Efficiency and Bid Rigging in Simultaneous Procurement Auctions under an Oligopoly

Aaro Hazak, Tanel Kerikmäe, Evelin Pärn-Lee

Tallinn University of Technology

Abstract

Splitting large procurements into several smaller ones has been promoted in the European Union and by OECD members among others as a way of enhancing competition and improving institutional frameworks for market efficiency. This paper presents a conceptual discussion of the causes and consequences of potential bid rigging when oligopolists are asked to make simultaneous bids for similar goods. It appears that calling for similar bids simultaneously may incentivise collusion among bidders, while arranging multiple consecutive procurement auctions could reduce that problem. Moreover, holding simultaneous procurement auctions may make the cost of supply relatively high for bidders because of the larger risks involved. Furthermore, bid rigging remains difficult to detect when there are simultaneous procurement auctions because of the large degree of uncertainty for bidders, which encourages relatively high bid prices that may, in fact, be collusive.

Keywords: bid rigging, collusion, oligopoly, umbrella pricing, simultaneous procurement auctions

1. Introduction

Procuring goods by inviting competitive bids remains a widespread practice for both governments and companies. Bid rigging or collusive tendering occurs when potential bidders agree in advance which of them will offer the winning bid or the only bid. Collusive tendering can happen for both

small and large contracts, and it can occur in both private and public procurement in a variety of industries, making it a significant issue of concern. Since collusion requires collaboration between companies, markets where there are fewer players, such as oligopolies, are often more prone to bid rigging than markets with a larger number of participants.

When bid rigging impacts a procurement, it may lead to prices being suboptimal and thus have an adverse effect on the profitability of the purchaser. Moreover, collusive tendering distorts competition and may pose a threat to the financial soundness and survival of honest competitors and of procurers. For these reasons bid rigging is a per se violation in many countries under both public procurement law and competition law and in some countries it is a criminal offence that is investigated and sanctioned under criminal law.

There may be different reasons why suppliers engage in bid rigging. One is bid suppression, which is where the parties involved in bid rigging want to achieve a relatively high winning bid price, and so only one of the parties submits a bid while the others agree to refrain from bidding or to withdraw bids they have already submitted, usually for some reward. The reward can be that the party suppressing their bid is engaged as subcontractor to the successful bidder and provides part of the goods to the winner. In practice, it is difficult if not impossible to detect whether a subcontractor of the winner could potentially have been an independent bidder and as such could have competed with the winner. In general, public procurement rules like Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement in the European Union do not prohibit bidders from engaging competitors as subcontractors. Article 57(4)d) of the Public Procurement Directive merely states that a contracting authority may exclude any bidder from participating in a procurement procedure if the contracting authority has a sufficiently plausible indication that the bidder has entered into agreements with other parties with the aim of distorting competition. Companies must observe the rules of competition law when collaborating with competitors by preparing and submitting a joint tender for example. In the EU this mainly comes under Article 101 (1) of the Treaty on the Functioning of the EU. Even though competitors cooperate and exchange sensitive information when making a joint tender, joint tendering does not necessarily imply collusive tendering as long as the cooperation in a joint tender that is being submitted is evident. The main difference between a joint bid and bid rigging is

that the joint bid is openly declared as collaborative while bid rigging usually remains a secret. There are grey areas however, as the position under competition law is not clear when competitors cooperate to submit a joint bid, but decide to go with separate bids just before submitting the joint one, for example (see Graells, 2015 for further examples).

In a more complicated case, the conspirators may agree to submit cover bids that are intended not to be successful with the aim of letting the designated winner win the bid. Cover bidding, which is also called shadow, courtesy or symbolic bidding, is designed to give the appearance that real competition is taking place, while in fact the bids made by the colluders are deliberately made higher than the bid of the agreed winner or exceed the estimated budget of the procurer or intentionally contain conditions that are not acceptable to the purchaser.

The procurer in a tender process usually wants to choose the best supplier while the rest of the bidders do not get a contract, but this winner-takes-all setting may inspire competitors to rotate the bids or allocate markets. In bid rotation the competitors agree upon a certain winning pattern among themselves over the course of many consecutive bids, while market allocation occurs when the competitors divide the market so that a certain supplier wins bids of a particular type or some bidders win in certain geographic areas or among certain customers.

