



# Auctions as the Most Efficient Form of Negotiations

ZEW—Leibniz Centre for European Economic Research

## 1 Introduction

Procurement makes up a large volume of the world's economy. The public procurement in the European Union alone is estimated at about 17% of EU GDP with €2000 billion for the year 2007.<sup>1</sup> Many different award mechanisms are used in these procurement processes, and classifying them into auctions and negotiations is a challenge. Still, there have been some attempts in the economic literature.

Gretschko and Wambach (2016) argue that in an auction, rules are set before collecting the offers. Bidders know how the winner of the auction is selected and rely on the auctioneer's commitment to adhere to this announced process. On the contrary, in negotiations, the rules on how a winner is selected are often unclear during the actual negotiation process. Very often, the award criteria and the rules, i.e., the decision rationale, are only determined after all offers are collected.

Subramanian (2010) takes a different approach to distinguish between auctions and negotiations. He argues that it depends on where the competitive pressure originates from. In an auction, the auctioneer is more or less passive and the primary source of the pressure originates from the competition between the bidders, i.e., bidders are competing against each other within a given framework or rule set,

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<sup>1</sup>Internal Market Scoreboard, n°19, July 2009.

whereas in a negotiation, the pressure comes from across the table. The negotiator never negotiates with more than one bidder simultaneously.

Subramanian (2010) also argues that in real-life procurement, a clear-cut separation between auctions and negotiations is not possible as hybrid mechanisms are standard practice. To this end, he coins the term “negotiauction”: “A negotiauction is a deal making situation in which competitive pressure is coming from both across-the-table competition and same-side-of-the-table competition.”

For the purpose of this chapter, we define auctions as introduced by Gretschko and Wambach (2016). Rules are set before bidders submit their bids and bidders know clearly what it takes to win the business.

In this chapter, we will explain why an auction can be a very efficient award mechanism and we will highlight the advantages of committing to a set of clear rules that is used to determine the winner. We also explain why the transparency and commitment to a specific rule set can lead to superior results compared to negotiation scenarios where the process is less defined and not fully transparent to the bidders.

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## 2 Why Use Auctions?

In procurement, suppliers are generally better informed about their costs than the buyer is, although many organizations try to use surrogate data to second guess the supplier’s cost calculation. This means the supplier’s cost position is private information. If the buyer were to determine the exact costs of her suppliers, she would, at least conceptionally, be able to skim most of the surplus in the transaction, i.e. leaving the successful supplier with a minimum viable margin. The implicit objective of any award mechanism, be it an auction or negotiation, is therefore to extract information regarding the fallback position of the bidders, i.e., the minimum price a bidder can accept given his own cost position.

In a negotiation, bidders do not have a strong incentive to reveal private information about their fallback and cost positions as submitting a good bid does not necessarily lead to an award of the business. An auction, on the other hand, can be an efficient mean of extracting private information as auctions facilitate the competition between suppliers, and the auction mechanism itself helps to reveal suppliers’ willingness to accept certain commercial conditions. The interests of the buyer and the suppliers are more aligned: The buyer prefers attractive commercial offers and the bidders know that the most competitive offer directly leads to an award of the business. This consequence, in conjunction with the transparency of the process and the buyer’s commitment to the outcome, drives prices down. In that sense, auctions are the breeding ground for competition between the suppliers.

There is another factor to consider. In a negotiation, a buyer needs to prepare offers and think about how to approach the individual bidders. In an auction, the information is extracted just by running the auction mechanism. The competitiveness of an auction works in favor of the auctioneer, and this competitiveness

increases with the number of bidders. This means that the workload for the auctioneer is not significantly higher if the number of bidders increases. As a result, an auctioneer might be better off trying to increase the number of bidders and let the auction do the work rather than spending costly efforts on information gathering.<sup>2</sup>

The more intimate communication with the bidders in negotiations can of course also work in favor of the buyer under the right circumstances. For complex projects, such as customized products or buildings, the suppliers might have a better understanding about what the optimal design looks like compared to the buyer. This makes it crucial that information flows from the suppliers to the buyer before the design of the project to be procured is finalized. It then depends on how well the buyer knows what the specification of the final product needs to be. Intuitively, one might think that if the buyer has a clear picture of the desired characteristics and can, in the best case, even assign a monetary value to each non-price dimension, an auction should still be the best way to proceed. If, on the other hand, the buyer is unsure about the project or product design and needs input from the suppliers before the business is awarded, the answer might not be so simple. Herweg and Schmidt (2017) consider this trade-off in a setting where renegotiations related to the design of the project can occur after the awarding. If the buyer can specify the characteristics of possible design changes in a complete contingent contract, then a scoring auction can be implemented to achieve this information flow and strong competition among bidders at the same time. According to Asker and Cantillon (2008), in a scoring auction, a certain score is assigned to each non-monetary dimension. Non-monetary attributes that a buyer may care about are, for example, time to completion or simply quality of the good. The buyer announces the scoring rule before the auction is held off, namely which score is awarded to which attribute and how the individual offers are ranked. The supplier who then submits the highest scoring offer wins the contract.

