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Revenues and welfare in auctions with information release ☆

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Abstract

This paper studies information release in symmetric, independent private value auctions with multiple objects and unit demand. We compare effects on welfare to those on the seller's revenue. Applying the dispersive order, the previous literature could only identify settings in which welfare provides the stronger incentives for information release. We generalize the dispersive order to k- and k–m-dispersion. These new criteria allow us to systematically characterize situations in which revenue provides stronger incentives than welfare, and vice versa. k–m-dispersion leads to a complete classification if signal spaces are finite and sufficiently many bidders take part.

JEL classification: D44; D82

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1. Introduction

This paper studies the effects of information release. We consider symmetric, independent private value auctions with multiple, identical objects and unit demand. The seller compares running an auction with either of two distributions of bidders' valuations. This abstract setting captures many models of information release. For instance, the two distributions could be the prior and posterior distributions of (conditionally expected) valuations associated with a signal that the bidders receive. In that case, the posterior is a mean-preserving spread of the prior. Information release increases the dispersion of expected valuations in the sense of the convex order. This implies that with sufficiently many bidders, not only welfare, but also seller's revenue increases through information release. Yet one or the other will react more strongly. We characterize which of the two is the case.

Alternatively, the two distributions could be posteriors associated with two different signals. In that case, there is not necessarily a ranking in convex order. Our analysis determines in such situations which posterior would be more favorable, from the welfare perspective compared to the seller's revenue perspective.

A welfare maximizer incorporates bidders' aggregated rents into his calculation, while a revenue-maximizing seller focuses on the selling price. Understanding how welfare and revenue incentives relate to each other therefore requires a thorough understanding of the behavior of order statistics. In case of a one-object auction, the first and second order statistics, i.e. the highest and the second highest valuations, and the difference between the two, are crucial. In multi-object auctions, more of the highest order statistics are relevant. If several prizes, like grants or promotions, are "auctioned off" to applicants in order to reward those who exert the highest efforts (bids), efforts of several applicants near the top matter.[1]

In addition to focusing on one-object auctions, the previous literature has typically modeled information release as an increase in the variability of valuations in the sense of the dispersive order (Ganuza and Penalva, 2010).[2] If the dispersive order holds, all order statistics lie further apart under one distribution compared to the other. This is a restrictive requirement leading to clear-cut results. Welfare always benefits more from the introduction of such a more dispersed distribution than seller's revenue. Yet many prominent situations of information release, e.g. refinements of information partitions, do not fit into this framework. Further, in many applications, the control of lower order statistics is not very relevant. As we will see, with some more bidders than objects, our analysis does not hinge at all on the behavior of the lower tails of the distributions.

Therefore, we introduce two new classes of stochastic orders that lead to a more flexible and directed control of the behavior of order statistics, the k- and k–m-dispersion orders. Increased variability in the sense of k-dispersion implies that the k highest order statistics move further apart through information release. Increased variability in the sense of k–m-dispersion implies the same conclusion if the overall number of bidders n is sufficiently large, $n > k + m$. Therefore, k–m-dispersion captures more distributions than k-dispersion. The latter can be seen as a special

[1] For example, Harvard University selected 2,000 students out of 34,000 applicants for its class of 2018; see https://college.harvard.edu/admissions/admissions-statistics.

[2] A related literature studies the problem of information acquisition in auctions from the bidder's perspective, e.g., Persico (2000). In there, a bidder compares how different signals affect his valuation estimate. We study the seller's problem in which information release transforms a distribution of unknown valuation estimates into another. Formally, information acquisition is thus a rather different problem that requires different statistical tools such as Blackwell's (1951) sufficiency or Lehmann's (1988) efficiency of signals.