Common Value Mechanisms with Private Information

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Extended Abstract

Consider the following situation. Two risk-neutral players wish to obtain an object. Each player gets a signal about the object value: Player 1 obtains signal s_1 and Player 2 acquires signal s_2. The common value of the object is an increasing function of both private signals, $g(s_1, s_2)$. This is a common value setting where players get signals about some parts of the value.

We assume that the signals have the following structure: they are either H (high) with probability $p \in [0,1]$, or L (low) with probability $(1-p) \in [0,1]$, independently for each player. That is,

$$s_i = \begin{cases} H, & with\ probability\ p, \\ L, & with\ probability\ (1-p). \end{cases}$$

The interpretation is that each player can get either a "good" signal or a "bad" signal. Thus, the value of the object maybe g(L, L), g(L, H), or g(H, H), with probabilities $(1-p)^2$, $2p(1-p)$, and p^2 respectively. We assume that $g(L, L) = 0$, $g(L, H) = V > 0$, and $g(H, H) = (1+\alpha)V$, for $\alpha \geq 0$.

The object is allocated to the players according to some mechanism. A "natural" mechanism asks players to submit their bids and allocates the object and the corresponding payments according to the bids. We consider the following mechanisms: a lottery and the standard auctions (all-pay, first-price, and second-price). We also consider the direct optimal mechanism where the players are asked to report their signals.

First, we describe symmetric equilibria in the lottery as well as in the all-pay, first-price, and second-price auctions. It is interesting to emphasize that symmetric equilibria are in pure strategies in the lottery as well as in the second-price auction. However, symmetric equilibria are in mixed strategies in the all-pay as well as in the first-price auctions.

Second, we find the ex-ante expected revenue in all these mechanisms. We discover the revenue equivalence result in the all-pay, first-price, and second-price auctions. It is a surprising observation, because revenue equivalence does not typically hold in common-value auctions. Our setting with two possible private signals and three possible prize values is an exception. Then, we compare the ex-ante expected revenue in the lottery and in the auctions. It turns out that if the value of the parameters α is sufficiently small (the highest prize value and the second highest prize values are relatively close), then for sufficiently small p the ex-ante expected revenue in the lottery is higher than the ex-ante expected revenue in the auctions. Otherwise, the ex-ante expected revenue in the lottery is lower than the ex-ante expected revenue in the auctions.

Third, we look for an optimal mechanism in our setting. As it turns out neither lottery nor auctions are optimal mechanisms. Although players' signals are independent, the optimal mechanism extracts all surplus from the bidders. We show that the standard auctions approach the revenue from the optimal auction as the value of parameter α increases. Moreover, we demonstrate that auctions as well as a lottery with the optimal reserve prices are optimal mechanisms.