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Fostering Participation

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Fostering Participation*

G. L. Albano, N. Dimitri, I. Perrigne and G. Piga

Abstract

This Paper argues that a buyer can lower the expected awarding price of a procurement contract by an appropriate choice of the reserve price. We also investigate how the "optimal reserve price" varies with the degree of interdependence among suppliers' production costs and the risk of collusion in the procurement market. The Paper also discusses how the buyer can foster the participation of new entrants or Small and Medium Enterprises in the procurement market.

Keywords: procurement, reserve price, participation.
Jel classification: H57, D44, D81, L41.

1 Introduction

***The content of the paper will appear in an extended version in Chapter 11 of *Handbook of Procurement,* edited by N. Dimitri, G. Piga, and G. Spagnolo, Cambridge University Press (2006)**

The authors would like to thank Vijay Krishna for insightful insights on "optimal reserve prices", and R. Calandruccio and P. Pacchione of the Energy group at the Italian Procurement Agency (Consip S.p.A.) for useful conversations on the practice of setting reserve prices in energy competitive tendering processes.

Participation in tendering processes is a crucial dimension of procurement. A commonly accepted view is that a large pool of suppliers has to be attracted in order to obtain economically advantageous conditions. The main intuitive reason is that, in most circumstances, a large number of participants induces tough competition which, in turn, translates into high savings and attractive standards of quality. Suppliers, however differ among each other in various respects. Market shares, access to the credit market, information on the nature of the procurement contract are only few dimensions of heterogeneity among them. Thus, if large participation is *per se* a desirable feature of a procurement tendering process, the final outcome will eventually be affected by the individual characteristics of participants. If only a few large suppliers participate it is likely that they will attempt to reach a tacit agreement to share the contract (or, to divide lots among them), and soften price-quality competition. If, instead, the pool of potential suppliers includes a large number of big and small firms, then anti-competitive behaviour becomes more difficult to sustain.
The buyer then faces a double task: attracting a large number of participants and influencing the composition of the pool of suppliers. Pursuing the two goals becomes even more compelling when the outcome of the tendering process determines the degree of competition among firms in a downstream market. While certainly a concern in the public sector, downstream market structure is also an issue in private procurement.

One noticeable example is provided by the celebrated 3G spectrum auction that took place in the UK in 2000. The number of licenses was the crucial dimension in determining the number of competitors in the after-auction market. In order to favour entry in a market with four big incumbents, five licenses were put up for sale, one of the most valuable of which reserved to new entrants. Eventually, the presence of new entrants was considered one of the successful features of the UK auction that certainly contributed to spur competition.

These introductory considerations address the fundamental point of this paper, namely whether or not from the buyer's stand point more suppliers are always better than less and, if yes, how the design of a tendering process might facilitate entry and active participation, especially by those potential candidates having characteristics which are of interest for the procurer.

In the ensuing discussion, Section 2 will discuss how some aspects of the design of a tendering process can affect participation. Section 3 will investigate in more depth one crucial aspect of the design, namely, the forces affecting the buyer's optimal choice of the reserve price. Finally, Section 4 will discuss the buyer's active policies for increasing participation.

2 The Design of a Tendering Process and Participation

The goal of this section is to explore the links between the design of a tendering process and participation. In most circumstances, aspects of the design such the presence and the level of a reserve price, the magnitude of participation costs, the number of contracts and the format of the tendering process determine both the level of participation and the characteristics of participating suppliers. In this sense, participation should be generally considered an endogenous decision by competing suppliers.

The link between design and participation is instrumental to answer a more fundamental question: What are the buyer's most effective solutions in attracting a specific class of participants such as small and medium enterprises or new entrants in a procurement market with a stable number of, possibly, strong incumbent firms? Affecting the composition of participating suppliers does not have necessarily an explanation in terms of efficiency or savings. Even if other objectives drive the buyer's preferred composition of suppliers, her problem is still to adopt the most appropriate set of rules for the tendering process so as to achieve the desired competitive scenario.

2.1 *Tendering Formats and Participation*

To what extent does the choice between a dynamic auction and a sealed-bid tendering format affect participation? A received view on this is that sealed-bid procedures generally induce higher participation relatively to dynamic (descending in

prices or ascending in discounts with respect to the reserve price) procedures, when participants are likely to be asymmetric. Asymmetry may come from different sources. In oil-lease sale auctions, where the quantity of oil is the relevant (common) uncertain component, before the auction takes place companies do not necessarily have access to the same information (seismic explorations, drilling samples etc.). Similar environments arise in procurement contracts for the provision of food and beverages to public schools, where transportation cost is the relevant (private) component of the contract evaluation. Big suppliers with a larger distribution network bear, on average, lower transportation costs than small suppliers.

Whether stemming from a common rather than private value component, asymmetries may keep small (weak) suppliers from participating when the format is dynamic. The argument is fairly simple. In a dynamic (say, ascending in discounts) format a weak participant anticipates that the contract will be eventually won by a stronger supplier, thus he will surely quit the contest at some point, before the auction ends. Indeed in such an auction a strong supplier, upon observing the offer from a weaker rival, can always slightly outbid him and eventually win.