If, on the other hand, the buyer cannot specify the characteristics of possible design changes and renegotiations are costly, a negotiation with a preselected supplier may yield a better outcome for the buyer. This reflects the intuition from above: If the buyer is not sure about what properties she desires, she cannot assign scores to different characteristics of her project. She would tend to rely on a price-only auction. But in a price-only auction, bidders have no incentive to reveal potential design flaws early on in the process. A supplier can expect to recoup profits after winning a “cheap” project by revealing design improvements and renegotiating the price only after he won the auction. One idea to mitigate the renegotiations would be to obligate the suppliers to allow for a fixed amount of design changes or repairs in case of contingencies. In an ideal case, the buyer is able

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<sup>2</sup>In a related but different context, Bulow and Klemperer (1994) confirm this intuition. Without considering the additional costs of negotiations for the bidders, they compare the revenue of the best possible negotiation with a simple English auction where prices descend until the second-last supplier drops out. The winner is then awarded the business for the price that the last bidder accepted. They find that if you can convince one more bidder to participate in the auction, the expected revenue of the auction is strictly higher than the expected revenue of the optimal negotiation.

to define envelopes of changes for those product characteristics that are particularly prone to changes after the auction. If the buyer is also able to quantify the expected cost implications of such changes, suppliers' can compete, as part of the auction, on their commitment not to charge the buyer for certain changes after the auction. It must be emphasized that these commitments could lead to risk premiums being charged by suppliers in the auction. An auction with sufficient competition will be able to reduce these risk premiums to the fair price for the insurance of not getting on additional cost later. This procedure has been successfully implemented in real-life markets (CIPS 2018).

It should, however, be noted that limited liability can lead to problems in this case, i.e., that the firms can only be held liable up to a certain amount before they file for bankruptcy. If a supplier is unable to carry out the repairs or changes for financial reasons, even if contracted upon, the buyer won nothing by auctioning of the project including potential changes. He would need to put the repairs or changes out to tender.<sup>3</sup>

Bajari et al. (2008) find empirical evidence for this intuition. They examine a comprehensive data set of private sector building contracts awarded in Northern California during the years 1995–2000. When the project is particularly complex or if there are very few bidders for the project, a negotiation is preferred over an auction. If the project is more standardized and there are enough bidders, an auction-like process is used to benefit from competition among suppliers.

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### 3 What Is Needed to Make Auctions Work?

#### 3.1 Commitment Leverages Competition

Most real-life procurement processes are related to multi-attribute goods and services. This makes a price-only auction a suboptimal choice, since the buyer cannot account for factors that she deems relevant for her awarding decision in the auction itself. On the other hand, if in a negotiation the suppliers know or anticipate that the price is not the only relevant criterion in the buyer's decision, they have very limited incentives to improve their price. However, from a buyer's perspective, a non-binding negotiation format where she chooses the winner after having seen all the offers might seem attractive, as it allows to take other non-price attributes into account without specifying them explicitly.

In order to benefit from the advantages of an auction as described before, the buyer must find a way to incorporate the additional attributes, such as product quality, service levels, or technical support into the auction. The bidders need to know exactly how the buyer values each attribute and in the best case how an improvement on each attribute increases their chances of winning. If the buyer is able to achieve this, the successful bidder can be determined as a direct result of the

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<sup>3</sup>For a more detailed discussion, see Engel et al. (2006).

auction, i.e., the auction carries a commitment from the buyer, and being competitive pays off for suppliers.

It can be argued that commitment is one of the most important factors of designing the procurement mechanism. Fugger et al. (2016) show that without commitment, there is the risk that competitive pressure cedes. They compare two settings of a reverse auction where prices start high and can be continually lowered by the bidders: In the first setting, there is commitment: The best bid according to pre-communicated rules wins. In the second setting, the buyer can choose her favorite bid after having seen all the final offers. This would be considered a negotiation with our definitions from earlier.

