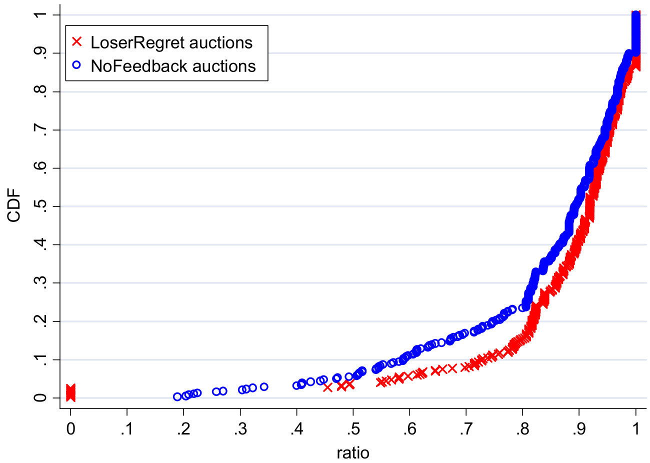

Fig. 1. Empirical distribution of the bid/value ratio by type of auction.

(Salo and Weber, 1995)-are not relevant for bidding in our design.[2] Our results do not suggest any significant differences based on anticipated regret across treatments.[3]

2. The experiment

We use FP auctions in which human participants bid against pre-programmed computers; this allows that objective probabilities of winning conditional on bids can be derived. The experiment was run at the Monash Laboratory for Experimental Economics at Monash University. Students in undergraduate and master's level courses in various disciplines participated in the experiment. Each participant was randomly assigned to a treatment (see Appendix A for instructions).

2.1. *LoserRegret auctions*

The sequence of events in a session corresponding to *LoserRegret* auctions were as follows:

1. Initial instructions described the showup fee (7 AUD) and the rate at which experimental currency-ECU was converted to money (AUD). The following instructions were communicated: (a) there will be 10 rounds in a session. (b) In each round, participants would be bidding in a FP auction against three pre-programmed computer bidders: each computer opponent would submit a bid by drawing randomly and independently from the set $\{0.75, 1.5, 2.25, \ldots, 75\}$, and each number had an equal chance of being drawn.[4] Participants could be assigned values drawn from the set of integers: $\{1, 2, 3, \ldots, 100\}$. (c) Participants could bid discrete integers up to their values and could not see the bids submitted by rival bidders at the time of bidding, (d) the highest bidder would win the auction and pay a price equal to her bid. Ties would be resolved in favor of the human bidder: if the bid submitted by the human agent was among the highest bids, then he would be the winner, (e) after bids were submitted for 10 rounds, auction outcomes would be revealed such that participants would get to know their earnings based on auction outcomes and one of the 10 rounds would be selected randomly for final payment.
2. A short quiz was administered to evaluate participants' understanding of the instructions and participants practiced bidding in three unpaid rounds.
3. In the bidding rounds that had payoff consequences a set of values was created by pre-selecting 10 ECU values from the set $\{1, 2 \ldots 100\}$. The set of 10 values selected was $\{31, 37, 43, 49, 55, 61, 67, 73, 79, 85\}$. This set was fixed for each participant. Values were assigned to participants (in each round) by drawing randomly without replacement from this set.

2.2. *Treatment differences*

The sequence of events for *NoFeedback* auctions was similar to those above, except for the following design differences. The bidders were instructed that after bids have been submitted for all rounds the computer will display whether they won the auction or not, their earnings based on auction outcomes, and

a. *LoserRegret auctions*: the highest (winning) bid for that auction.
b. *NoFeedback auctions*: any other information regarding the bids of the other bidders will not be shown.[5]

Table 1 summarizes treatment differences.

3. Results

A total of 40 and 38 participants were assigned to *LoserRegret* and *NoFeedback* auctions, respectively. The actual mean payoff for a participant inclusive of the participation fee was about AUD 23. The summary statistics for bids at various value draws arereported in Table 2.

Treatment differences

First, we explore treatment differences at various value draws. As described in Table 2, although the means of the bids are slightly larger at most value draws in *LoserRegret auctions*, the p values for the Wilcoxon rank-sum test and the Kolmogorov–Smirnov test for equality of distribution of bids, suggest that the hypothesis of equality of distribution of bids cannot be rejected at any value draw except for ECU value $= 67$ at 10% level. Second, we calculate the bid–value ratio for each bid–value pair. In Fig. 1, the cumulative distribution functions (CDFs) of the bid–value ratios for *LoserRegret* auctions and *NoFeedback* auctions are plotted. The CDF of the bid–value ratio for *LoserRegret* lies below the corresponding CDF for *NoFeedback* auctions for bid–value ratio less than 0.8; however for bid–value ratio larger than 0.8, the CDFs for these treatments tend to overlap. This figure indicates slightly more aggressive bidding in *LoserRegret auctions*.

We further explore treatment differences by estimating the following:

$$y_{i,r} = \alpha + \beta R + \eta_{\boldsymbol{i},\boldsymbol{r}} \tag{1}$$

where $i = 1, 2, \ldots, N$; $r = 1, 2, \ldots, 10$, and $R = 1$ for *LoserRegret auctions*, 0 otherwise and $\eta_{\boldsymbol{i},\boldsymbol{r}}$ are errors. The dependent variable $y_{i,r}$ equals the bid or the bid–value ratio in various specifications. If $y_{i,r} = bid_{i,r}$ value-fixed effects were added. If $y_{i,r} = bid_{i,r}$ ($y_{i,r} =$

2 Our study has developed contemporaneously with Katuščák et al. (2015) in which treatment conditions similar to ours, have been studied.

3 Thus, we are equating feedback with regret as in FO. Although recent papers have attempted to generalize the regret theory (e.g. Saran and Serrano, 2014), the theory as applied to auctions (FO, EWK) does not specify the circumstances under which regret may or may not be anticipated.

4 These bids correspond to 75% of the values that could have been drawn for computer bidders from the set $\{1, 2, 3, \ldots, 100\}$ in each auction using alternative procedures. Thus, in our design computer bidders submit risk-neutral Nash bids without subjects being explicitly instructed about the correspondence between computer bids and value. Thus, we are able to circumvent the "anchoring" confound which may have influenced bidding if a bidding rule which described computer bids as a fraction of their values was used.

5 These differences are consistent with the feedback (treatment) conditions reported in FO.