Economic Focus
February 2009

Microeconomix
Economic analysis applied to Law

Auction design and risk of collusion

In order to award a procurement contract, a buyer may choose between entering into negotiations and running a procurement auction. The theoretical economic literature suggests choosing a procurement auction[1], because under certain conditions it induces competitive bidding resulting in the best possible price for the buyer. This suggestion is based on the assumption that bidders do not collude. However, in practice, bidders may collude and therefore procurement auctions do not necessarily guarantee the best prices for the buyers.

It is a common belief that auctions allow for generating the highest possible revenue even though suppliers may collude. For example, in its decision concerning collusion in the market for electric cables[2], the French competition council suggested that as compared to negotiations the introduction of a procurement auction had a goal of increasing competition in the market.

In fact, auctions may not succeed in eliminating collusive behavior. The present article discusses collusion in auctions and indicates the measures that the auctioneer could adopt to prevent collusive behavior. In particular, it reviews the standard factors related to collusion and links them with auction rules. These standard factors include cartel's ability to (1) generate extra profits, (2) divide the surplus in such a way that all the colluding parties are satisfied, (3) detect deviations and (4) punish detected deviations.

Types of auctions

In contrast to negotiations, which are often very flexible, procurement auctions usually have fixed rules, including bidding rules, allocation rules and pricing rules. The bidding rule specifies the bids that potential sellers may submit. The allocation rule explains how the winning bidder is chosen. Finally, the pricing rule defines the price the buyer will pay to the winning bidder.

A first-price procurement auction is perhaps one of the simplest examples of a procurement auction. In this auction, bidders simultaneously submit sealed bids. The buyer opens all the bids and ranks them from the highest to the lowest. The bidder who submitted the lowest bid is awarded the procurement contract at the price equal to his bid.

A reverse English auction is another example of popular procurement auction formats. In this auction, bidders offer decreasing prices. The price continues to fall until one bidder remains in the auction. This bidder is awarded the procurement contract at the price offered by his last competitor.

In general, there are two major types of auctions: open auctions, including reverse English auctions, and sealed-bid auctions, comprising first-price procurement auctions. In open auctions, bidders submit multiple bids and receive some information feedback on the actions of their opponents. In sealed-bid auctions, bidders submit single bids and have very little information concerning other bidders' activities.

Forms of collusion in auctions

The ultimate goal of collusion is to elevate the price above the competitive level and to benefit from the generated surplus. To achieve this goal, colluding parties need to agree how to inflate the price and how to divide the generated surplus. These two tasks are perhaps more difficult in auctions than in the other market settings, because bidders do not have a direct control on prices but only on their bids and because very often only one bidder is awarded the contract. Given the auction rules, bidders need to have a common understanding how to increase the price by means of their bids. Furthermore, the losing bidders, who do not immediately realize gains from collusion, need to have a clear interest in joining the cartel.

Bidders collude by engaging in various forms of bid rigging, including: bid suppression, complementary bidding, bid rotation and joint bidding[3]. Bid suppression and complementary bidding are the schemes used to elevate the price. In a bid suppression scheme, some of the suppliers agree to refrain from bidding or withdraw previously submitted bids, while other suppliers submit high bids. In a complementary bidding scheme, most of the bidders submit unrealistically high bids.

[1] See for example Bulow, J. and P. Klemperer (forthcoming), "Why Do Sellers (Usually) Prefer Auctions?", *American Economic Review*.
[2] Décision n° 07-D-26 du 26 juillet 2007.
[3] Kovacic, W.E. (1990), "Bid rigging and price fixing", in: "The Antitrust Government Contracts Handbook", American Bar Association, Chicago.

Bid rotation and joint biding are the schemes that colluding bidders use to divide the generated surplus. In a bid rotation scheme, colluding bidders take turns in being the lowest bidder. In a joint bidding scheme, colluding suppliers submit a joint bid and agree how to divide the profit between them.

