IFREE small grant on Asymmetric Sequential Auctions
Scientific report

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1 Overview

This research aims to test two implications of the theoretical analyses of asymmetric sequential first-price auctions (Cohensius and Segev, 2018). Two experiments tested the following two predictions. The results, described in more detail below, provide partial support to the first prediction, and full support to the second prediction.

1. In symmetric auctions, the sequential protocol—i.e., bidders bid sequentially and observe previous bids—allows late bidders to win the auction at a lower bid than they would have placed if all bids were placed simultaneously. As a consequence, seller revenue is lower than with the standard simultaneous protocol. With strong asymmetries, in contrast, revealing the bid of a strong bidder to the weak bidder[1] levels an uneven playing field, and is predicted to increase the seller's revenue.

2. With three bidders (and values drawn from uniform distributions with a common lower bound), the optimal order in terms of seller revenue is to elicit bids moving from the strongest bidder to the weakest bidder. The theoretical analysis predicts that switching the order of the two weaker bidders will have little impact on expected revenue. Switching the order of the two stronger bidders, however, is predicted to reduce expected revenue substantially. The intuition is that, with strong asymmetries, the weak bidder will have little effect on the outcome, as the competition is mainly between the two strong bidders.

The IFREE funds covered subject payments for the two experiments (with 184 and 72 participants, respectivley) plus pilot sessions, in addition to programming and research assistance in conducting the sessions. Based on the initial results, we applied

[1] One bidder is considered stronger than another bidder if the ex-ante distribution of values of the first bidder first-order stochastically dominates that of the second bidder.

for a grant from the Israeli Science Foundation (application number 155/17), which was unfortunately rejected. The paper based on the experiments is under preparation. In the following, we provide more detail on the design and results of the experiments.

2 A comparison of simultaneous and sequential auctions

In the first experiment, we manipulated the protocol (simultaneous vs. sequential) and symmetry (symmetric vs. asymmetric bidders) in a 2×2 between-subjects design. In the symmetric treatments, values were drawn from a uniform distribution over $[0, 60]$, whereas in the asymmetric treatments, the value of one bidder was drawn from a uniform distribution over $[0, 90]$, and the value of the other bidder was drawn from a uniform distribution over $[0, 30]$. Participants were randomly allocated to the roles of Bidder 1 (high distribution, first mover) and Bidder 2[2] and were rematched within matching groups of eight participants (four in each role) for ten periods. Roles were then switched for an additional ten periods.

Figure 1 shows the mean prices in the four treatments. As predicted, the sequential protocol significantly reduced the seller's revenue with symmetric bidders ($t = 3.55, p = 0.001$; cf. Fischer, Güth, Kaplan, and Zultan, 2014). As predicted, this difference reversed in the sequential treatments, although the difference was small and non-significant ($t = 0.32, p = 0.753$).

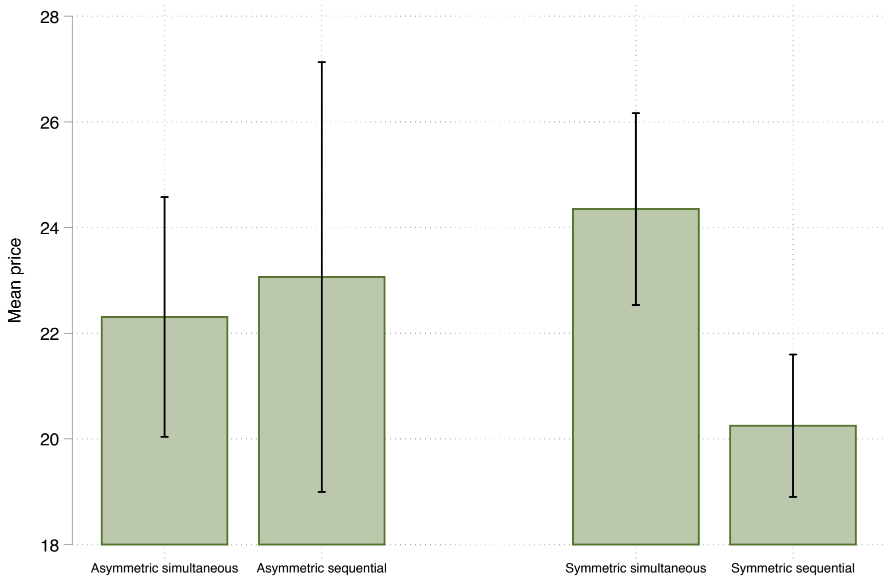

Figure 1: Mean prices with 95% confidence intervals based on robust standard errors clustered on matching groups.

