

# Procurement Auctions with Corruption

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## Extended Incomplete Abstract

Imagine a government needs to build a bridge with certain specifications and invites bids from potential contractors on cost. The winning bidder then constructs the bridge and the government department relies on the inspector to check that specifications are met. In many real life situations such inspectors employed by the government would be willing to overstate the quality of the bridge in exchange for a bribe from the contractor.

In a real life example, a procurement auction for blood test kits ran by the Health Department of the West Bengal Government in India went horribly wrong presumably due to corrupt practices. The blood test kits are used for screening collected blood for various infections, and subsequent use without having to route them through a central blood bank which normally causes delay. The government, like any other procurement auction had specific requirements for the kits, and presumably there were inspections. However, the winning bidder, who had bid quite low, allegedly supplied expired and low quality test kits in large parts, even pregnancy kits and blood sugar kits were supplied in the lots. The result was quite a tragedy and a large number of people including numerous children were allegedly infected with HIV, Hepatitis C and other life-threatening diseases. Bridges collapsing and roads falling apart under presumably low quality construction are very large in number in countries like India. In most of these auctions there are clear rules and specifications and they are adhered to by the auctioneer in awarding the contracts. The problem often arises due to a corrupt inspection and monitoring process, and the effects of that in the manner in which bidders bid in the auctions and influence the results. What makes these problems worse is the fact that often a contractor can successfully put the blame on other factors, e.g., bad weather for delays, unforeseen engineering issues for bridge collapse, etc., with impunity. In fact, the case of the blood test kits has not yet resulted in any real conviction.

The existing literature on auctions (Laffont and Tirole, 1991; Lengwiler and Wolfstetter, 2005 and 2006; Burguet and Che, 2004, Compte, Lambert-Migiliansky and Verdier, 2005) with corruption focuses on bid manipulation where the auctioneer can award an object to non-winning bid in exchange for a bribe. We look into corruption in auctions arising out of the moral hazard feature of procurement and construction contracts and examine the extent to which rules could be modified to minimize the effect of corruption on the auctioneer's objective.

In the model we consider the principal or government (buyer, henceforth) would like to contract out a project to one of potential contractors. The project generates value  $V$  to the buyer with probability  $\beta(0)$  and causes loss  $L$  with probability  $1 - \beta(0)$ . The bidder can exert an effort ( $q = 1$ ) or shirk ( $q = 0$ ). If the bidder exerts effort then the success probability changes from  $\beta(0)$  to  $\beta(1)$  where  $\beta(0) < \beta(1)$ . We normalize the values so that  $V + L = 1$ . The auctioneer has the ability to check the effort, but will skip the inspection (unknown to the buyer) for a bribe  $B$ . In some situations the buyer may be the auctioneer and there may be a separate inspector who is able to check the buyer's effort. The analysis will not depend on these small distinctions. We allow contingent payments and assume that the buyer can include a penalty  $P$  with the contract for failed projects. Bidders vary in their cost types. A bidder's type  $\theta$  is his private information and distributed on an interval  $[0, 1]$  as  $F(\cdot)$ . We will consider two kinds of situations. In the first, the basic cost of the project is type independent. So if a winning bidder does not exert any effort the cost for the project to him is 0, but if he exerts effort then it costs him  $\theta$ . In the second scenario we assume that the basic cost of the project is type dependent. Thus, a type  $\theta$  bidder has cost  $\theta$  if he does not exert any effort and a cost  $\theta + c(\theta)$  if he exerts an effort where  $c(\cdot)$  is an increasing function.

The auction is a second-price format with reserve  $r$ . The buyer sets a target quality and bidders bid to supply that specified quality. The bidder with the lowest bid wins, provided his bid is no more than the reserve, and upon winning decides to set the quality. If an inferior quality is supplied then the bribe must be paid.

We consider both type-independent as well as type dependent basic project costs.

In the type-independent case the cost of supplying low effort is 0 and that for supplying high effort is  $\theta$ . If a bidder with type  $\theta$  wins the auction then the cost to the winner is  $\theta$  if the winner puts the effort, and  $B$  if the winner does not put the effort. It follows that the winner will choose effort if and only if  $\theta \leq B + P(\beta(1) - \beta(0)) \equiv \theta^c$ . A bidder's weakly dominant bidding strategy in the auction is given by

$$\begin{aligned} w(\theta) &= \theta + (1 - \beta(1))P && \text{if } \theta \leq \theta^c \\ &= B + (1 - \beta(0))P && \text{if } \theta > \theta^c \end{aligned}$$

We find that the buyer is not worse off (and possibly better off) without the inspection whenever the penalty is unlimited. The buyer opts for a corrupt inspector only if penalty is limited. Since the bribing bidder's bid does not depend on his type, it follows that the buyer can screen out the corrupt types by setting the reserve appropriately even when the inspector must inspect by law or structure of the procurement process. We also show that the buyer finds it profitable to screen out the corrupt types if and only if  $\beta(0) < L + B$ . We also find that if  $ng(0)$  is positive and not small (i.e.,  $ng(0) > 1/(\beta(1) - \beta(0))(1 - P)$ ). If the penalty  $P$  cannot be large and the bribe  $B$  is small, too, the buyer finds it profitable to keep the corrupt inspector. (To be completed soon.)