As will be further argued, the possibility of collusion is closely related to auction rules. By manipulating auction design, an auctioneer may eliminate collusive behavior. Some of the ways of eliminating collusive ways are indirect (for example reserve prices), while others are direct (for example forbidding joint bidding).

Bidders' ability to generate collusive profits

Bidders' motives to collude depend on cartel's ability to generate collusive profits. When reaching a collusive agreement, colluding parties compare their profits resulting from their ordinary activities with those they are able to jointly generate. Collusion is more likely to occur when the difference between collusive profits and firms' independent profits is especially high. Three main factors determine this difference: (1) entry barriers, (2) demand elasticity and (3) reserve prices.

Entry barriers

Entry barriers affect a cartel's ability to generate extra profits. In the absence of entry barriers, any supra-profit triggers market entry, resulting in decreased profitability of cartel's operations. In the presence of entry barriers, the existing firms may be able to generate extra profits that are not threatened by the market entry.

Bidding procedures often put restrictions on bidders' participation by requiring bidders' pre-qualification. For example, bidders may be asked to meet certain technical and financial criteria or to acquire licenses for their products or services. These requirements often constitute important entry barriers facilitating collusion among bidders. Indeed, bidders who wish to pre-qualify need to spend extra time, cost and effort. Some of the potential bidders may prefer not to register and to avoid this extra cost. Therefore, the pre-qualification has a negative effect on the number of registered bidders. This entry-deterring effect does not only decrease competition in the bidding market, but also helps bidders to reach a collusive agreement.

The construction industry is an example of a bidding market with clear entry barriers that have contributed to the creation of numerous cartels. For instance, licenses' requirement and various financial hurdles constitute barriers to entry in the construction industry. These entry barriers are likely to be one of the reasons why cartels have historically affected this industry. As the recent report published by the Organization for Economic Co-operation and Development (OECD) claims, the problem of cartels in the construction industry does not appear to be subsiding[4]. A recent example involves a case brought by the Office of Fair Trading in the UK. The statement of objections has been issued against 112 firms in the construction sector in England[5]. The suspected behavior includes complementary bidding and transfers from the winning bidder to the losing opponents.

Demand elasticity

Cartel's profits depend on demand elasticity. The lower the demand elasticity, the higher the profit the cartel is able to generate and the more likely the cartel formation. The relation between demand elasticity and cartel formation may partly explain some of the bid rigging cases in large government procurements. For example, the Hungarian competition council found eight construction companies guilty of bid rigging in a public procurement concerning the construction of roads in the municipality of Budapest[6]. In that case, it seems that the construction of roads was of high urgency and therefore that demand was rather inelastic. Given the inelastic demand, construction firms must have realized that by colluding they were able to charge high prices. This realization probably greatly contributed to the cartel formation.

Reserve prices

The reserve price is directly related to bidders' ability to generate collusive profits. Colluding bidders typically increase their profits by inflating their bids. The reserve price defines the maximum possible bid and hence in theory should limit bidders' ability to increase their profit[7]. In practice, colluding bidders may sometimes realize that the auctioneer is unable to commit to the reserve price. In that case, bidders recognize that a given auction may be cancelled and organized again with the higher reserve price and therefore, they may prefer not

[4] See the OECD Policy Roundtables, Construction Industry "Construction Industry", 2008.
[5] See press releases of the Office of Fair Trade in the UK, 52/08, 17 April 2008.
[6] Hennen, T. and A. Defossez (2005), "The Hungarian competition council finds 8 construction companies guilty of bid rigging in respect of a road construction contract ("Municipality of Budapest")", *e-Competitions*, 306.
[7] Kovacic, W.E., R.C. Marshall, L.M. Marx and M.E. Raiff (2006), "Bidding rings and the design of anti-collusive measures for auctions and procurements", in: "Handbook of Procurement", ed. Dimitri, N., G. Piga and G. Spagnolo, Cambridge University Press, Cambridge.

to engage in serious bidding and to wait for the auction rules to change[8].