With such a conviction in mind, since participation in a dynamic auction always entails some positive cost on bidders, given by the sum of both organizational expenses and possible entry fees, a weak potential applicant may get discouraged and simply avoid entering the auction. This is because a very low chance of winning the contest would render expected advantages from participation lower than the overall cost.

It should be borne in mind, however, that advantages from participation are not always confined to direct returns (such as the supplier’s expected revenue) but also to indirect ones. For example, in a dynamic auction even if a supplier correctly anticipates that his chances to win are nil, he might still want to compete (and pay a price for it) so to make stronger rivals pay more than what they would have paid had he not entered. As a general principle, however, a participant should be careful not to bid below the expected cost for performing the contract in order to avoid losses ex-post. To sum up, participation could be justified also when the expected economic costs imposed on the opponents are higher than own costs. Finally, participation by weak suppliers with thin chances of winning could also be interpreted as a way to signal their presence and their willingness to be active in the relevant market.

Sealed-bid procedures, instead, generate an element of uncertainty on the final outcome that may benefit weak suppliers. Consider, for instance, a procurement tendering procedure to award a contract for the maintenance of a hospital's central heating and electric equipment. If the contract has already been assigned in the past, it is likely that the pool of potential participants will include some (if not all) of the past winners ("incumbents") and other suppliers ("entrants"). The contract surely involves a firm-specific (private) component in the production costs (individual firm's efficiency in performing the task), but also requires an accurate knowledge of water pipes, electric wires, the structure of the building etc. Suppliers may be similar as to the private component, but they are not quite likely to be so as to the second one. If at least one incumbent supplier participates, then the latter has access to better information about the intrinsic characteristics of the task. In formulating his offer the incumbent will include a positive mark-up that, however, leaves room for a more aggressive bid by one of the entrants. A sealed-bid format does make the auction outcome uncertain by not guaranteeing to strong participants the ability to outbid systematically weaker ones. Such an uncertainty makes the prospect of positive profit rosy even to weak participants, which would render the latter suppliers more inclined to participate.

Sealed-bid formats can also have dynamic versions, with more than one round. In this environment, information circulating during the contest can originate situations akin to dynamic (descending) auctions. Strong participants could decide to be less aggressive and offer high prices in early rounds of the contest, possibly above those of weaker suppliers. Indeed, they can always decrease their bids later in the contest in order to catch up and win the contract. The conclusion appears more plausible when the number of rounds is not fixed ex-ante. Indeed, although each round is a sealed-bid session the contest will eventually reach a stage where weak participants will be unable to lower their bids offers, and thus they are forced to quit. Hence, weak suppliers may be discouraged to enter altogether. However, when the number of rounds is fixed, and known to all participants, a weak supplier may enter the contest with the conviction that reaching the last sealed-bid round would give him an opportunity to win.

To sum up, sealed-bid procedures appear to be more appropriate than open procedures to favour participation of weak suppliers, without typically discouraging

participation on the part of stronger ones. This leads to the following Practical Conclusion.

Practical Conclusion 1
Sealed-bid auctions tend to favour participation relatively to dynamic formats when participants are heterogeneous.

A remarkable example illustrating the above summary is given, once more, by the celebrated 3G UK spectrum auction. When at first it seemed that there were going to be only 4 licenses on sale, with 4 incumbents Paul Klemperer, one of the UK Government advisors, proposed to include a final, sealed-bid session after the first, dynamic (ascending) phase of the auction: the so called Anglo-Dutch format. In particular, the original proposal for the 3G auction was to allow the first five highest bidders of the ascending phase to make sealed-bid offers for the four licenses, in the second and final stage of the contest. This final sealed-bid stage was conceived to have two functions: to countervail possible collusive behaviour as well as to provide new entrants with a concrete possibility of winning one license, if they could make it to the final stage. The underlying conviction was that such a format would have induced entry of new firms thus enhancing competition among bidders. Eventually, the Anglo-Dutch solution was discarded because licenses became 5, and a Simultaneous Ascending Auction was adopted.

2.2 *Reserve Prices, Entry Costs, Entry Fees and Financial Guarantees*

Reserve prices, entry costs, entry fees and financial guarantees represent other dimensions of a procurement tendering design that might have a significant effect on participation. In what follows, we will discuss how these aspects can affect the composition of the pool of suppliers willing to compete for a procurement contract.

(a) Reserve Price

Consider a sealed-bid (lowest-price) tendering procedure for awarding a single contract for cleaning services. The buyer has a very high opportunity cost for not awarding the contract. This cost captures, for instance, the buyer’s option of entering a bilateral negotiation with a well-known, but not very efficient, contractor who does

not belong to the competing pool of suppliers. The cost might also capture the possibility that the buyer organizes an in-house supply of the same services. In either case, letting a pool of suppliers compete for the project implies that the buyer will never be willing to accept a winning bid above her opportunity cost since she can always discard that bid and have the project performed at a lower cost. The buyer, although unable to distinguish more efficient from less efficient suppliers, is reasonably confident that suppliers' private costs (measuring their efficiency levels) are all below her opportunity cost. Such a conviction reinforces her decision to set a tendering procedure to award the contract rather than negotiating it with the well-known, inefficient, contractor (or resorting to in-house production).