In addition to these practices, collusive tendering can also take the form of bribery of the contracting authorities or communication with other tenderers (Zarkada-Fraser and Skitmore, 2000). Such communication is particularly challenging not only for the competitors but also for the investigators, since not every innocent exchange of information qualifies as collusion under competition law rules.

The common feature of all these and other bid rigging practices is that by predetermining the winning bid the bidders do not truly have to compete with each other. Bid rigging often remains difficult to detect and it is hard to gather sufficient evidence for a legal case to be brought. In many cases, collusion is sought through a purely legal investigation into agreements and other forms of communication between suspected bidders. Often the only way to reveal a procurement cartel and

collect evidence on it is through whistleblowing, as happened in 2002 when a major case of collusion was discovered in the Dutch construction industry (Doree, 2004). Several authors have however searched for techniques for detecting quantitative bid rigging, including Porter and Zona (1993), Bajari and Ye (2003), and Porter (2005).

This paper looks into collusive tendering in simultaneous calls for bids in an oligopoly, a case which has not received much attention in the literature. Simultaneous procurement auctions are when the party seeking to purchase some goods splits the total procurement into lots and calls for several bids for similar goods simultaneously, rather than asking for the bids consecutively one by one. Calling for simultaneous bids is common practice in the EU member states, including in public procurement, when similar services are procured for different geographical areas or different organisational units for example. A key reason for making simultaneous calls for bids is when the timing of procurement is regular, say annual, because of the financial or budgeting cycle of the procuring organisation. It has also been argued that splitting large procurements into smaller parts may attract additional competition, for example in the OECD Guidelines for Fighting Bid Rigging in Public Procurement and recitals 78 and 79 of Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement. The EU procurement rules very much encourage bigger contracts to be divided into lots, but it is left up to the contracting authority to decide whether to use consecutive or simultaneous auctions. What makes simultaneous procurement special is that as competitors often face capacity constraints and are subject to economies of scale, the total procurement volume of simultaneous calls for bids may exceed the total capacity that an individual supplier is able to cover. This means the bidding strategy of the bidders must consider how to make their bids so that their total capacity constraints and economic breakpoint levels are properly addressed if they win, while their profits are maximised at the same time. In seeking to address these uncertainties, suppliers may be motivated to engage in collusion.

The fewer competitors there are in the industry, the easier it is for them to establish and maintain an efficient cartel. Oligopolistic markets may be particularly vulnerable because of the combined effect of the small number of market participants and the capacity constraints of individual companies. That is why this paper is focused on the specific case of bid rigging in simultaneous

sealed-bid procurement auctions in an oligopoly. Following the literature overview, Section 3 of the paper presents a conceptual argumentation for understanding the drivers of bid rigging under such circumstances, and Section 4 provides a discussion of the results.

2. Literature

Several authors have sought to provide a theoretical platform for understanding the efficiency of procurement in an oligopoly and other considerations of bid rigging. Feuerstein (2005) and Weishaar (2013) provide a comprehensive review of studies on the subject. In one of the first papers on the topic, Friedman (1971) considers a Cournot oligopoly, and demonstrates that joint profit maximisation strategies work better than individual ones. Later theoretical studies find further reasons why oligopolies are particularly vulnerable to collusion. Shapiro (1989), among others, explains that bid rigging is generally more likely to occur when there is a small number of suppliers, as it is difficult to operate and coordinate a long-term cartel when there are a lot of suppliers. Selten (1973) and Phlips (1995) find that there is a higher risk of long-term collusion occurring if barriers to entry mean few competitors enter or are likely to enter a market, so that existing market participants are protected from the competitive pressure posed by any new entrants. New entrants and other changes on the supply side like mergers, as discussed by Compte et al., 2002, are believed to make any existing bid rigging agreements vulnerable, while stability in the market increases the risk of collusion. Several authors have argued (see Scherer and Ross, 1990 for an overview) that the more homogeneous the procured goods are, the larger the chance of collusion between competitors. Similarity in products and cost structures makes it relatively easy to understand the profit maximisation strategies of competitors and the preferences of procurers, so that long-term agreements on mutually beneficial cooperation can be arrived at.

