IFAMD Market Commentary 09/2016

- Quo vadis, game theory in procurement? -

Game theory has been establishing itself for over ten years as a serious method for the development of negotiation and procurement strategies for the industrial goods business in German-speaking countries. While respectable game theory will find an optimal response to every conceivable market or competitive situation – and be that response merely the merciless revealing of a party's weak negotiation position – the market features ever more "players" who, citing game theory, will always try to implement novel approaches, though they are often driven only by the perceived need to constantly remain innovative as (external or internal) consultants.

In this Market Commentary, the Institute for Applied Mechanism Design (IFAMD) proposes for discussion ten principles that any respectable application of "game theory in procurement" should adhere to.

Initially, for a better understanding of the relevant types of negotiations and auctions that lend themselves to industrial goods procurement, as well as their ramifications, we would like to refer to the book "Game Theory Bargaining and Auction Strategies" by Gregor Berz, published in 2015 by Palgrave McMillan (and previously published in German as "Spieltheoretische Verhandlungs- und Auktionsstrategien" in 2007 by Schäffer-Poeschel, with a second edition in 2014). Since 2006, the Institute for Applied Mechanism Design has been offering consulting services to renown industrial customers, applying game theory to procurement and sales. As our flagship project, we may officially cite our support for the German soccer *Bundesliga* in the last two TV rights tender periods – a billion Euro business associated with lots of emotion and public attention. Simultaneously, and in addition to a range of private corporations, in recent years we have also had the opportunity to advise a large customer who is subject to public procurement laws, providing us with extensive experience in the interaction between game theory and procurement regulations.

It is against this background that we consider ourselves in a position to supplement the "Market Commentaries" published on our website at www.ifamd.de, this time with some observations regarding *our own market*, i.e. regarding the application of game theory to procurement – both in the context of private business and subject to public procurement laws.

Already when the method was first developed more than ten years ago, a handful of principles motivated by game theory emerged, whose observance is a precondition for the most successful application of negotiation mechanisms optimised by means of game theory – be they auctions or sequential negotiation processes. The principles essentially comprise the consistent application of a bonus system and the internal commitment to actually implement the result achieved through a negotiation mechanism as the decision in favour of a supplier (discussion known as "Auction vs. Bidding").

The bonus system renders the decision alternatives (i.e. the bidders' offers) comparable; it replaces as the decision criterion the price with value for money, including all product properties that are relevant for the decision, and it thus maximises the customer's price sensitivity. Only then will a decision carry commitment, which is ideally conveyed through a procurement (or auction) contract concluded with all bidders and which also legally obliges the buyer to comply with the negotiation process he communicated. Compliances with these elementary rules has for years been reflected in the criteria of the *IFAMD Procurement Certificate*, which we offer as a signal of "tough but fair" negotiations to our clients, vis-à-vis their suppliers.

In conjunction with the increasing popularity of the method "game theory in procurement" in recent years, we have seen in the market certain modes of application which this comment will critically discuss. In response to these developments, we would like to state ten additional principles that any respectable application of game theory in procurement should adhere to. These principles are already implicitly covered by the IFAMD Certificate.

Principle 1: no bonus system without communicating to each bidder their individual score

As consultants to bidders in industrial procurement processes, we have – particularly in the auto industry – for many years encountered communication to bidders that, while providing a methodologically clear explanation of the bonus system, fail (with various excuses and both with respect to individual criteria and in sum) to indicate to our clients what bonus or malus their bids were assigned. A variant which we have also observed several times and which is particularly subtle is to tell specifically our client that the sum of all their bonuses and penalties is a great big zero, typically arguing that they are the desired strategic partner or preferred supplier, and all competitors are judged in relation to them.

The (at least) psychological effect of such communication to suppliers is fatal with respect to what the bonus system was intended to achieve in the first place: There can be no evidence left of the customer's price sensitivity. The method becomes implausible and its respectability is questioned by the supplier. The negative repercussions concern not only the method of the bonus system; suppliers will be quick to generalise their perceptions and evaluations to game theory at large. This is why we advise firmly against intransparent bonus systems in the context of procurement procedures inspired by game theory.

However, the advice regarding transparency can only be implemented consistently in the context of private business. In the realm of public procurement law, by contrast, there is always the risk of accusation by a supplier who claims unfair treatment. This is why in this context, the evaluations of the bids are typically not disclosed – especially seeing that, ironically, procurement law specifically does *not* demand disclosure of the evaluations despite its *transparency requirement*.