The buyer publicly announces a reserve price determining the highest acceptable offer (maximum bid), so bids above the reserve price are rejected. Consequently, those firms with production costs *above* the reserve price cannot participate. Should they submit an acceptable bid and win they would suffer losses. Thus any supplier efficient enough to be able to submit an acceptable offer knows that his competitors will belong to a pool of participants with expected costs below the reserve price. While the number and the heterogeneity of the pool of competing firms are reduced, submitted offers are normally more aggressive than in the absence of a reserve price. The simple reason is that the reserve price "informs" each bidding supplier that his competitors are on average more efficient than what they would be otherwise. Thus each active supplier has to compensate the lower chances of winning, due to more efficient competitors, by submitting a more aggressive (that is, lower) offer.

This simple example forces us to add a crucial caveat to our discussion in the introduction on the buyer's desirability of a large participation. From the buyer's perspective, announcing a reserve price makes it more likely that each single firm is unable to participate. However, the degree of competition among those suppliers which do participate is enhanced, thus the buyer expects better economic offers and a lower expected awarding price. Such a sophisticated line of reasoning makes us wonder how people in real auctions interpret the presence of a reserve price. A noticeable example is provided by a series of auctions for cards from the game *Magic:*

The Gathering[1] that were manipulated to modify the reserve price. One of the strengths of such a "field experiment" was the pool of participants who had heterogeneous demographic backgrounds, but shared an intense interest in auctioned items. They were then valuable subjects for testing the presence of strategic behaviour in auctions. The results of this experiment fully confirmed the predictions just described: increasing the reserve price decreased the number of bids received and the chances of selling the good, *but* increased revenue for goods which were actually sold. Even more interestingly, bidders reacted strategically to the existence of a reserve price, that is, they bid more aggressively when the minimum bid was raised. We conclude that there exist circumstances in procurement auctions under which the buyer may profit from lowering the reserve price below her opportunity cost.

It is worthwhile summarizing the nature of the competitive framework we have considered so far. The fixed number of competitors captures a procurement market where entry is basically limited over time[2], while idiosyncratic private costs are the relevant source of uncertainty (e.g., managerial skills) among firms. Then, by lowering the level of maximum bid, the buyer *lowers* (expected) participation but raises her savings thanks to a lower expected awarding price.

There exist, however, different circumstances under which the adoption of a reserve price may *increase* participation. Consider a situation in which suppliers' production cost for performing a contract is affected by a component common to all suppliers, such as uncertainty about the composition of different tasks in the final demand. If uncertainty about the actual production cost is such that inexperienced firms fear they are likely to incur in the Winner's Curse, that is, to realize losses ex-post, participation may be seriously deterred. However, a publicly announced reserve price may convey some of the buyer's information about the cost of performing the contract, thus helping suppliers form a less imprecise estimate of that cost. This may encourage entry, hence participation.

(b) Entry Costs and Entry Fees

[1] See Reiley (2005) for further details on the game and for a more detailed analysis of the results of the field experiment sketched in the text.

[2] This might be the case, for instance, when specific know-how is necessary in order to formulate a valid offer for the project.

We turn now our attention to participation costs that comprise entry costs and entry fees. Entry costs typically include all expenses borne by a supplier to "prepare" a bid: efforts by specialized personnel ranging from technical staff to lawyers, but also resources spent in estimating the value of the contract as in the case of geological surveys for oil drilling rights auctions. Consider first those entry costs that are necessary to formulate a bid. They exert an effect on participation similar to the one induced by a reserve price. In this last case, the set of potential suppliers is divided into two sub-groups: those ones with an efficiency level guaranteeing positive expected profits from bidding, and less efficient suppliers with production costs above the reserve price. When the buyer does not announce a reserve price, but sizeable participation costs arise, suppliers will become *active* participants only if their expected profit at the tendering stage compensates the participation cost. Since less efficient firms expect on average lower profits than more efficient competitors, those unable to compensate entry costs will not become active participants.

Entry costs as those to obtain information on the value of the contract may generate an additional effect on a supplier's decision whether or not to participate. In oil-lease auctions, the quantity of oil underneath the ground, which determines the value of the contract, can only be estimated by conducting costly geological surveys. Before this is done, each potential participant has hardly any idea about the value of the contract. Investing resources up-front is, however, not sufficient to estimate the profitability of the lease contract since the latter depends upon the number of firms that are willing to make similar investments. In such circumstances, a *potential* participant becomes uncertain about the number of competitors that will *eventually* submit an offer. Thus, while the introduction of a reserve price makes it less likely that each potential participant is efficient enough to participate, the reserve price itself allows each participant to estimate the level of efficiency and aggressiveness of those who *will* participate. Such estimates become even more imprecise when entry costs have to be borne for obtaining information about the value of the contract. In this case each participant, before deciding whether or not to bear such costs, has to evaluate several scenarios that differ with respect to the number of competitors who have paid similar costs and have become active participants.

