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Designing Hybrid Mechanisms to Overcome Congestion in Sequential Dutch Auctions

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Abstract

A common problem in many mature markets is how to deal with congestion—a situation in which transaction requests from market participants cannot be accommodated in an expedited manner. This paper examines the congestion problem in sequential Dutch auction markets. Transactions in these markets typically involve perishable goods, thus market clearing speed is crucial. Traditionally, sequential Dutch auctions are implemented with fast-paced auction clocks that process equally attractive bids in the order they arrive and only award the first bidder as the winner in each round. This could lead to serious congestion in case of demand surge. We propose a hybrid mechanism that capitalizes on the discrete nature of the auction clock and batches together the highest bids, allowing multiple transactions at the same price in each round. To evaluate the performance of the hybrid mechanism, we first develop a game-theoretic model comparing the hybrid mechanism to the traditional sequential Dutch auction mechanism. Our model predicts the hybrid mechanism will achieve higher operational efficiency without compromising allocative efficiency. We then complement the theoretical analysis by evaluating the hybrid mechanism through a quasi-natural field experiment. The empirical analysis of the field data shows that the hybrid mechanism can significantly speed up the market clearing process and increase price stability without affecting the expected revenue. Our findings shed new light on the design and operation of multi-unit auctions.

Keywords: Mechanism design, market congestion, discrete bids, quasi-natural field experiment, hybrid mechanism, sequential Dutch auctions, analytical model, game theory, digital transformation