Profit redistribution

Generation of collusive profits requires firms to focus on common interest and to act as a monopolist. The common interest may not be in line with individual firms' incentives and therefore a firm may need to be compensated for losses incurred. The compensation usually takes the form of a transfer from a firm that directly gains from collusion to a firm that suffers immediate losses.

In bidding markets, the winning bidder realizes immediate gains from collusion. The remaining bidders face a choice between the compensation for following the collusive agreement and profits resulting from competitive bidding. When the compensation is high enough, it is easier to convince firms to join a cartel and collusion is more likely to occur.

Profit redistribution schemes

In practice, transfers, bid rotation and subcontracting are used to sustain bid rigging. In some cartels, part of the bidders is offered financial transfers for not involving in competitive bidding. For example, from the early 1980s until at least June 1997, stamp dealers organized pre-auctions to determine which bidder would win the auction and to agree on payments that the other bidders would receive[9].

Bid rotation scheme constitutes another profit redistribution mechanism. In this scheme, bidders take shifts in winning similar auctions. For example, from at least 1930 to mid-1980s, the international heavy equipment cartel used a bid rotation scheme based on the phases of the moon[10].

Finally, the winning bidder sometimes subcontracts part of the awarded contract to the conspiracy members. For example, following an invitation of the Hungarian universities and government to discuss possible procurement of IT solutions in 2004, IBM, SAP and ISH allegedly chose the winning contractor and agreed that the losing bidders would receive subcontract business from the winning bidder[11].

While the auctioneer has little possibility to monitor pre-auctions or bid rotation schemes, possibility of subcontracting is usually specified in the auction rules. To avoid collusion among bidders, it is advisable for the auctioneer not to allow for subcontracting.

Market concentration

Market concentration appears to increase bidders' ability to redistribute generated profits. In concentrated markets, the number of significant market players is limited. With a small number of market players it is easier to reach a collusive agreement and to divide the generated surplus[12]. Indeed, bid rigging has been uncovered in concentrated markets (for example in the school milk market[13]).

Detection of deviations

To enforce a collusive agreement, cartel members need to monitor their compliance. Since perfect monitoring is usually impossible, firms use imperfects measures (for example prices or market shares) to detect deviations from collusive agreements. These measures are imperfect because they are not only affected by firms' affairs but also by shocks to the economy. Market transparency allows for distinguishing between direct effects of firms' actions and market shocks. Besides, firms find it easier to understand market signals, when they produce similar goods and have similar costs and capacities.

Procurement rules used in a bidding market determine market transparency and bidders' ability to collude. In particular, open auctions, in which bidders see each others' bids, encourage anticompetitive behavior[14]. In open auctions, bidders do not only interact more frequently, which gives them a chance to agree on the division of gains from colluding in the auction, but also see each others' actions, which allows them to immediately detect deviations from the agreement. Therefore, open auctions are more prone to collusion and may generate lower revenues than sealed-bid

[8] Klemperer, P. (2008), "Competition Policy in Auctions and "Bidding Markets"", in: "Handbook of Antitrust Economics", ed. Buccirossi, P., MIT Press, Cambridge.

[9] See the Department of Justice press release "California stamp dealer charged with rigging auctions," June 26, 2002.

[10] See "International electrical association: a continuing cartel", U.S. Government Printing Office, Washington 1980.

[11] For details see Small, H. (2006), "Client Alert: SAP and IBM Fined in One of Europe's First IT Bid-rigging Case", European Competition Law Practice Group.

[12] Albano, G.L., P. Buccirossi, G. Spagnolo and M. Zanza (2006), "Preventing Collusion in Procurement: a Primer", in: "Handbook of Procurement", ed. Dimitri, N., G. Piga and G. Spagnolo, Cambridge University Press, Cambridge.

