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Notes

On the benefits of dynamic bidding when participation is costly

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Abstract

Consider a second-price auction with costly bidding in which bidders with i.i.d. private values have multiple opportunities to bid. If bids are observable, the resulting dynamic-bidding game generates greater expected total welfare than if bids were sealed, for any given reserve price. Making early bids observable allows high-value bidders to signal their strength and deter others from entering the auction. Nonetheless, as long as the seller can commit to a reserve price, expected revenue is higher when bids are observable than when they are sealed.

JEL classification: D44

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1. Introduction

Bids in sealed-bid auctions may arrive at different times but, since they are sealed, equilibrium play is the same as if bids were simultaneous. This paper considers the welfare and revenue implications of an alternative policy of publicly revealing all bids as they arrive, prior to an otherwise standard second-price auction with costly bidding in which bidders have i.i.d. private values. In particular, I consider a dynamic-bidding game that extends Samuelson's [27] costly-

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bidding model to a setting with multiple "bidding rounds" in which bids can be simultaneously submitted, with bids made in each round automatically revealed prior to the next round.

Bidders with higher values submit earlier bids in equilibrium, allowing them to deter lower-value bidders from competing. Such entry deterrence benefits higher-value bidders, by allowing them to obtain the object at a lower price, while also benefiting lower-value bidders as they avoid entering auction contests they would otherwise lose. Consequently, bidders' interim expected surplus is higher under "dynamic bidding" when there are multiple bidding rounds than under "sealed bidding" when there is only one bidding round, for any given reserve price.

Equilibrium entry is not efficient under dynamic bidding, even when the reserve price is set to zero. The reason is that each bidder's private benefit from deterring others' entry, that he can win the object at the reserve price rather than the second-highest bidder value, differs from the social benefit of entry deterrence, that others do not incur the cost of bidding. This contrasts with the well-known result that equilibrium entry is efficient under sealed bidding with a zero reserve price; see e.g. Stegeman [28].

Example 1 *(Inefficient equilibrium entry).* Two bidders have i.i.d. private values uniformly distributed on $[0, 1]$. The cost of bidding $c = \frac{1}{10}$ and there are two bidding rounds. The efficient symmetric entry thresholds in this example are $\frac{5}{8}$ in the first round and $\frac{1}{4}$ in the second round, while the equilibrium entry thresholds are $\frac{2}{5}$ in the first round and $\frac{1}{5}$ in the second round. (See the online supplementary material for details.) Note that the object is more likely to be sold in equilibrium than is efficient ($\frac{1}{5} < \frac{1}{4}$) and bidders are more likely to enter early in equilibrium than is efficient ($\frac{2}{5} < \frac{5}{8}$).

Although equilibrium entry is inefficient under dynamic bidding, equilibrium expected total welfare is strictly higher under dynamic bidding than when bids are sealed, for any given reserve price (Theorem 1). For an intuition, note that allowing multiple bidding rounds has two sorts of effects on equilibrium play, each of which tends to increase expected total welfare. First, dynamic bidding facilitates welfare-enhancing entry deterrence, as bidders who would have entered but lost in a sealed-bid auction now avoid incurring the cost of bidding. Second, dynamic bidding reveals information about others' values to those who choose not to enter early, encouraging some bidders who would have chosen not to participate in a sealed-bid auction to enter in a later round of the dynamic-bidding game.

What about expected revenue? For any given reserve price, the effect of dynamic bidding on seller expected revenue is ambiguous, as the revenue from new sales to lower-value bidders may or may not dominate the lost revenue from selling to higher-value bidders at lower prices. If the seller is able to commit to a reserve price,[1] however, expected revenue is higher under dynamic bidding than under sealed bidding. Intuitively, the reason is that since dynamic bidding makes the auction more attractive to bidders at any given reserve price, the seller can raise the reserve without losing sales. Indeed, raising the reserve price allows the seller to extract all the welfare gains associated with better bidder coordination in the form of greater expected revenue.

The paper focuses on a setting in which bidding is costly and bids are publicly observable, but the analysis carries over to an alternative setting in which bidding is costless and unobservable

[1] The seller's reserve price is set before the game begins and, in particular, does not depend on the realized timing of entry into the auction. The seller can obviously do even better if able to commit to a reserve price that changes over time or to more general dynamic mechanisms, the analysis of which is beyond the scope of this paper.