Indicative Bids as Cheap Talk

Ken Hendricks, University of Wisconsin
Daniel Quint, University of Wisconsin

Extended Abstract – September 3, 2012
(Full draft expected by end of September)

Investment banks often sell financial assets via multi-stage mechanisms that use non-binding, "indicative" bids to select bidders for an auction. One of the most commonly-used mechanisms uses multiple rounds of indicative bids: while as many as thirty bidders might typically be contacted initially and ten might submit initial non-binding bids, no more than three are chosen to participate in the actual auction. This avoids excessive duplication of costs associated with due diligence and bid preparation, which are known to be substantial; while still (hopefully) selecting the "right" bidders, those likely to have the highest valuations for the asset.

However, it is not clear how much, if any, of their private information bidders should be willing to reveal though non-binding bids. In the absence of participation costs (and without reputation concerns), we would expect indicative bidding to be a "free-for-all": all bidders submitting unrealistically-high bids because entrants expect to earn positive surplus. When participation is costly, bidders may be willing to reveal some information, in order to avoid being selected when they are up against stronger bidders and therefore unlikely to win; but how much they can reveal in equilibrium, and the effects this has on revenue and efficiency, has not been studied.

We aim to answer these questions. We analyze a simplified model with one round of indicative bidding, which we model as cheap talk a la Crawford and Sobel (1982). There are $N$ potential bidders. The seller makes available a finite set of ordered messages $\{1, 2, \ldots, M\}$. Each bidder gets an initial signal $s_i$ of his likely willingness to pay for the asset, and chooses which message to send. The first message is "opt out," or decline to participate. The other messages are "opt in" messages; the two bidders who send the highest ones advance to the second round, with ties broken randomly. The bidders who advance each incur a cost $c$; get an additional signal $y_i$, pinning down their valuation $s_i + y_i$ of the asset; and then participate in a standard English auction with no reserve price. If only one bidder "opts in," he incurs the participation cost but gets the asset for free; if all bidders opt out, no sale occurs, and the game ends.

We assume that $s_i$ are *i.i.d.* draws from the uniform distribution on $[0, 1]$; that $y_i$ are *i.i.d.* draws from an arbitrary distribution $F_y$ with support in $\Re^+$; that $\{y_i\}$ are independent of $\{s_i\}$; and

that $c > E\max\{0, y_i - y_j\}$, so a bidder only wants to participate in the auction if he is either alone or against a strictly-weaker opponent.[1] Under these modeling assumptions, we prove the following results.

**Theorem 1.** *Fix the primitives of the game – $N$, $c$, $F_y$, and the number of messages available in the first round $M$. A symmetric equilibrium exists, and is effectively unique.*[2] *Further, given $N$, $c$, and $F_y$, there is a finite number $M^* \geq 2$ such that...*

1. *If $M < M^*$, all $M$ messages are used with positive probability in equilibrium*
2. *If $M \geq M^*$, only the first $M^*$ messages are used with positive probability (and the equilibrium does not depend on $M$)*
3. *In either case, letting $m = \min\{M, M^*\}$, there is a series of thresholds*

$$0 = \alpha_0 < \alpha_1 < \alpha_2 < \cdots < \alpha_{m-1} < \alpha_m = 1$$

*such that bidders with signals in the interval $(\alpha_{k-1}, \alpha_k)$ send message $k$*

Thus, regardless of how many messages are available, there is an upper bound on the number that are used in equilibrium, and therefore the amount that bidders are willing to "separate" from other types of bidders. More "separation" can occur when there are fewer bidders, and when there is more bidder surplus expected ex post:

**Theorem 2.** *The maximum number of messages used in equilibrium, $M^*$, is decreasing in $N$ and $c$, and increases when the variability of $F_y$ is increased via a mean-preserving spread.*

We solve some numerical examples; we find that when $M^* > 2$, so that by varying the number of messages available, the seller can induce different equilibria, expected revenue is increasing in the number of messages allowed. Thus, the seller appears to have no incentive to artificially limit the number of messages available. This agrees with intuition: with more messages, the lowest threshold (the level below which bidders opt out) is lower, and the intervals $[\alpha_{k-1}, \alpha_k]$ are generally narrower, so with higher $m$, it is more likely that two or more bidders will agree to participate, and more likely that the "right" bidders (those with higher initial signals) will be selected. We conjecture

[1] We also assume that $c < 1 + E(y_i)$, so that the participation cost is not high enough to make the entire game trivial.

