Do Irrelevant Payoffs Affect Behavior When a Dominant Strategy is Available: Experimental Evidence from Second-Price Auctions

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Motivation

Unlike laboratory results for English auctions, bidding in Second Price Auctions (SPAs) tends to be above the weakly dominant strategy.

Hypothesis: dominant strategies are rare and may not be obvious to bidders, but bidders are nonetheless responding to more common incentives in a **predictable** way.

- When the consequences to overbidding are mitigated, there will be more overbidding; when the consequences are more severe, there will be more overbidding.
Main questions:

- Is bidding in an SPA affected by changing out-of-equilibrium payoffs? If so, how is it affected?
- How well do models suggested to account for out-of-equilibrium bidding behavior fit our data?
Experimental Design

- Four sessions of second-price auctions: two sessions with 3 bidders per auction, 2 sessions with 6 bidders per auction
- 60 paying periods
- Values drawn from a uniform distribution over [0, 100]
- Starting balance of 150 ECU, with exchange rates of $1 = 20 ECU$ for 3 bidder sessions and $1 = 14 ECU$ for 6 bidder sessions
Treatments

- Treatments: Multiply losses by $\beta$ =
  - 1 for the first 20 periods
  - 0.1 for the next 20 periods
  - 20 for the last 20 periods

Note that the weakly dominant strategy is totally unaffected by the value of $\beta$
Results with 3 bidders

Mean Deviation: Bid – Value over time
Results with 3 bidders

Scatterplots of values vs. bids

\[ \beta = 1 \]

\[ \beta = 0.1 \]

\[ \beta = 20 \]
Results with 6 bidders

Mean Deviation: Bid – Value over time
Results with 6 bidders

Scatterplots of values vs. bids

\( \beta = 1 \)
\( \beta = 0.1 \)
\( \beta = 20 \)
Subjects are not bidding their values, but are nonetheless responding to changes in the payoff function in a "common-sense" way: when the price of getting “caught" overbidding goes up, there is less overbidding; when the cost goes down there is more overbidding.

Overbidding can be almost completely eliminated and some underbidding occurs.

Bidding behavior changes despite the fact that subjects are not experiencing large losses.
Several models have been proposed to explain deviations from optimal bids in auctions. We consider the following models:

1. Symmetric Nash Equilibrium with normal and logistic errors
2. level-k
3. Quantal Response Equilibrium (QRE)
None of the models predicts a response to a change in $\beta$.

level-k predicts the same thing as SNE: value bidding

QRE seems like a good candidate because it takes the entire payoff function into account
SNE with normal errors provides the best fit for the data for all treatments except 3 bidders with $\beta = 0.1$, for which QRE is better.

The superiority of QRE for this case is driven by the logistic error structure and not the specifics of the model. The fit of SNE is improved by allowing it to have a logistic error structure.
We reject the related notions of spite and joy-of-winning (JOW) for the following reasons:

1. JOW does not explain experimental results for English or first-price auctions
2. JOW predicts that overbidding should rise 10-fold from $\beta = 1$ to $\beta = 0.1$ which is not borne out by the data
3. Spite predicts overbidding to be higher for lower value bidders than higher value bidders, but this is not borne out in the data
We suggest the following behavioral explanation:

- Subjects do not have a detailed model of their opponents’ strategies, but they understand that raising their bid raises the probability of winning.

- Subjects believe that, if they win, the price will be a fraction of their bid.
Our behavioral explanation can account for our data and explain behavior in both English auctions and FPAs

1. because bidders know the price will be exactly their bid in either an English auction or an FPA, this crystallizes for the bidder the trade-off between a higher probability of winning and the resulting effect on profits

2. our explanation predicts overbidding in a second-price auction and predicts even more overbidding when the downside of overbidding is diminished
Subjects overbid in the presence of a dominant strategy but respond to changes in out-of-equilibrium incentives in a predictable way.

Previous formal models fail to predict the results of manipulating $\beta$, while spite/JOW have other flaws.

We provide a loose explanation that generalizes to other auction formats and predicts that bidders will naively bid above their value in SPAs. It asserts that

1. Bidders know that raising their bid raises the probability of winning but do not have in mind a model of how others behave.
2. Bidders believe that, if they win, the price will be a fraction of their bid.