Theoretically, they find that once bidders are uncertain about how the buyer selects the winner, then, in equilibrium, the non-binding reverse auction enables them to implicitly coordinate on high prices. This high-price equilibrium is also found in their experimental study done at the University of Cologne. The participants were students with no experience in procurement. Still, they were able to collude on a high price while not even being able to communicate in any other form than the price. It is worth noting that this collusive equilibrium is only stable because there is a lack of commitment on the buyer's side. The tacit collusion works as follows: The suppliers start with a relatively high offer. These offers are such that if the auction concluded at this point, everyone has a positive probability of winning the contract given the uncertainty regarding the buyer's final decision. If one supplier was to lower the offer, the other suppliers would simply follow. This means the first supplier would have to reduce his offer even further, which makes it unattractive to lower it in the first place. Thus, no supplier has an incentive to improve on his initial offer.

For the buyer, this is just as bad as "standard" collusion, where bidders coordinate on a winner before the auction and split up the revenue of the collusive agreement.<sup>4</sup>

If the buyer is not able to commit to the outcome of the selection process, i.e., the auction, suppliers might collude as described above. Another commitment issue could be the buyer's limited ability to make meaningful longer-term agreements because of a fragmented product portfolio. This can be, for example, the case in the consumer goods industry, where buyers might have to run tens of smaller auctions for very similar requirements every year. Every time the company decides to launch a new product edition or variant, the buyers need to secure the respective supply. As the exact future specification is unknown, the buyer cannot include them in any longer-term agreements without facing the risk of significant on-cost charged by the supplier. This situation not only prevents the buyer from leveraging economies of scale, it also could lead to another form of collusion called strategic demand reduction (Milgrom 2004, pp. 262, 264). With strategic demand reduction, suppliers decide not to compete on all projects and instead to divide the market

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<sup>4</sup>In another study regarding commitment, Engelbrecht-Wiggans et al. (2007) find that while buyer-determined mechanisms might generate higher buyer surplus, this is only the case when bidders know that the number of competitors is high.

between each other. That way, every supplier can win some of the many auctions run by the buyer for a non-competitive price instead of maybe winning a larger number of projects with slim margins.

This frequent real-life problem can be addressed by bundling future demands in one single auction. As the future demand is unknown, the buyer needs to move away from sourcing an exact specification at the point it becomes known. Supplier must rather compete on a cost or price model defined by the buyer, which is used after the auction to determine the actual price of a part once the product characteristics have been finally agreed by the business. This approach ensures that the buyer can leverage his full volume over a larger period, i.e., increases the buyer's commitment, and is also likely to attract more bidders as the business becomes more attractive—both effects lead to better outcomes for the buyer.

### **3.2 Comparability Enables Commitment**

As outlined above, the buyer must find a way to incorporate non-price criteria into her award decision in order to allow him to run an auction that carries commitment. But how can this be achieved? In practice, two options are prevailing. (1) Some buyers use qualitative scoring mechanisms in order to evaluate softer aspects of the procurement such as product quality, suppliers' reputation and reliability, relationship issues, supply chain risks, and so on. The buyer then assigns a qualitative point score to each criterion and weighs them according to their perceived relative importance. While this artificial construct allows to add non-price factors and product attributes into the decision, this process is prone to making a suboptimal decision. The process of assigning scores and weights is a highly subjective process which does not fully reflect the financial consequences of a given supplier selection. (2) An alternative approach is to monetize the non-price factors. A buyer could, for example, monetize supply chain risks by asking the question what is needed to mitigate this risk. If the answer is, in this example, additional stock-pilling, then the additional cost for storage is a reasonable proxy for the financial consequences of the selecting a riskier supplier. In this second option, no artificial weighing is needed at all as all aspects are monetized and brought to a common denominator, i.e., in Euros or US Dollars.

In both options, the buyer has the ability to incorporate additional product attributes into her sourcing decision and communicate these to the suppliers, which in return allows her to conduct an auction that carries commitment.

### **3.3 Controlling the Information Flow to the Bidders**

To run an auction with full commitment, the buyer needs to be transparent about the exact award criteria for the project and communicate these clearly to the potential suppliers. However, being transparent about the other types of private information related to the market at hand can have adverse effects on revenue.

There are many details a buyer can choose to pass on to the bidders. A first example is information about the competitors' bids. Haruvy and Katok (2013) experimentally investigate the effect of transparency about the bids in a setting where bidders have two exogenously given characteristics: costs and quality. The score of a bid is the monetary bid minus the quality score, and the lowest scoring bid wins the auction. They compare two auction formats, the sealed-bid auction and an open-bid, dynamic auction. In each of those formats, they compare two information regimes. In one regime, bidders know about the qualities of their opponents, and in the other regime, they do not.