[2] Meaning, all symmetric equilibria differ only in the actions of a finite set of types who are indifferent between two messages. Thus, ex ante, all symmetric equilibria lead to the same outcome with probability 1.

that this result – revenue increasing in the number of messages used – holds generally, but we have not yet been able to prove it. In the examples we have solved, total surplus is also increasing in the number of messages used, but bidder surplus is decreasing (because winning bidders benefit from all their competitors opting out, or from not facing the strongest possible opponent, both of which are more likely with fewer messages).

We also analyze the limit of equilibrium play as the number of bidders gets large. For $N$ sufficiently large, $M^* = 2$, so only two messages are used in equilibrium, "in" and "out". While the entry threshold goes to 1 as $N$ grows, the probability that no bidder enters, and the probability that exactly one bidder enters, are both bounded away from 0 (and from 1) in the limit.

We compare such "large-$N$" equilibrium play in the message game (now with only two messages) to the natural alternative, an ordinary English auction with endogenous participation: bidders learn $s_i$, decide (simultaneously) whether to participate, and those who do pay $c$, learn $y_i$, and participate in a standard English auction. We find that as $N$ grows, our two-message equilibrium outperforms the standard auction:

**Theorem 3.** *As $N \to \infty$, the unique symmetric equilibrium of the two-message game gives strictly higher revenue, and strictly higher total surplus, than the equilibrium of the auction without messages.*

This ranking, however, does not always hold for small $N$. In the examples we solved, we found the following pattern. The "most revealing" equilibrium (the one with $M^*$ or more messages available) yielded higher revenue than the standard auction, but the equilibria with fewer messages sometimes did not; and the auction without messages was sometimes more efficient than any of the equilibria of the auction with messages. (It always induced less entry, but this also reduced participation costs, which sometimes dominated the other effects.) Bidders tended to prefer the standard auction to the most-revealing equilibrium of the message game, but not always to the equilibria with fewer messages.

Finally, we are in the middle of establishing the effects of adding a reserve price. Since the message game sometimes leads to a single bidder entering, and winning the object for free, one might think the seller could increase revenue by imposing a reserve price. However, this is not the case. We expect to prove the following result:

**Conjecture 1.** *For $N$ sufficiently large, any reserve price imposed by the seller would strictly reduce both revenue and efficiency.*

Any reserve price – even one that would never prevent a sale – reduces bidder surplus in the one-bidder-enters case; this in turn reduces the incentive to participate. In equilibrium, when $N$ is large, entry is below the efficient level; so reducing it reduces total surplus. In the limit as $N \to \infty$, bidder surplus is zero, so it is the seller who bears the cost of reduced entry, which overwhelms the added revenue when exactly one bidder enters. In fact, because equilibrium entry is below the efficient level, a small *negative* reserve price – a commitment to *pay* the lone bidder some amount, in addition to giving him the asset for free, in the event just one bidder opts to participate – could increase both revenue and efficiency when $N$ is suffuciently large.

Our paper studies a feature common in the sale of financial assets, the use of non-binding indicative bids to select bidders for an auction. We find, as in the Crawford and Sobel cheap-talk model, that privately-informed bidders are willing to communicate some of their private information, by truthfully revealing which of multiple intervals their private signal fell in, but that communication is limited – there is an upper bound on the number of messages used in equilibrium, and therefore no equilibrium where bidders fully reveal their information. We find that more communication is possible when there are fewer bidders, smaller participation costs, or greater variability in the information still to be learned (and therefore greater additional "information rents" anticipated by bidders who advance). We compare the mechanism with indicative bids to a standard auction without them, and find that when the number of potential bidders is sufficiently large, the use of indicative bids increases both revenue and efficiency; and we expect to show that when $N$ is large, the use of reserve prices in addition to indicative bids would be strictly counterproductive.

(We expect a full draft of the paper to be available by the end of September.)