[2]In the symmetric simultaneous treatment, the labels had no implications for the auction.

3 The order of bidders in 3-player asymmetric auctions

In the second experiment, we studied 3-player auctions with sequential protocol. The values of Bidder 1, Bidder 2, and Bidder 3 were drawn from uniform distributions over $[0, 120]$, $[0, 70]$, and $[0, 20]$, respectively. Roles remained fixed throughout fifteen periods of play, and participants were matched into groups of three bidders, one in each role, within matching groups of twelve participants. Three order of plays, $\{1, 2, 3\}$, $\{1, 3, 2\}$, and $\{2, 1, 3\}$, were manipulated within-subjects. Each order appeared in five of the fifteen periods, randomized independently for each matching group.

The results are consistent with the theoretical predictions. Figure 2 shows that switching between bidders 2 and 3 has little effect on the identity of the auction winner. In contrast, if the strong Bidder 1 is allowed to bid after Bidder 2, Bidder 1 (Bidder 2) is significantly more (less) likely to win the auction. A mixed-effects regression[3] with random effects for subjects and robust standard errors clustered on matching groups confirms the effect on the winning probabilities of Bidder 1 ($\chi^2(1) = 7.70, p = 0.005$) and of Bidder 2 ($\chi^2(1) = 14.65, p < 0.001$).

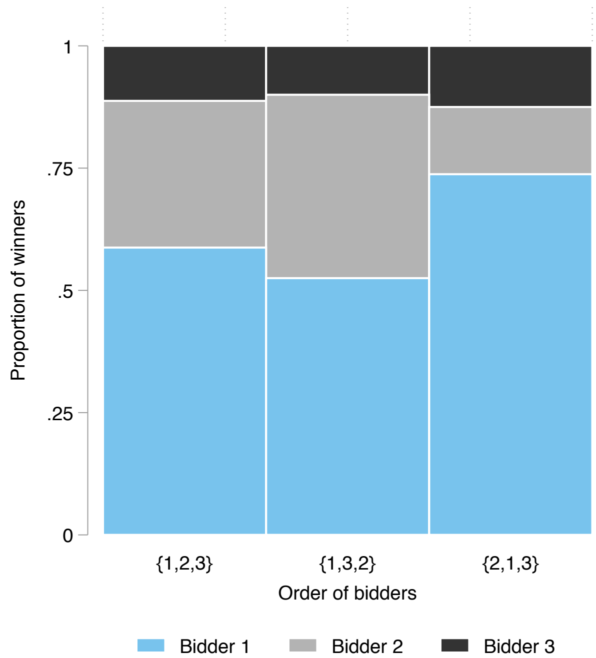

Figure 2: Distributions of auction winners by order of play.

[3] All results reported here remain virtually identical using fixed effects specifications.

The mean price obtained under the theoretically optimal order $\{1, 2, 3\}$ was 74.3. As predicted, the mean price when the weak Bidder 3 moved before Bidder 2 was slightly lower, at 64.7. When Bidder 2 moved first, followed by Bidders 1 and 3, however, the price substantially dropped to 48.1. We tested the effect of the order of bidders on the mean prices using a mixed-effects regression with random effects for the first mover[4] and robust standard errors clustered on matching groups. The mean price in the $\{2, 1, 3\}$ was indeed weakly significantly lower than the other two orders, ($p = 0.073$ and $p = 0.078$), whereas there was no significant difference between the two orders where the strong Bidder bids first ($p = 0.123$).

[4]As the first mover is essentially the price setter in a sequential auction.

References

Cohensius, Gal and Ella Segev (2018). Sequential bidding in asymmetric first price auctions. *The BE journal of theoretical economics* 18(1), pp. 1–21.

Fischer, Sven, Werner Güth, Todd R. Kaplan, and Ro'i Zultan (2014). Auctions and leaks: a theoretical and experimental investigation. *Mimeo*.