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Principle 2: no auction without an auction contract

Likewise in the auto industry, a practice that has meanwhile become commonplace is to print the signatures of certain internal stakeholders or decision-makers onto the slides used for communication with the suppliers in order to convey the buyer's commitment to the communicated negotiation and decision process. This fashion of signalling commitment is certainly better than none at all. However, no "signed" PowerPoint presentation can have any legally binding effect whatsoever. Again advising bidders, suitable countermeasures have allowed the IFAMD on several occasions to successfully avert auctions that had been announced with such "signed" communication to suppliers. Though naturally not possible in every instance, such action represents quite a feat if successful. By contrast, such countermeasures are usually ineffective if a legally binding auction contract exists, which may already have been signed by a number of competitors.

Admittedly though, auction contracts are not really expedient in all types of procurement procedures. Specifically, they are of little value if, though a number of alternatives are available, there are collusive tendencies among them, i.e. if the suppliers would rather not bid at all than to submit themselves to some set of rules. In such a situation, we specifically advise against a simultaneous negotiation and decision mechanism (i.e. an auction). Instead, buyers should rather implement a sequential process, which may serve to deliberately address and break up the collusive behaviour. To already cast such a sequential process into the rigid form of a procurement contract is a task of arbitrary difficulty. Yet it is even more difficult to have such a contract signed by the collusive suppliers. In such cases, in purely methodological terms, a procurement contract is typically not the way to go. We therefore strictly recommend an "auction contract" whenever an auction is possible as the core of a negotiation and decision mechanism optimised with the help of game theory.

Principle 3: no dynamic English auction – prefer English ticker auctions

In the world of electronic auction platforms that are used for industrial procurement, the dynamic English auction is still the most common format. In particular, the variants of the so-called "rank auction", in which the individual bidders are told their rank in relation to their competitors, and the "traffic light auction", in which instead of the rank the bidder will be shown no more than a certain colour (whatever it may represent), continue to enjoy great popularity with industrial buyers. Certainly there is a charm to only showing a leading bidder their rank if the intention is not to tell them by how much their bid differs from the competitors'. However, then the relevant game-theoretic question is rather whether an English action was the best choice for this type of competitive situation in the first place.

The numerous advantages of English ticker auctions have already been treated exhaustively in the book mentioned above and shall therefore not be repeated here. Let us merely highlight briefly that most bidders will not be able to reliably respond to a market signal from in an English auction by reducing their price within a few hours. Therefore, an English auction should be consciously scheduled to last for several days, if not weeks. Only a ticker auction will allow the auctioneer to properly conduct this process.

It remains to be stated that in over ten years of advising with auctions, the IFAMD has not conducted a single dynamic English auction. In situations with multiple lots, which pose a certain combinatorial challenge especially for English auctions, so far in each case we have been able to effectively conduct English auctions as ticker auctions with the help of a so-called price pattern.

A further remark may be permitted here concerning the nomenclature which has established itself in the market: Various operators of electronic auction platforms are referring to English ticker auctions as “Japanese auctions”. This designation is redundant, for in terms of auction theory, the English ticker auction is fundamentally an English auction – in a much more precise way than, for example, a rank auction or a traffic light auction.

Principle 4: no Hong Kong auction with only one winner

When we first heard of the following pattern of negotiation, we had to clarify several times whether we had understood correctly: All bidders are invited to a hotel, and each is placed in a different room. Every fifteen minutes, a sheet is handed into each room with a price level to be confirmed by the bidders. Each round of sheets quotes a lower price than the previous one, and the process ends when confirmations are no longer forthcoming. So far, at first glance, the description exactly matches the process by which we also conduct an English ticker auction. However, there is a small and yet decisive difference: While in an English ticker auction the submission of an offer sheet is always accompanied by the information as to whether other bidders confirmed the previous step, in this scheme, the supplier was not given any feedback regarding the competition. The latter model is therefore *not* an English ticker auction. Up until a few years ago, this process was quite common in the Stuttgart area (Southwest Germany) – at least we have encountered it several times on the bidders’ side.

Prior to discussing the above process, let us briefly discuss the Hong Kong auction, which is again described at length in the book mentioned above. For this ticker auction, whose procedure resembles the English auction like a twin, a name of its own does make sense, since it is neither a first price auction nor a second price auction. Again the small and yet decisive difference is that in the Honk Kong auction, not only the last bidder to remain in the confirmation process emerges from the ticker as the winner, but additionally also the bidder who was the last to exit the chain of confirmation. Thus, the procedure yields two winners: the last and the last but one bidder. The procedure can easily be generalised to the identification of n winners: Like an English auction with n-1 winners, it ends when only n-1 bidders remain confirming the offer. But the last bidder to exit is also among the winners. In terms of auction theory (and except for the market price-forming effect of the implementation via a ticker), this procedure corresponds to a multi-unit-uniform-price auction, in which the price for all winners is not determined by the best loser (as would be the case according to pure Vickrey logic), but the worst winner, who, in a ticker auction, i.e. in the Hong Kong auction, is the last bidder do exist. (Granted, the other winners still confirmed the penultimate tick, but this we must abstract from for the purpose of this consideration – after all, ideally the ticker steps are infinitesimally small.)