There are mixed results in the theoretical literature for the effect of capacity constraints on collusion. Brock and Scheinkman (1985) find that capacity constraints affect potential collusion differently for large and small bidders, as small bidders are less exposed to the adverse effects of defecting from cartel agreements. Davidson and Deneckere (1990) demonstrate that increases in collusively agreed prices are positively related to increases in the level of capacity or excess

capacity as market players use the additional resources gained from collusion to expand their capacity in the hope of earning even more profit.

While most of these theoretical studies address one-off auctions, Jofre-Bonet and Pesendorfer (2003) suggest a methodology for estimating the outcomes of repeated procurement auctions with capacity constraints. The Jofre-Bonet and Pesendorfer (2003) study is important in the context of the current paper, as they model consecutive procurement auctions, which is the most likely alternative to simultaneous procurement auctions. They show two distinct effects that may be equally relevant with simultaneous auctions. First, they show that winning a large contract may mean some resources of the successful bidder are committed for that contract and renting additional resources, though possible, could increase the total cost and thus disadvantage the bidder next to its competitors. Second, they show an experience effect where rendering services under one contract may give the bidder useful experience for other similar contracts and thus lower the cost of future contracts. Jofre-Bonet and Pesendorfer (2003) back up the theory with the finding from empirical data on US highway construction procurements that capacity constraints do affect the bidding strategies of companies.

Aoyagi (2003) studies repeated sales auctions, finding that collaboration over multiple consecutive auctions gives a better payoff for bidders than does collusion in one single auction. However, his paper does not address the effects of simultaneous auctions or reverse procurement auctions. Several authors have studied simultaneous auctions, including Gunay and Meng (2012), Brusco and Lopomo (2009), and Engelbrecht-Wiggans and Kahn (2005), but they have done so from the perspective of the sales auction and mostly in the context of simultaneous ascending auctions, which differ in principle from the simultaneous sealed-bid purchase auctions studied in this paper. Lundberg (2005) appears to be the only author to date to discuss simultaneous procurement auctions. She presents an interesting bidding strategy model showing that this type of purchase auction encourages aggressive bidding, and she provides results of its empirical testing. Her paper does not cover bid rigging issues, however.

Previous empirical studies have primarily sought to quantify the effects and efficiency of procurement auctions and bid rigging by taking examples of specific cases and industries. Flambard and Perrigne (2006), for example, study the procurement of snow removal services in Canada, finding among other results that differences in how far away a service provider is from the area to be served causes differences in the bidding strategies of suppliers. Pesendorfer (2000) looks for potential collusion in school milk procurement auctions in the USA. He shows that the informational asymmetry caused among market participants by a cartel tends to lead to a pre-selected cartel member being the successful bidder, while non-cartel market players are less likely to succeed as they are less informed. Chotibhongs and Arditi (2012) use cost structure and bid distribution testing to detect potential bid rigging in the construction sector using US data.

It is important to understand the broader economic context and effects of the inefficiencies related to bid rigging. Economic fluctuations may change the investment and business strategies of companies, because changes in demand and the availability of funding (Männasoo et al., 2017) and stock market performance (see e.g. Männiste et al., 2011) affect the incentives for market participants to engage in collusive activities as a last resort in order to survive. Rotemberg and Saloner (1986) and Bagwell and Staiger (1997) consider how economic fluctuations affect collusion, finding in general that the incentives for collusion are higher at times of economic uncertainty when competitors are seeking to recoup losses with gains from bid rigging and other forms of collusion. Furthermore, the effectiveness of regulations and the broader institutional framework is key in sustaining economic development when there is the fierce global competition. Designing institutional conditions to prevent bid rigging and other market distorting practices is an important way to help keep businesses viable alongside easier taxation principles (see e.g. Hazak, 2009), regulations on the use of human and physical capital and financing for it (Levine et al., 2001; Virkebau and Hazak, 2017; Hazak et al, 2016, among many others), and bidding market efficiency (Klemperer, 2007; Van Siclen, 2010; Williams, 2014). Institutional inefficiencies relating to bid rigging may thus affect much more than just the financial results of a particular bidder and procurer, and may give market participants an unhealthy way to seek competitive advantage instead of finding ways to improve productivity and innovate in the use of intellectual and physical capital.

3. Conceptual argumentation

This section seeks to present a conceptual argumentation for the specific features of simultaneous sealed-bid procurement auctions and their effects on potential bid rigging and the outcomes of auctions. The conceptual framework builds on a comparison of simultaneous and consecutive procurement auctions as the main alternatives in practice. We do not seek to provide a comprehensive model of the behaviour of the bidders, but focus on some important characteristic features of that behaviour in simultaneous procurement auctions.