[13] See "U.S. Investigating School Milk Bidding in 16 States", New York Times, August 5, 1991.

[14] Klemperer (2008).

auctions, where competing bids are not revealed to the participating bidders. Overall, the amount of information provided to the bidders increases the likelihood of collusion by enabling detection of deviations.

The relation between auction format, auction revenue and collusion may be illustrated with an example of the U.S. Forest Service, which historically used both open and sealed-bid auctions to auction timber. Athley, Levin and Seira (2004) show that during the 1980s in the Northern region of the United States (including Idaho and Montana), open timber auctions were less competitive than corresponding sealed-bid auctions[15]. They argue that collusion in open auctions may explain the observed revenue gap.

Punishment of deviations

A system of punishments often helps to implement a collusive agreement. For example, colluding parties may agree to stick to the collusive agreement, as long as no party deviates, and to enter into a price war, after detecting a deviation. This collusive agreement could be successfully enforced, because the threat of the price war would discourage firms from deviating.

Bidders' ability to punish the deviating firms depends on auction duration. For example, in open auctions, where bidders submit multiple bids, there is always time to punish a detected deviation. By contrast, in sealed-bid auctions, bidders are not given any chance to revise their bids and hence, may face difficulties in punishing deviations. Therefore, open auctions are more prone to collusion than sealed-bid auctions[16].

Bidders may also try to punish deviating bidders in future auctions. When similar auctions are organized frequently, the threat of future bidding war may deter deviations. When auctions are organized at long irregular time intervals, the threat of future bidding war loses its importance and collusion is more difficult to sustain[17].

Concluding remarks

While auctions are believed to be better at preventing collusion than negotiations, the problem of collusion does not tend to disappear in auctions. Fortunately, an auctioneer may control the risk of collusion by choosing an appropriate auction design. In particular, the risk of collusive behavior in auctions depends on auction rules (concerning pre-qualification, reserve prices, subcontracting and joint bidding), auction information feedback and auction duration and frequency.

Pre-qualification often constitutes an important entry barrier eliminating some of the potential bidders. With a smaller number of bidders, it is easier to collude. To limit the risk of collusion, the auctioneer may try to simplify the process of pre-qualification and pre-qualify as many bidders as possible.

Reserve-prices are a tool that may be used to fight against collusion. In the absence of a reserve price, colluding bidders may submit unrealistically high bids and enormously inflate the price. The reserve price limits such behavior.

Some auctions allow for subcontracting and joint bidding, even though they are common forms of bid rigging. Given their pro-collusive effect, they should be allowed in auctions with great caution.

Information revealed during the auction gives bidders an opportunity to communicate. In particular, in open auctions, bidders have a possibility to communicate a collusive agreement and to observe deviations from the agreement. Therefore, open auctions tend to be pro-collusive and an auctioneer wishing to minimize the risk of collusion should opt for sealed-bid auctions or at least provide very little information feedback on submitted bids and active bidders.

Inappropriately chosen auction duration may boost collusion by giving bidders time to figure out their optimal collusive behavior. In open auctions, bidders have time to reach a collusive agreement and to adjust it to unexpected circumstances. Short auctions, such as sealed-bid auctions, should be preferred by an auctioneer suspecting that participating bidders form a cartel.

Finally, bid rigging is related to auction frequency. Repeated auctions facilitate distribution of collusive profits and give bidders an option to punish detected deviations in the previous auctions. Auctions organized at long irregular intervals are less prone to collusion.

Marta Stryszowska

Marta Stryszowska is a Senior Economist of Microeconomix. She holds a PhD in economics from Tilburg University (the Netherlands).

[15] Athley, S, J. Levin and E. Seira (2004), "Comparing Open and Sealed Bid Auctions: Theory and Evidence from Timber Auctions", FEEM working paper.
[16] Klemperer (2008).
[17] Kovacic et al. (2006).