Participation costs may also include entry fees, namely a non-refundable payment due to the buyer that allows potential suppliers to submit their bids. Entry fees have an impact on participation similar to the one induced by a reserve price.

Each potential participant will be willing to submit a bid if his efficiency level guarantees expected profit high enough to compensate the amount paid to the buyer. Entry fees then cut off all potential participants whose production costs are above a threshold value.

Participation costs (e.g., entry fees and entry costs in the form of expenses to prepare a bid) and reserve price have a similar effect on participation. However, there are substantial differences after competition for the contract has taken place. Suppose a small supplier has borne sizeable organizational costs to submit his bid, but discovers he has not been awarded the contract. This supplier, together with all other losers, will suffer losses *ex-post*, although all of them expected positive profits before submitting their bids. A losing supplier, when participation costs are negligible, suffers no loss if the buyer has introduced a reserve price. Losses due to presence of either entry costs or entry fees, although sunk once competition is over, may have a dramatic impact on participation in *future* procurement tendering contests. Small and Medium Enterprises that bear substantial participation costs for participating but hardly win any contract may decide, at some point, to exit the procurement market. Whenever participation is viewed in a dynamic framework, considerable participation costs and entry fees may have a potentially dangerous drawback. The possibility that some Small and Medium Enterprises (SMEs) leave the procurement market may justify the buyer's intervention to increase participation.

We conclude this section with a brief discussion on the role of financial collaterals. Financial deposits, and more in general guarantees, are normally used by to screen financially solid and reliable suppliers. These deposits typically constrain the amount of financial resources that suppliers can allocate to the competitive tendering. Financial deposits may be assimilated to entry fees, but some of their features require a brief, separate discussion.

Financial deposits, which are typically non-refundable, both prove a supplier's reliability and represent a signal of commitment. In procurement markets, they are frequently used to prevent phenomena such as abnormally low bids submitted by suppliers that may find themselves in financial distress.[3] If one of these suppliers is able to win the contract he would try to renegotiate with the buyer better contractual clauses in order to remain afloat in the market. This may happen thanks to managers'

[3] This seems to be a recurrent problem in the construction industry.

limited liabilities, and the buyer's potentially high costs for replacing the contractor who does not carry out the agreed performance. While reducing the risk of abnormally low bids, financial collaterals may reduce the participation of SMEs since they normally suffer from a limited access to the credit market relatively to bigger suppliers.

The discussion developed so far leads us to formulate the following

Practical Conclusion 2

Reserve prices, entry costs and entry fees typically reduce expected numerical participation. However, they generally enhance the level of competition and may lower the expected awarding price.

(c) Number of Contracts-Lots

We focus here on the relationship between the number of lots and participation. Contracts normally differ under a variety of perspectives such as quantity, geographical location, and nature of products. In procurement, contracts typically refer to the same type of product and may differ according to geographical location and/or quantity.

We start with the simple consideration that the higher the number of lots the higher the expected number of participants. The immediate argument is that the more lots are procured the greater is the range of available opportunities for suppliers. More explicitly, consider a procurer wishing to buy *20.000* PCs, together with a contract for technical assistance. In order to do so the procurer organizes a competitive tendering where the number of PCs is divided into *10* lots of *2.000* PCs each. Furthermore, imagine that the procurer had already awarded a contract for the supply of *10.000* PCs and for technical assistance to a big supplier, LAPFAST Ltd. It seems clear that if LAPFAST is interested in participating in this new competitive tendering, his role of incumbent would generate informational advantages, especially on the costs of the contract related to technical assistance. Indeed, while all other suppliers may possess general information concerning the PC characteristics, such as the average failure rate of their components, only LAPFAST knows the specific characteristics of the organization, and so the specific failure rates. Even if such organization-specific statistics are not too different from the average figures, potential applicants may think that this piece of information will help LAPFAST bid more accurately. In some cases,

this may discourage participation even if more lots are available and all other firms would possess the necessary requisites to win some of the lots. Indeed, entrants may think that winning against a better informed supplier might be due to an optimistic estimate of the specific costs and decide not to enter. Should the procurer fear that reduced participation would lower the degree of competition, and increase the expected purchasing price, then she might announce, as a possible remedy, the organization-specific failure rates of PCs components. In so doing, the procurer can help *all* suppliers to form a reliable estimation on the expected costs for technical assistance.

We finally observe that there exist another exception to the positive relationship between the number of lots and participation. In certain sectors the number of qualified bidders is limited, so increasing the number of lots beyond a certain threshold cannot increase participation. For example, the fragmentation of contracts in high number of lots in the pharmaceutical industry is not likely to increase participation in a competitive tendering at least in the short run.