The process described above may now be understood as a Hong Kong auction in its generalisation to n=1, i.e. with a single winner. However, from the perspective of auction theory, this does not really make any sense, for the process merely corresponds to a simple first-price sealed bid auction, given that bidders do not receive any feedback from the market anyway. The entire event only amounts to an attempt at creating psychological pressure and has nothing in common with the "market price-forming effect of a ticker auction". With all due respect, this is not a respectable way of forming a price in the industrial goods sector.

Principle 5: no "information option" or other questionable "privileges"

Recently we have repeatedly come across auction rules in which the bidders are given the opportunity, in return for an individual price reduction during the auction, to "buy" something that will influence their potential in the auction. Such "privileges" may for example include selected information about the position of the competition in the auction, the opportunity simply to take a "timeout" during the auction, some option in the context of other business (with the same customer, naturally), or whatever – there appears to be no limit to the imagination of self-declared game theorists in this context.

Take for example the information option: After all, the auctioneer himself should know best which party he wants to supply with market information (e.g. the price level of the competition). To leave the degree of price transparency in an auction up to a bidder's willingness to pay is highly disputable to say the least. That practice will systematically give an advantage to the bidder who likely has the best cost position anyway (otherwise they would not be prepared to pay for information on top), compared to the competition, who cannot afford that information. This distortion of competition simply systematically disadvantages the auctioneer.

With any such options or privileges, the same question always arises: Why are they not treated with the classical mechanisms of auction and negotiation theory? Not that the IFAMD is not quite prepared to adopt and to implement good ideas from others but, as auction designers, we have not yet encountered a single situation in which such "buying of options" might have occurred to us as a solution. And the IFAMD will certainly not implement such frills merely for the purpose of trying something new. My advice (as an auction designer): Hands off.

Principle 6: no Dutch auction with only one bidder

This is quite an old topic, which we will also mention here for the sake of completeness: Clients often ask us whether they should stage a Dutch auction despite already knowing that only one bidder will participate. The question is indeed legitimate: After all, so long as a monopolist is not aware of his competitive position, it is quite possible to invite him to a first-price sealed-bid auction, since this only amounts to an invitation to submit an offer, which is called for in some fashion anyway if business is to evolve. Even a monopolist who knows what he is must at some point be invited to tender. So why not in the course of a Dutch auction?

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Well, if the bidder knows that he is a monopolist, he would naturally reduce the auction to absurdity by simply waiting for the highest price that is eventually reached. This makes no sense. If, conversely, the bidder does not know that he is by himself, then the Dutch auction at least has the effect that the bidder feels exposed to competition and may thus confirm earlier than the price which we would have submitted in a conventional bid. This would indeed make sense in pure one-shot games. However, given that typically in procurement markets we repeatedly encounter the same suppliers, there is a considerable risk of the bidder somehow learning that he is or was alone in that auction. Even if that realisation comes only after the auction is concluded, it may leave a bad taste, and this bidder will never again feel any competitive pressure in a Dutch auction. Our long-standing advice is therefore: If it is clear from the outset that there will only be one bidder, avoid a Dutch auction. If, however, bidders withdraw during the preparations for the Dutch auction, suddenly leaving only one participant when the auction actually starts, then naturally this auction need not be cancelled, there is nothing but to grit your teeth and get to it.

Principle 7: no Dutch auction with "sudden death" logic

This, too, is a well-known story: The point of the Dutch auction is essentially to allow the bidder to be as certain as possible when submitting his bid that he will be the winner. The auctioneer in turn hopes that the bidder will confirm an even lower price since the latter need not be concerned about having unnecessarily revealed his price. Ideally, the ticker steps would be infinitesimally small, the ticker would rise continuously, and the risk of more than one bidder confirming the same price would be zero. In practice, however, this is not possible; purely for the sake of administering the process we require some step size, and for every step we require a price level that is to be confirmed within a certain period of time. Thus, we potentially face the problem of having to deal with two bidders who confirm the same price.