3.1. Simultaneous auctions and competition

First, it is important to understand how simultaneous auctions affect the number of interested bidders. As pointed out in Section 2, the fewer bidders there are, the higher the risk tends to be of bid rigging or another form of collusion. If potential bidders were of different sizes, they would face different levels of capacity constraints. It is evident that the larger the procurement, the fewer bidders there would be who could submit a bid, as those bidders who found the procurement to be beyond their capacity constraints would refrain from bidding, and could at best act as subcontractors in a bid. In this sense, it appears reasonable to split larger procurements into smaller parts to enhance competition, as suggested for example in the OECD Guidelines for Fighting Bid Rigging in Public Procurement and in the EU regulatory framework discussed in Section 1.

Given though that larger market participants tend to benefit more from scale effects than their smaller competitors, meaning they can offer better prices in both divided and undivided procurements, the claimed gains from splitting a procurement up to support smaller businesses may be wishful thinking. Another argument for splitting procurements up to support smaller businesses is that suppliers constrained by limited capacity could outsource additional resources so that they could bid for larger procurements. Where there is an oligopoly though, the potential resource providers would be the other players in the limited market and as market participants want to maximise their profits, it is unlikely that smaller market players would be successful with

bids that outsource resources from their competitors, while even a marginally higher price would make their bid less attractive than that of a competitor whose resources could be outsourced. An additional counter argument is that legal limits on outsourcing mean for example that a bidder may not be allowed to make a bid and at the same time act as a joint bidder or sub-contractor for another bidder. So even if competitors could agree on a way to overcome the capacity constraint, such an arrangement may be legally questionable and not applicable in practice. For these reasons, neither allowing smaller suppliers to participate nor outsourcing additional resources would change the bid results in practice if the other features of the bidders remain similar, including their access to information, and if the lowest price is the selection criterion.

3.2. Simultaneous auctions and bid prices

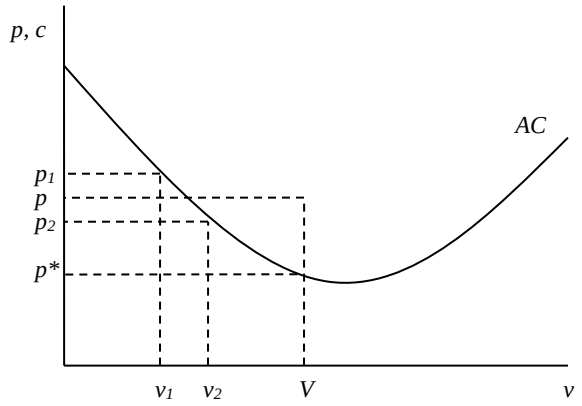
Second, it is important to understand how the simultaneous arrangement of the auctions affects bid prices. The most important difference with simultaneous bidding is that combinatorial bidding becomes impossible, as a bid in a simultaneous auction cannot be conditional on the outcome of any of the other simultaneous auctions or any of the other simultaneous bids. Consequently, and in direct contrast to consecutive bids, bids submitted simultaneously are independent of each other.

This may give the false impression of being counter-collusive, meaning that the less chance there is to bid in consideration of other bids or previous auctions, the less chance there may seem to be for bid rigging or other collusion between the bidders. That the bids are submitted independently of each other does not mean though that combinatorial bidding is not considered when the simultaneous bids are submitted.

Simultaneous auctions create significant uncertainty for bidders about whether they can achieve sufficient economies of scale. It is evident that costs are a key input for a bidder calculating what the profit maximising bid should be. Leaving aside any special circumstances, bidding below cost or exactly at cost would not be rational as no profit would be generated.

Assuming for simplicity that the goods being procured in the simultaneous auctions are identical, uncertainty about the outcome of any of the simultaneous auctions means it would not be rational for a bidder to submit any bids at less than the unit cost of supplying the amount of procured goods in that individual auction if the bids in the other simultaneous auctions are unsuccessful. If the price offer from the bidder assumes scale effects from winning more than one auction, but only one bid is then successful, the bidder would suffer losses by fulfilling the procurement. This is illustrated in Figure 1. Given the average cost curve *AC*, which represents economies of scale conditional on volume, it would not be rational to bid below the level of *AC* for any volume. If the amount procured for one of the auctions is v_1, it would be rational to bid at price p_1 or above. If the amount procured under another of the simultaneous auctions is v_2, it would be rational to bid at a price above p_2 for that auction. Should the bidder win just one of the auctions, it would not suffer any losses from fulfilling the procurement.

