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

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ENERDAY 2025, Dresden, April 4, 2025

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Outline

Background and motivation

- Procurement auctions are crucial for securing goods/services at competitive prices
- Key challenge: High uncertainty for bidders regarding future costs, particularly prominent in renewable energy auctions
- Common practice: certain prequalification prior to entering the auction (Kreiss et al. 2017)
  $\Rightarrow$ a priori investment in information acquisition
- Impact of the mandatory setting:
  - Reduce uncertainties regarding future costs
  - Reduce participation and competition (Samuelson 1985)
  - Exclude potential interested bidders, leading to inefficiency
- Alternative: voluntary setting, e.g., German photovoltaic auctions (Bundestag 2017)
- **Research question:** Mandatory vs. voluntary a priori investment in information acquisition

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Related literature

- **Auctions with participation costs**
  - Pure strategy (cutoff strategy): Samuelson (1985), McAfee and McMillan (1987), Tan and Yilankaya (2006), Celik and Yilankaya (2009), and Gillen et al. (2017)
  - Mixed strategy (randomized participation): Levin and Smith (1994), Menezes and Monteiro (2000), and Jehiel and Lamy (2015)
- **Information acquisition before or during auctions**
  - General: Stegeman (1996), Persico (2000), Bergemann and Välimäki (2002), and Schweizer and Szech (2017)
  - Static vs. dynamic auction: Compte and Jehiel (2007), Gretschko and Wambach (2014), and Gretschko and Simon (2024)

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Model

- Single-unit second-price procurement auction
- $N \geq 2$ risk-neutral firms (potential bidders)
- Each firm has private costs x_i, which are a priori unknown to the firm
- x_i is the realization of the random variable $X_i, i \in \{1, ..., N\}$, i.i.d. on $[\underline{x}, \bar{x}]$ with F and f
- The realization of X_i can only be known after an investment $c \geq 0$ in information acquisition
- The auctioneer has the maximum WTP $x_0, x_0 > \underline{x}$ and sets a reserve price $r \leq x_0$

Settings

Mandatory setting:

- The auctioneer requires a priori investment in information acquisition
- For participants: c is sunk costs and x_i is known $\Rightarrow \beta(x_i) = x_i$ if $x_i \leq r$

Voluntary setting

- An investment in information acquisition is voluntary, except for the winner
- For investors: c is sunk costs and x_i is known $\Rightarrow \beta(x_i) = x_i$ if $x_i \leq r$
- For non-investors: only the distribution of X_i is known $\Rightarrow \beta = \mathbb{E}[X_i] + c$ if $\mathbb{E}[X_i] + c \leq r$
  $\mathbb{E}[X_i] + c := \mathbb{E}[X] + c, \forall i \in \{1, ..., N\}$

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Possible symmetric equilibria

Our analysis identifies five types of symmetric equilibria depending on c and r

- 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 $q_2 \in (0, 1)$, $q_1 + q_2 \leq 1$.

Different equilibria depending on c and r

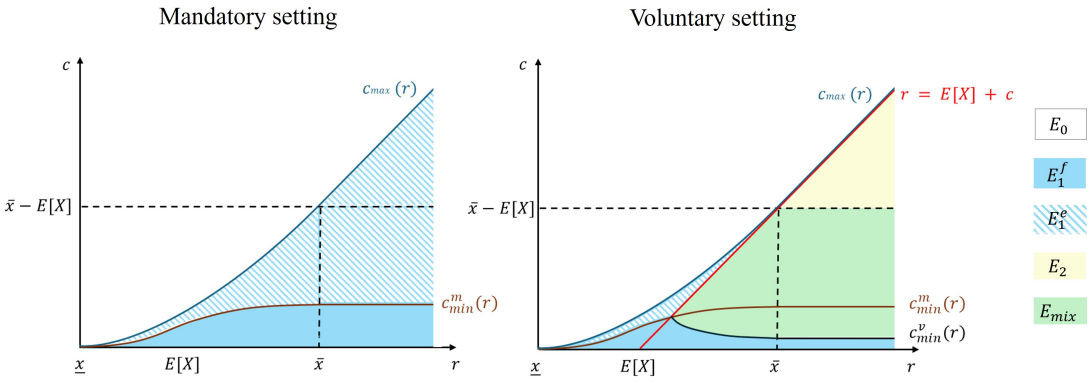

Figure: Different equilibria depending on c and r in mandatory and voluntary settings

Comparison between mandatory and voluntary settings

- **Expected participation**: voluntary setting $\succeq$ mandatory setting
- **Expected a priori investment**: voluntary setting $\leq$ mandatory setting
- **Optimal reserve price**: different locally optimal reserve prices
  - E_1^f: $r^* = x_0 - \frac{F(r_j^*)}{f(r_j^*)}$ (Krishna 2010)
  - E_1^e: $r^* = x_0$ (Jehiel and Lamy 2015)
  - E_2: $r^* \in [\bar{x}, x_0]$
  - E_{mix}: $r^* = x_0 - \frac{F(r_j^*)}{f(r_j^*)} - \frac{1-q_1}{q_1 f(r_j^*)}$

  Given c, the globally optimal reserve price r^* is continuous and increases in x_0
- **The participants' expected profit**: voluntary setting $\succeq$ mandatory setting if c is sufficiently high to exclude potential bidders
- **The auctioneer's expected profit**: Depending on c and x_0, either setting can be favored
- **Expected welfare**: $r = x_0$ is welfare maximizing, voluntary setting $\succeq$ mandatory setting

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Conclusion

The current analysis of our model shows advantages of the voluntary setting over the mandatory setting in terms of

- higher expected participation
- higher expected welfare
- higher participants' expected profit if the information cost is sufficiently high
- in certain cases even higher auctioneer's expected profit

Answer to our research question: voluntary setting $\succeq$ mandatory setting

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