

"ON THE REGULATION OF PROCUREMENT
BIDS"

by

Bernard SINCLAIR-DESGAGNE*

N° 89 / 66 (TM, EP)

* Assistant Professor of Decision Sciences, INSEAD, Boulevard de
Constance, 77305 Fontainebleau, France

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ON THE REGULATION OF PROCUREMENT BIDS ¹

Bernard Sinclair-Desgagné ²

Assistant Professor
Technology Management Area
European Institute of Business Administration (INSEAD)

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² Present address: Bernard Sinclair-Desgagné, Technology Management Area, INSEAD, Boulevard de Constance, 77305 Fontainebleau Cedex, France. [BITNET: DESGAGNE@FREIBA51]

ABSTRACT

It is shown that a rational buyer should not put any restriction on the non-price components of procurement bids, when both her utility and the sellers' profit functions are linear in price, and her preferences are common knowledge.

SOMMAIRE

Il est démontré qu'un acheteur rationnel ne devrait pas émettre de réserves sur les composantes non monétaires des offres, lorsque son utilité et les profits des vendeurs varient linéairement avec le prix et que ses préférences sont connaissance commune.

1. Introduction

Competitive bidding arises on two occasions: when a seller faces many bidders, or when a buyer faces many sellers. The literature usually focuses on the former case, where bids are prices, and treats the latter as a trivial symmetric case with bids being also scalars. This ignores the important fact that sellers involved in competitive bidding have an incentive to provide the buyer with both price and non-price information. Hence, procurement bids are usually multi-dimensional.³

This observation raises an interesting issue. Should a procurement agency let the sellers specify all the characteristics of a good, or should it rather make the sellers compete on fewer dimensions, say price only, by imposing some requirements or standards? In this paper, we look for an answer to this question. Intuitively, to confine bidding on fewer features may benefit the buyer by accentuating competitive pressure on the sellers. Our formal result, however, is that provided utility and profits are linear in price and the buyer's preferences are common knowledge, competitive bidding over all dimensions dominates, from the buyer's point of view, setting minimum standards and accepting bids on a restricted subset of dimensions.

The next section is devoted to presenting the model that

³ In defense procurement, for example, the US government considers bids that include a performance description of the future weapon, a development schedule and time delivery, and an estimated total cost. See Rich and Dews (1986), and also Williamson (1985) chapter 13.

drives this proposition. This model resembles Gilbert's (1977) formulation in that the set of equilibrium bids always has a single dimension (it is a curve in a space). But we assume here that the buyer's utility is common knowledge and we focus on the dimension of the bids as a crucial decision variable for the buyer.

We establish the proposition in the third section. No differentiability assumption is needed. The proof leans on the fact, stated as lemma 1, that a seller who knows the buyer's preferences is induced to submit a bid that maximizes his and the buyer's joint utility.

Concluding remarks follow in section 4.

2. The Model

A procurement bid b may have several components. Let us write $b = (q, p)$, where p denotes the price of a good or service with non-price characteristics q . As usual p is a real number, but q can belong to an arbitrary nonvoid set Q .

Procurement bids are sealed, and a winning bid must be one that best satisfies the buyer. The buyer ranks the bids according to a utility function $U: R \times Q \rightarrow R$ that is linear in price, i.e. $U(q, p) = V(q) - p$ for some function $V: Q \rightarrow R$.

Sellers are bound by the bids they suggest. A seller who wins with a bid (q, p) incurs a cost $C(q; t)$, $C: Q \times T \rightarrow R$ being a function that depends on the proposed non-price attributes q and on a privately known type t drawn from an arbitrary set T ; this seller then earns a profit $p - C(q; t)$ that varies linearly in price.

The joint utility of the buyer and a seller of type t is then given by the function $J(\cdot; t) = V(\cdot) - C(\cdot; t)$. We shall assume that this function reaches a maximum in Q .

3. When unregulated procurement bids are better

Let the buyer's utility function be common knowledge. A seller of type t who submits a bid (q, p) has then an expected benefit

$$[p - C(q; t)] P(V(q) - p), \quad (1)$$

where $P(U)$ is the probability that no other seller submits a bid that yields a utility higher than U to the buyer; one usually assumes that the function $P: R \rightarrow [0, 1]$ is nondecreasing. If no constraints are put on q , a seller of type t would then submit a bid in $Q \times R$ that maximizes (1). Assuming that such a bid exists for any t , let us denote it (q_t, p_t) , and let

$$\pi_t = [p_t - C(q_t; t)] P(V(q_t) - p_t).$$

We can now prove the following assertion.

Proposition. In a procurement situation where the buyer's utility and the sellers' profit functions are linear in price, and where the buyer's preferences are common knowledge, it is in the buyer's best interest not to put any requirements on the non-price attributes of the procured good or service.

First, observe that the expected benefit (1) can be written as

$$[(V(q)-C(q;t)) - (V(q)-p)] P(V(q)-p), \quad (2)$$

which is equal to

$$[J(q;t) - U(q,p)] P(U(q,p)) . \quad (3)$$

The proposition will then follow from the next two lemmas.

Lemma 1. $\pi_t = \max_{p \in R} [J(q_t^*;t) - U(q_t^*,p)] P(U(q_t^*,p))$, where $q_t^* \in \operatorname{argmax}_{q \in Q} J(q;t)$.

Proof:

Let $\pi_t^* = \sup_{p \in R} [J(q_t^*;t) - U(q_t^*,p)] P(U(q_t^*,p))$.

By definition, $\pi_t \geq \pi_t^*$.

Now take p^* in R such that $V(q_t^*)-p^* = V(q_t)-p_t$.

Then, $\pi_t \leq [J(q_t^*;t) - U(q_t^*,p^*)] P(U(q_t^*,p^*)) \leq \pi_t^*$,

and the lemma is proven.

Lemma 2. Let $u \in \operatorname{argmax}_{u \in R} [J-u] P(u)$. u is a nondecreasing function of J .

Proof:

Consider u and u' corresponding to J and J' respectively, where $J > J'$. We have

$$[J-u] P(u) \geq [J-u'] P(u') ,$$

$$[J'-u'] P(u') \geq [J'-u] P(u) .$$

Combining the two inequalities, we get

$$(J-J')P(u) \geq (J-J')P(u') .$$

Since $P(\cdot)$ is nondecreasing, it must be that $u \geq u'$, so this lemma holds.

Now, to complete the proof of the proposition, consider a situation where the buyer would require the non-price components of bids to belong to a subset \underline{Q} of Q . Clearly,

$$\sup_{q \in \underline{Q}} J(q;t) \leq \max_{q \in Q} J(q;t).$$

Hence, by lemmas 1 and 2, the ex post utility of the buyer would be lower than it would be if no constraints were imposed on the bids.

4. Concluding remarks

The above proposition only confirms the traditional wisdom that leaving decision making power to the better informed party increases total surplus (Hayek (1945)). Lemma 1 says, furthermore, that procurement bids maximize a seller's and the buyer's joint utility, when the buyer's preferences are common knowledge.⁴ This may be seen as another argument for the use of procurement bidding by buyers in a weak bargaining position; in this sense it complements proposition 2 of Milgrom (1987). Under more stringent assumptions (independence of types, monotonicity of $J(q_t;t)$ in t) lemma 1 would also allow applying the theory of optimal auctions (see Harris and Raviv (1981), Myerson (1981), Riley and Samuelson (1981)) and conclude that unrestricted procurement bidding with a reserve utility is optimal for a buyer with a strong bargaining position.

⁴ Note that one can get this result without assuming that the utility and profit functions are linear in price; linearity in only one (anyone) numerical argument is enough.

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