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Mandatory vs. Voluntary a priori Investment in Information Acquisition in Procurement Auctions

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Procurement auctions play an essential role in securing goods or services at competitive prices. One of the key challenges, particularly prominent in renewable energy auctions, is the high uncertainty bidders face regarding future costs. To mitigate this risk, it is common practice to require certain prequalification measures prior to entering the auction (Kreiss et al., 2017). This requirement implies an investment in information acquisition. While mandatory investment enhances contract security, it imposes sunk costs on participants, resulting in reduced participation and lower competition levels, and may exclude interested bidders, leading to an inefficient outcome (Samuelson, 1985).

In response to these challenges, this paper compares two procurement auction settings in terms of participation, optimal reservation price, expected profit and efficiency (expected welfare): one with mandatory and another with voluntary investment in information acquisition. Although costly, the a priori investment serves to eliminate uncertainties about future costs. Our paper complements the existing literature on the voluntary setting and the comparison between mandatory and voluntary settings (see e.g. Bergemann and Välimäki, 2002; Jehiel and Lamy, 2015).

We consider a single-unit procurement auction with $N > 2$ firms (potential bidders) with a priori unknown private costs x_i. The firms will learn their own costs after an investment $c \geq 0$ in information acquisition. The auction is conducted as a second-price auction, where the auctioneer has a maximum willingness to pay of x_0 and sets a reserve price $r \leq x_0$.

In the mandatory setting, the auctioneer requires participants to invest c before participating in the auction. That is, all participants have already learned their true costs x_i when submitting their bids and c is sunk cost. They will bid truthfully in the auction if $x_i \leq r$ or will not bid if $x_i > r$.

In the voluntary setting, each participant can choose to invest c to learn the own costs x_i (investor), or not to invest and thus receive no additional information other the distribution of the costs (non-investor). The winner, however, has to invest c after the auction if the winner has not done it before the auction. In the auction, an investor will bid truthfully if $x_i \leq r$ or will not bid otherwise, while a non-investor will bid $\mathbb{E}[X_i] + c$ as a dominant strategy if $\mathbb{E}[X_i] + c \leq r$ or will not bid otherwise (Ehrhart et al., 2015).

Our analysis identifies five types of symmetric equilibria depending on c and r (see Figure 1: Equilibria depending on c and r in mandatory and voluntary model):

E_0: No participation
E_1^f: Full participation, all firms participate and invest c
E_1^r: Randomized participation, all firms participate and invest c with probability $q \in (0, 1)$
E_2: All firms participate without investment with probability $q' \in (0, 1]$
E_{mix}: All firms participate and invest c with probability $q_1 \in (0, 1)$ and participate without investment with $q_2 \in (0, 1)$, $q_1 + q_2 \leq 1$

Expected participation: The voluntary setting leads to higher expected participation than the mandatory setting.

Optimal reservation price: For each equilibrium, we determine different locally optimal reserve prices. Given c, the globally optimal reserve price is continuous and increasing in x_0 and takes the maximum of two locally optimal reserve prices after switching to another equilibrium.

Expected profit: Given the optimal reserve price: The participants expect a higher profit in the voluntary setting than in the mandatory setting, as long as c is high enough to exclude potential bidders, while the auctioneer's expected profit varies between the settings depending on c and x_0.

Expected welfare: A second price auction with $r = x_0$ implements the efficient auction. The voluntary setting always equals or exceeds the mandatory setting in terms of expected welfare.

The voluntary setting demonstrates clear advantages over the mandatory setting in terms of participation, participants' expected profit, and efficiency. Additionally, it can lead to higher expected profit for the auctioneer in certain settings.

Primary authors: WANG, Runxi (Karlsruhe Institute of Technology (KIT)); Prof. EHRHART, Karl-Martin (Karlsruhe Institute of Technology (KIT)); Dr OTT, Marion (ZEW –Leibniz Centre for European Economic Research)

Presenter: WANG, Runxi (Karlsruhe Institute of Technology (KIT))

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