Practical Conclusion 3
In general, the higher the number of contracts/lots the higher participation in a competitive tendering.

3 Optimal Reserve Price

The basic idea of an optimal reserve price is a trade-off between foregone transactions because of a low reserve price and gains from increased pressure on bidders to extract their rents[4]. The exact computation of the optimal reserve price would require the knowledge of the number of suppliers, the underlying distribution of their production costs, and other idiosyncratic characteristics of suppliers. In general, these elements are unknown to the interested person, which makes the computation difficult. Recent developments of econometric techniques have made feasible such a computation[5]. Moreover, the optimal reserve price can also be directly

[4] This section mainly relies on the excellent review of auction theory by Krishna (2002).
[5] See Guerre, Perrigne and Vuong (2000).

estimated from the buyer's expected cost, which can be rewritten in terms of the observed bid distribution[6]. These methods are now integrated in some decision tool packages. Any firm interested in participating in or designing itself a competitive tendering process needs to enter a few parameters concerning the procurement environment. The package will provide an optimal reserve price and the estimated probability of not concluding the transaction, that is, the chances that all tenders will be higher than the reserve price. Nonetheless, these packages are expensive and require some computer skills.

This section will provide a few basic qualitative rules that can be adopted in different environments. As explained in Section 2.2, the procurer finds it profitable to exclude high-cost firms from the procurement process. In order to achieve this objective[7] the procurer sets the reserve price at a value below his opportunity cost to perform the contract. When the suppliers' costs are independent from each other, the optimal reserve price does not depend on the number of participants and as such should not vary across different competitive environments. This result is no longer valid when some correlation or more generally dependence across suppliers' costs is expected. With such a dependence, it is unclear how the optimal reserve price should vary with the number of participants though some results suggest that it should increase with competition. When this dependence is strong, it is then optimal for the procurer to set a reserve price equal to his opportunity cost. The intuition behind such a result is quite simple. The exclusion principle holds because the gain on bids from having a lower reserve price outweighs the foregone transactions. This is due to the difference in value between the lowest and the second lowest cost. With a strong dependence among costs, this difference becomes very small leaving little room for an optimal reserve price lower than the buyer’s opportunity cost.

Practical Conclusion 4

It is optimal for the buyer to set a reserve price below his opportunity cost. When participants' costs are expected to be dependent the optimal reserve price tends toward the buyer's opportunity cost.

[6] This is explored in Li, Perrigne and Vuong (2003).
[7] Financial guarantees, which are widely used in procurements, can play a similar role.

When some common component is expected in the procurement, that is, when the ex-post cost for performing the contract is unknown to suppliers at the time of the competitive tendering and this cost is expected to be the same whatever the contractor's identity, the optimal reserve price is lower than in the environment where suppliers only differ with respect to the private component of production costs. The reason is quite simple. In a common value environment, winning the competitive tendering reveals some ``bad news'' as it is likely that the winner underestimates the real cost for performing the job. This effect is known as the Winner's Curse. To correct for the winner's curse, competing suppliers need to adjust upward their bids. The optimal reserve price follows the same strategy. The intuition behind this result is similar as when costs are dependent since a dependence among suppliers' costs is similar to having a common component.

Practical Conclusion 5

When some common value is expected in the competitive tendering, the reserve price should be set at a larger value than when private information is the norm.

Suppliers may face many uncertainties whereby preferring a certain outcome to an uncertain one. Suppliers' fear of risk affect their bidding strategies. As such, suppliers may accept to pay a premium or, equivalently, to reduce their profit to avoid the risk. Suppliers' fear of risk renders bidding more aggressive in the sense that suppliers will adjust their bids downward. Therefore the procurer does not have to exercise the same pressure on suppliers to extract their rents or profits as suppliers are willing to give up some of their rents because they cannot bear the risk. Consequently, the optimal reserve price can be set at a larger level than when suppliers are indifferent to risk. Risk is an intrinsic component of procurements as various exogenous conditions occurring after the competitive tendering such as weather, variations in the price of material can deeply affect the costs of construction for buildings, bridges or roads.

Practical Conclusion 6

When suppliers have fear of risk, the reserve price should be set at a larger value than when risk does not matter.

Procurement contracts usually involve important transportation costs of heavy material. This gives suppliers located in the proximity a clear advantage in terms of cost. Thus suppliers cannot be treated alike and have to be considered as heterogeneous or *asymmetric*. In this case, the procurer can take further advantage of such an asymmetry by using discriminatory policies such as discriminatory reserve prices in favour of disadvantaged or high-cost suppliers. In the same spirit, a price preference policy can be used to discount[8] the bid of disadvantaged bidders as further explained in the next Section.

Practical Conclusion 7

When suppliers are asymmetric or heterogeneous the procurer should use discriminatory policies in favour of disadvantaged suppliers such as different reserve prices or price preference policies.