In the dynamic auction, bidders can see all the price offers as they are submitted, while in the sealed-bid auction, bidders only know their own bid. This means that in the four treatments, there are varying levels of uncertainty concerning the rank of a bid. In the open-bid dynamic auction with information, bidders know exactly whether they have placed the highest bid or not. In the sealed-bid auction with no information, bidders do not even know how good their offer really is since they do not know their quality offset.

One behavioral trait that is often observed in the context of uncertainty in experimental and real-world behavior is risk aversion. If a person is risk-averse and exposed to uncertainty, she attempts to lower this uncertainty. In the context of auctions, the implications of a bid are most usually subject to uncertainty. When submitting the bid, the bidder does not know whether he will win the auction. He can, however, increase this winning probability by making his bid more attractive. For a risk-averse bidder, the connected monetary loss has less impact than the gain in winning probability. This means that, for example, in a sealed-bid auction, a risk-averse bidder bids more aggressively than a risk-neutral bidder.

In the setting from above, theory yields a clear prediction for risk-averse bidders: The auctioneer would prefer the sealed-bid, no information setting, since in this auction the ambiguity is twofold: Bidders do not know the bid of their opponents, neither the score of their bid. Indeed, the authors find that revenue-wise, the less informative, sealed-bid format is best for the buyer. This means that if an auctioneer can expect bidders to be risk-averse, and information flows between bidders are not important, she should use a format that incorporates a lot of uncertainty.

Another information that the buyer can choose to withhold from the suppliers is the number of actual bidders in an auction. Consider as an example the situation where only one potential bidder shows up. Then, using an English auction where the price starts high and decreases until the second-last bidder drops out, is not a good idea. In this English auction, the bidder would win the project for the starting price, since from the beginning, he is the only bidder left. Using a first-price auction instead, and not communicating to the bidder the actual number of bidders, might be better for the buyer. In a first-price auction, the theoretically optimal bidding strategy depends on the number of bidders. If our lonely bidder were to believe that there are several competitors, the buyer would achieve a much better price. On the other hand, if there are many potential suppliers, a buyer would prefer to reveal that number in order to further encourage competition. A similar thought is expressed by Subramanian (2010): "a sealed-bid auction makes sense when the number of

potential bidders is fewer than five or six. The non-transparency of the process invites the possibility that bidders will bid against themselves [...] an open-outcry auction makes sense when you expect several potential bidders to show up.”

But the revelation of the number of bidders must not become a signal in itself in this situation. If bidders can infer the number of competitors from whether the number is announced or not, or from the choice of the auction format, they will adjust their behavior accordingly.

This setting is explored theoretically and experimentally by Fugger, Katok, and Wambach (2017). Their research question is whether the buyer can exploit suppliers’ uncertainty about the number of competitors in procurement auctions. In their setting, the buyer first observes the number of suppliers and then chooses between a first-price and a second-price auction. Suppliers do not observe the actual number of bidders but know that either few or many suppliers are participating. Suppliers observe the buyer’s format choice and submit bids. They find that buyers behave according to the rule-of-thumb proposed by Subramanian (2010), i.e., buyers prefer first-price auctions if the number of suppliers is small and second-price auctions if it is large. It turns out that in this study the suppliers failed to anticipate that the chosen auction design is indicative about the number of bidders.

We can conclude that while a buyer should always be transparent about the rules of the auction, it can be favorable for her to withhold further information about the details of the market at hand under certain circumstances. But this should not be understood as a general practical conclusion. If, for example, the number of potential suppliers is low, the buyer might prefer to withhold the information, if the number is high, she might favor transparency. But especially in repeated markets, the buyer must be careful not to expose her private information with her decision to reveal or not.

### **3.4 The Right Auction for the Market at Hand**

Rules matter. The design of an auction can change the outcome. Decisions like using an increasing or decreasing price schedule or bidders submitting prices versus them simply accepting or rejecting prices can be crucial in real-life procurement.

How to design the optimal mechanism goes well beyond the scope of this article. This has two reasons. First of all, even in clean, theoretical environments, the optimal mechanism is typically not trivial to find. Second, in practice, each procurement comes with a number of project-specific complexities and challenges that need to be addressed and sometimes imply contradicting recommendations from theory. This makes it often impossible to come to a clear answer to what the optimal design consists of.