Some auction platforms provide the option of applying the "sudden death" logic in this context: The bidder who first confirms the crucial step – and be it by mere milliseconds – wins. We advise against this procedure. In industrial procurement, the placement of orders should not be decided on the basis of the suppliers' bidding speed. Instead we prefer the "full step" logic, according to which all bidders can use the full time interval to confirm the step, regardless of whether others have already confirmed ahead of them. Naturally, the auctioneer must ensure that the bidders do not know whether the others have already confirmed the step. Nevertheless, the risk of two bidders confirming the same ultimate step remains. In that case, a tie round should be held among these two bidders. Our recommendation here (as identically with every descending ticker – English or Hong Kong) is that in choosing the ticker step size, a conscious trade-off should be made between the simpler administration of larger steps on the one hand and the ideal of infinitesimally small steps on the other hand.

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Principle 8: no supplier communication that does not explicitly state the ticker steps

This is something we have experienced several times recently: A ticker auction is announced – be it of the English, Hong Kong or Dutch variety – but the bidders are informed about the size of the ticker steps only on the day of the auction, not ex ante. However, game theory thrives on the bidder's ability to form an optimal strategy based on the decision mechanism, to optimise his behaviour given the rules of the game. This is not possible if he does not know the rules in full and well in advance – and the size of the ticker steps is an essential part of these rules.

The situation becomes particularly absurd in combination with a special "privilege" that is offered for sale prior to a Dutch auction. This is precisely what we have recently witnessed with respect to two corporations from the automobile industry: Without knowing the size of the ticker steps, the supplier is invited to buy the "privilege" of being the "tie breaker" in a Dutch auction. In other words, if he confirms the same ticker step as another bidder, there will be no tie round as described above, the tie breaker will immediately be the winner. Our general attitude towards the sale of privileges has already been described further above. In this context, however, the practice becomes especially absurd because the value of being the tie breaker depends exclusively on the size of the ticker steps in the Dutch auction! Therefore, if a tie breaker privilege is to be offered, at least it should be offered in conjunction with the information regarding the size of the ticker steps.

Principle 9: no game theory under public procurement law in collusive markets

Though the eight recommendations given so far are based on observations made in the context of private business, they are equally applicable to procedures under public procurement law. Furthermore, the first eight recommendations all refer to auctions – which, however, constitute only one half of the method "game theory in procurement".

The second, perhaps even more fascinating half concerns collusive markets, in which auctions are not possible. We have already touched upon this issue above. Collusive markets require sequential negotiation and decision processes in order to adequately address the collusive behaviour of the market participants. However, certainly for good reasons, public procurement law specifically contains a deeply entrenched principle, namely the *requirement of equal treatment*, which outlaws any differential treatment of the bidders. Consequently, public procurement law permits only simultaneous negotiation and decision processes. Thus, in collusive markets subject to public procurement law, the hands of game theory are effectively tied. This insight is in particular confirmed with respect to our public-sector customer. In the context of public procurement law, the IFAMD will only apply game theory in the preparations for tenders if the markets in question are strongly competitive.

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Principle 10: no unmotivated negotiation and auction design

Finally, we would like to share the general observation that we repeatedly encounter designs for auctions and negotiations that from our perspective are devoid of any serious game-theoretic foundation. Insidiously, one and the same mechanism may pass as "optimised from a game theoretic perspective" in a certain competitive setting and yet be simply inadequate in another setting. This will often make it difficult for laymen to distinguish a negotiation design that is founded in serious game theory from one that is based on the buyer's random trial and error. Either way, all buyers who think and talk about game theory in procurement should be aware that game theory is not constituted by the mechanisms themselves. Rather, only the choice of mechanism can be optimised from a game-theoretic perspective in a given competitive situation – and optimised it must be if we are to do justice to the method of "game theory in procurement". The IFAMD endeavours to provide a game-theoretic foundation to every proposal for an auction design. For simpler cases, i.e. if only one winner is to be identified in a highly competitive (an in particular not collusive) market and if a bonus system renders all bidders sufficiently comparable, we have developed a universal scheme according to which a specific standard auction design is proposed on the basis of three objective criteria. Each criterion can assume either of two manifestations, hence we call this scheme the *IFAMD Awarding Cube*. In more complex cases, e.g. with multiple lots and winners, the IFAMD Awarding Cube line of thought can also often be applied, and we typically derive from it the recommendations to our clients.

To summarize, we list once more the ten basic principles that have become dear to us in the course of our extensive experience in the German-language industrial goods market:

1) **no bonus system without communicating to each bidder their individual score**
2) **no auction without an auction contract**
3) **no dynamic English auction – prefer English ticker auctions**
4) **no Hong Kong auction with only one winner**
5) **no "information option" or other questionable "privileges"**
6) **no Dutch auction with only one bidder**
7) **no Dutch auction with "sudden death" logic**
8) **no supplier communication that does not explicitly state the ticker steps**
9) **no game theory under public procurement law in collusive markets**
10) **no unmotivated negotiation and auction design**

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