Collusion is known to be a latent problem in procurements. A bidding ring or cartel acts as a reduction of competition since the bidding ring submits only one serious bid. The use of reserve prices can mitigate the negative effects of collusion, which tends to increase the expected cost. When collusion is suspected, it is recommended to use a lower price than in the absence of collusion to force the bidding ring to bid lower.

Practical Conclusion 8

When collusion among suppliers is suspected, the reserve price should be set at a lower value than in the absence of collusion.

Announcing a reserve price implies a strong commitment of the buyer. The exclusion principle of the optimal reserve price implicitly assumes that the buyer accepts the possibility that the transaction does not occur. Thus, the buyer can perform the job or contract and can postpone the allocation of such a contract. If the

[8] This practice is widely used in procurements when the government wants to favour local firms, national firms or firms owned by minorities. See Flambard and Perrigne (2005) for the simulation of discriminatory policies in snow removal procurements.

commitment is weak, that is, if the buyer is open to bargaining after the competitive tendering when the contract has *not* been allocated, rational suppliers will wait in the prospect of obtaining later a better deal and will not participate in the competitive tendering.

Practical Conclusion 9

A weak commitment in the reserve price will induce lower participation and will reduce the buyer' expected savings.

In the same spirit, it is usually better to announce the reserve price than keeping it secret. In a simple, competitive environment, suppliers will adjust their bids to this "random" reserve price and will tend to bid higher. There exist, however, some circumstances under which a secret reserve price may allow the buyer to increase expected savings. When suppliers are known to fear risk, an unknown reserve price adds an additional uncertainty to bidding. We have seen previously that suppliers tend to bid more aggressively as they are willing to pay a premium to avoid risk/uncertainty.

A secret reserve price acts the same way. A secret reserve price may also encourage suppliers' participation or entry as it increases their ex-ante probability of being awarded the contract. When suppliers face some (sunk) entry costs to evaluate the feasibility of the contract, they may find unprofitable to participate as the announced reserve price is too low in view of their expected performance. When such an information is not revealed, the unknown reserve price will make their participation more profitable in expectation. Lastly, a secret reserve price may give some discretion to the buyer to refuse the lowest offered bid. This is rational for the buyer if she anticipates to receive a lower bid in a future procurement.

Practical Conclusion 10

When suppliers have fear of risk, or when they face some entry costs, a secret reserve price can be a better option than an announced reserve price.

The practical conclusions derived in this Section are based on the assumption that the buyer's main motivation is to minimize the expected cost for performing some contract. In public procurements, this seems to be a reasonable assumption. Nonetheless, the buyer may face other constraints such as political constraints when the contract has to be allocated to a local supplier because of employment issues or time constraints when the contract has to be allocated in a short period of time. These constraints may invalidate some of the above practical conclusions. There are also other competitive tendering processes such as the sequential and the multi-unit ones as well as other downstream interactions among suppliers as the case of subcontracting for which the buyer's optimal reserve price policy is yet unknown.

4 Methods to Increase Participation

In the previous sections we have explored the circumstances under which a higher number of participants does not necessarily induce a more desirable outcome for the auctioneer, namely higher savings. Nevertheless, in a number of instances the procurer is interested in inducing a higher level of participation than the one that would otherwise arise. For instance, when participation costs are sizeable or when big incumbent suppliers enjoy informational advantages, Small and Medium Enterprises may anticipate a low chance of winning. Thus entry of small suppliers may be inhibited if the procurer does not take appropriate actions.

In what follows we will discuss how to foster participation of weaker suppliers by operating on the auction design[9]. The general and common principle underlying these methods is to encourage weaker participants to enter by increasing their chances to win, sometimes even by reserving to them some of the lots.

(a) Limited Bidding in a Multi-Contract Competitive Tendering

According to this criterion the number, or type, of lots that a supplier can win is limited and defined before the competitive tendering starts[10]. More specifically, tendering rules may specify a maximum number of contracts that a supplier is entitled

[9] The main references from which we borrow some of the idea developed here are Klemperer (2004) and Milgrom (2004).
[10] Ayres and Cramton (1996), Milgrom (2004)

perform, or on which contracts participants are allowed to bid. Clearly, bidding behaviour may be very sensitive to these differences and, in turn, originate rather different final outcomes.

In sale auctions such as the 3G spectrum auctions in the UK and the US, these measures were indeed introduced for a series of reasons which included also the need to promote entry of weaker or non-incumbent bidders; the other main preoccupation, notably in the UK auction, was market structure. In particular, the rules in the Simultaneous Ascending Auctions, which was eventually adopted by the UK Government for the 3G British contest, with five licenses on sale included that no bidder was allowed to win more than one licence, and that one of the largest licenses (in terms of spectrum size) was reserved to new entrants. Behind such a rule one could easily see a concern for both auction participation as well as for market structure, in the sense of avoiding dominant market positions. The presence of a *set aside* license, reserved to new entrants favoured entry. Moreover, it forced the four incumbents to compete only on four licenses, together with new entrants who were allowed to bid on all licenses. The competitive bidding behaviour on the four licenses reserved to incumbents, was probably due to the new entrants making offers on all of them, in so doing forcing all the bidders to genuinely compete. The presence of new entrants was probably due to the set aside licenses that were reserved to them. More in general, set aside items can increase the level of competition among stronger bidders, due to less objects now available to them. Although smaller bidders may generate lower revenues on the set aside licenses, more aggressive competition among stronger bidders might imply an increase in revenue on the non set aside licenses, that would render the total returns higher in this case[11].