Still, it can be helpful to understand the advantages and disadvantages of the most common auction formats. Take, for example, the English auction as described before: The price starts high and decreases for a fixed amount with every tick of the price clock until the second-last bidder drops out. The remaining bidder wins the project for exactly this price. Thus, we classify the English auction into the second-price mechanisms. An English auction can be most suited when a supplier would want to update his bidding strategy as soon as he gets to know private information held by other bidders, e.g., their estimated efforts required to complete the project. In the case that supplier's bid can be expected to improve, once they receive more information, the English auction might present a good option.

One counterpart to the English auction is the ascending price-ticker auction, the so-called Dutch auction. In the Dutch auction, the price starts low and increases with each tick of the price clock until the first bidder accepts the price, hence a first-price mechanism. This format is a good choice when the number of bidders is relatively small as described before, or when suppliers are expected to bid very aggressively. This can be the case if, e.g., a supplier wants to win a new client or needs to fill his capacity. Another reason to use the Dutch auction is when the auctioneer expects suppliers' cost positions, and therefore fallbacks, to differ significantly. Let us assume, for example, two suppliers have costs of 10\$ and 6\$ per unit, respectively. In an English auction, the project would be awarded for 10\$ while the Dutch auction would yield a price closer to 6\$ per unit.

On the other hand, dynamic first-price mechanisms are less suited when the aforementioned information flows are important. In a Dutch auction, as soon as you get information, namely that one of your opponents has won, it is already too late to adapt.

In practice, the situation is typically more complicated. Let us assume a buyer conducts a procurement where she believes an English auction to be a good fit as all suppliers have to cope with uncertainties related to the project. These could for example be the yield of new manufacturing process or the costs required to deliver a turnkey project in a new market segment. If she also has reason to believe that bidders' cost structures differ significantly, e.g., due to different manufacturing locations, she might be confronted with contradicting recommendations. This is why, in practice, auction designers often combine different auction formats into a so-called multi-stage hybrid auction design, where each stage utilizes a specific auction format to address one specific challenge in the procurement.

As a case study, let us assume a buyer wants to procure battery cells for her new electric vehicle program and requires quantities that can only be satisfied by a dedicated factory. Suppliers are coming from different countries. All of them are using different manufacturing concepts and none of them has ever entered mass production for such cells before. At the same time, winning the contract is of strategic importance for every single supplier, as winning such contract would be the first step toward establishing one's own technology as the market standard.

Following the argumentation above, it is not obvious which single auction format would be best suited. The buyer might, therefore, resort to a hybrid auction format. In a first stage, the buyer runs an English auction to determine the two front

running suppliers. An English auction allows each bidder to learn about the other bidders' fallback as they understand at every step of the decreasing price clock that more than one bidder considers the current price level to be reasonable. They might also get to know the number of suppliers who are active at each step if the auctioneer chooses to reveal this information. This auction establishes a market for the buyer's unique requirement in real time as suppliers are competing for the business.

In order to mitigate the downside of the English auction, i.e., only getting to the second-best price, the buyer runs the English auction only until two bidders are left. By doing so, she leverages the advantage of the English auction, i.e., market making, up until the third-last bidder drops out. This leaves two bidders who by then have a much better understanding of what the other contender is willing to accept. If the buyer then switches with the remaining two suppliers to a Dutch auction, she might be able to leverage the advantages of first-price mechanisms, i.e., mitigating the risk of large asymmetries between the fallbacks of the best and second-best bidder.

This simple case study shows how the advantages of different auction formats can be combined into a multi-stage hybrid auction, an aspect that is highly relevant for sourcing managers and buyers.

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## 4 Conclusion

Auctions present a great tool to promote competition, but a buyer should pay close attention to the details of the market at hand. Aspects of the project like its complexity, but also characteristics of the supplier pool like asymmetries or even just the expected number of potential bidders matter when deciding which award mechanism to use.

Broad practical conclusions are difficult, as the properties of the best award mechanism depend crucially on the situation at hand. If a complete design of the project can be drafted and contracted on and the performance of the supplier is easy enough to verify, then an auction provides suppliers with the greatest incentives to lower their prices. If on the other hand, input from the suppliers is crucial while the project is not yet awarded, for example, during the design stage, a negotiation can be favorable to an auction. This is the case for very complex projects where contingencies can be too numerous or unforeseeable to the buyer to include them all in a contract.

Still, setting up an auction with commitment to the auction rules can be a considerable task in an organization, but it can be worth it.

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