It is important to remind here that in the 3G UK example, where the number of licenses that were open to all bidders was exactly equal to that of incumbents, a major role in the final success concerning the overall volume of revenues was the attractiveness of the set aside license, though just a single one. In fact, equality between the number (four) of remaining licenses and the number of incumbents might have still originated collusion, even if licenses differed. For example, on this point the Italian Antitrust Agency recommends that in order to prevent collusion and avoid

[11] Ayres and Cramton (1996) discuss this case in a purely private value case.

market dominance the number of lots has to be lower than the expected number of participants.

As an alternative, the UK Government could have set aside two licenses, not necessarily the two largest ones, thus increasing even further the competition among the incumbents, with their number now being strictly higher than the available supply contracts.

Observe, however, that set aside per se does not necessarily imply that enough competition would arise on the reserved lots. More concretely, suppose that, everything else being equal, in the UK 3G auction only few and weak entrants had entered rather those nine who actually participated. Then in such a scenario competition could have been weak on *all* licenses. With maximization of expected revenue as one of the main goals, the final outcome in this case could have been even worse than without set aside licenses. Indeed, had those few entrants been too weak, bidding on the reserved license could have generated lower revenues than if incumbents had been also allowed to bid on all licenses.

Setting contracts aside in procurement, and so reducing the number of lots available to strong bidders, can also have the further consequence of protecting weak participants such as Small and Medium Enterprises which may run the risk of disappearing from the market altogether if they are unable to get a share of sizeable procurement contracts. Economic as well as political reasons may sometimes suggest this prospect to be undesirable in procurement, and so a set aside policy may become recommendable.

(b) Bidding Credits

In order to induce small suppliers to enter, the procurer may introduce bidding credits[12]. The mechanism is very simple. It consists in applying monetary *discounts* to the bids of smaller suppliers, provided they win a contract. This clearly implies that those bidders who can benefit from monetary discounts have to be well identified before the contest begins. In an open ascending auction the right might, in principle, be assigned also in the course of the auction, but this procedure may suffer from a number of complications and would presumably be unable to achieve the same results.

[12] Ayres and Cramton (1996), and Milgrom (2004).

More specifically, if bidding credits are meant to induce entry then the announcement that such credits may or may not be given in the course of the auction has to take place before the contest starts. Without such an announcement, the goal of inducing higher participation would clearly fail.

The possibility of enjoying a discount of, say, 100*t%* of the winning bid in a selling auction with an exclusively private component allows a bidder with value *v* to raise his price up to *v/(1-t)*. In a procurement competitive tendering, discounts become credits. If the winning bidder is awarded the contract at a price *p*, it receives a payment of *p(1+t)* from the buyer. To see the possible consequences of bidding rewards in a procurement competitive tendering, consider a sealed-bid lowest-price format for a single contract. There are two firms, *1* and *2*, with production costs $c_1 > c_2$ respectively. Thus firm *1* is the 'weak' bidder while firm *2* is the 'strong' one. If $c_1 / (1+t) < c_2$, namely $t > (c_1 - c_2) / c_2$, then the weak bidder could in principle outbid the strong one. Since the buyer typically does not know bidders' costs, and so the lowest price that they are willing to offer, the problem is the correct calibration of *t*. A fundamental trade-off arises. If *t* is too high then a weak participant has a high chance of outbidding a strong one. However, the resulting allocation would be inefficient in the sense that the contract would not be awarded to the most efficient (lowest cost) supplier. On the other hand, if *t* is too small, weak participants may perceive the probability of outbidding strong ones as too low and thus decide not to participate

In multi-contract tendering processes, bidding credits may produce effects which are similar to the ones generated by set aside contracts[13]. To illustrate this point, consider a simultaneous ascending (in discounts) auction with two lots and two bidders. Moreover, assume that a strong bidder is willing to offer a discount for each item equal to *10%*, while the weak bidder is willing to offer a *5%* discount for the first object, and *8%* for the second. If *t=0.03 (*namely *3%)*, the weak bidder cannot outbid the strong one on the first lot, but is able to win the second lot. The final outcome of this auction with bidding credits could then be the same as that of an auction without bidding credits, but where the second contract is set aside for the weak bidder.

(c) Anglo-Dutch

[13] See Ayres and Cramton (1996).

Our aim here is to emphasize that the final sealed-bid stage may encourage the participation of smaller suppliers. Indeed even if a small supplier is systematically outbid in the dynamic phase by a bigger competitor, he can profit from the uncertainty arising in the last sealed-bid session provided that he is able to reach that stage. The exact rules of the Anglo-Dutch format depend upon a variety of factors. We thus conclude the Paper by describing a procurement process in which some problems may arise owing to the buyer's adoption of an Anglo-Dutch format.

The buyer wishes to procure *900* PC monitors. We first consider the case where all monitors are of the same size, say *15* inches, and then monitors of three different sizes. In both situations there are *3* lots of *300* monitors each; clearly, the two situations differ with respect to the composition of lots. In the former each of the three contracts is made of *300* monitors of *15* inches, while in the second the three lots are respectively *300* monitors of *15* inches, *300* of *17* and *300* of *19*. Hence in the first case lots are perfect substitutes , whereas in the second case they are not.

Consider first the case of perfect substitutes. Bids are expressed in terms of discounts for each single lot, with respect to a reserve price. Owing to perfect substitution, the reserve price is the same for all lots. The number of bidders is strictly greater than *3*, namely strictly higher than the number of lots.

Within this multi-lot context, the first open ascending phase ends when a predefined number of bidders have remained in the contest, while all others have dropped off. Exit can be observed when bidders stop obeying to the activity rule. Suppose that, say, *4* bidders are admitted to the second phase. Then in this sealed-bid phase of the contest bidders submit discounts which must be higher than what they proposed in the open phase. The three highest bidders win the three lots, and are paid a price equal to the reserve price minus the submitted discounts according to a discriminatory criterion. A variation could be that they are all paid the same price equal to the reserve price minus the third highest discount according to a uniform price criterion.

In the second situation, namely when the three lots differ according to the monitor inches, the buyer would normally set different reserve prices, and participants bid separately on each of them. Those bidders submitting the highest two discounts in each lot are admitted to the sealed-bid phase. Notice that if there are less than four different bidders admitted to the second phase, some corrections have to be adopted in order to reduce the risk of collusion among bidders. To illustrate this point consider

the following table where on the columns the numbers *1,2,3* and *4* stand, respectively, for the highest, second highest etc. offer made on the relevant lots, which are indicated on the rows. Capital letters in the cells identify bidders' identities.

	1st	**2nd**	**3rd**	**4th**
15 inches	*A*	*B*	*C*	*D*
17 inches	*C*	*B*	*D*	*E*
19 inches	*B*	*A*	*E*	*A*

Table 11.1

According to the above entries, in the sealed-bid phase bidders *A* and *B* should compete for the *15* inches, *C* and *B* for the *17* inches and *B* and *A* for the *19* inches. Overall, only subjects *A, B* and *C* will participate in the sealed bid final phase and there could be a clear potential for collusive behaviour, with participants coordinating on low offers in all the three lots. A possible remedy against the risk of collusion could be to allow the third highest offer, in the three lots, to participate in the sealed-bid phase unless the first three positions are occupied by the same three subjects in all lots. In this case, the fourth highest offer will be allowed to bid for the existing lots. In table 6.1, it is in the *17* and *19* inches lot that new participants appear, namely *D* and *E*. Although in the *15* inches lot there is no third competitor, the presence of a third bidder in the other two lots is likely to reduce the risk of collusive.

(d) Premium Auctions

As an instrument to encourage entry, giving a premium bears some analogies with bidding credits (Milgrom, 2004). In a single-lot competitive tendering, for example, it may consist in providing losing bidders with a money premium corresponding, in percentage, to the difference between a losing bid and the one immediately lower.

A possible premium structure could be like the one summarized by the following table, reporting the offers of a first-price (in discounts) sealed-bid competitive tendering.

	1st	**2nd**	**3rd**	**4th**
Bids	*50*	*30*	*20*	*15*
Premiums	*0*	*0.30(50-30)*	*0.30(30-20)*	*0*

Table 11.2

In table 6.2, the top row describes, in discount percentages, the four highest bids while the bottom row the premium scheme. This specifies that the best loser is awarded *30%* of the difference between the first and the second highest discount, while the second best loser obtains a *30%* fraction of the difference between the third and the fourth highest offer. As shares of differences between discount percentages, figures in the table must be interpreted in terms of the discounted reserve price. For example, if the reserve price is *100*€ then the premium going to the second best offer is *0.30(70€-50€)=6*€, where *70*€ is the second lowest bid and *50€* is the lowest bid. By a similar reasoning, the premium going to the third best offer is *3*€.

Bibliographic Notes

The result that a revenue-maximizing seller or a cost-minimizing buyer should use a binding reserve price is a milestone in auction theory. The first seminal contributions trace back to Myerson (1981) and Riley and Samuelson (1981). Krishna (2002) provides an excellent analytical survey of auction theory.

The design of spectrum auctions in Europe and the US has raised new issues such as the participation to sale auctions of disadvantaged and/or budget constrained firms, and entry of new firms in the market. Our discussion on the methods to foster participation are inspired by Klemperer (2004) and Milgrom (2004).

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