Figure 1. Economies of scale and rational minimum bids



However, if the bidder won more than one bid, the total amount supplied would earn a total mark-up of more than the market return for supplying that amount of goods. Figure 1 shows that should the bidder win both auctions, the total volume supplied would be $V = v_1 + v_2$. The break-even point for *V* would be p^*, but as the bidder has been successful with both of the individual bids, it can earn an average price of *p* or even above, meaning the profit it makes above the market rate is $(p - p^*)V$. It is evident that the same pattern is repeated if more than two auctions are arranged simultaneously.

Normally, bidding at above the market rate would make bids less likely to succeed, as the larger the mark-up is, the less likely it is that the bid will win. However, if all the competitors followed a similar rational bidding strategy to avoid losses, such bids above the rate of market returns could succeed. So if the profit maximising bidders competed as usual by trading off between the higher profits from bidding a higher price and the higher likelihood of winning the bid with a lower price, and none of the bidders was prepared to tolerate losses, successful bidders would be able to earn profits at above the market rate. It is clear from this that under such circumstances information about the bidding strategies of competitors becomes especially valuable for each bidder. We will discuss this in Section 3.4.

It is also interesting to note the differences in bid prices in simultaneous, consecutive and undivided procurement auctions if bidders follow this bidding strategy of maximising profit and avoiding losses. It can be seen from Figure 1 that if auction 2 were held after the outcome of auction 1 was known to the bidders, bid prices for auction 2 would be dependent on success in auction 1. Should the bidder be successful in auction 1, any bid at a price above p^* in auction 2 would guarantee that no losses would be made. This means that in consecutive auctions, a successful bidder could earn their profits above the market of $(p - p^*)v_1$ from auction 1 alone. The same pattern would be repeated if more than two auctions were arranged consecutively. The bidder that wins the first bid would have a competitive advantage over other bidders in the following auctions, as it can enjoy the benefits from economies of scale. This may lead to wins in all the consecutive auctions if the other bidders do not change their bidding strategy.

If the total procurement is undivided and bids are invited for the entire procurement at once, bidders would place their bids in correspondence with the total amount being procured. In the example illustrated in Figure 1, the bidder would be acting rationally if it bid at least price p^* for the total procurement volume V. In that case there would be no profits available above the market just from the way the procurement is organised. However, as discussed in Section 3.1., the number of bidders may be lower, and this could have an adverse impact on bid prices and could motivate collusion.

A further point to consider is umbrella pricing (Blair and Maurer, 1982; Inderst et al., 2014), which occurs when a dominant company or a cartel creates an umbrella of artificially elevated prices above the market price. To be successful in the bid, small companies or companies that are not in the cartel would need to bid a price below the umbrella price. Whether a non-colluding bidder can place a profitable and executable bid at less than the umbrella price depends on its size, as both scale effects and capacity constraints in fulfilling the contract pose limits for the bidder. Under these scale effects or capacity constraints, which the umbrella price setter is often aware of in an oligopolistic market, the total volume of demand from customers would push the price up to the umbrella price so that the smaller bidders are pushed out. Consecutive auctions would allow the small companies or companies that are not part of the conspiracy to adjust their pricing strategy to reflect the earlier auctions and thus make a bid at below the umbrella price, making the umbrella pricing strategy ineffective.

3.3. Simultaneous auctions and capacity constraints

Third, we need to understand how capacity constraints affect simultaneous procurement auctions. In non-simultaneous, or consecutive, auctions, a bidder who is successful in the first auction knows it would have less capacity available to participate in any future auctions until it has completed the procurement it won. The cheapest bidder should be successful in the first auction, and if the cheapest bidder is capacity constrained, it might not be able to participate in some future bids. This means that more expensive bids would have a chance of winning later auctions. Succeeding in future auctions may then earn higher profits for the bidder than success in an earlier auction. The less capacity the bidder has available when a project is being bid for, the more likely it is that winning this bid will prevent it from winning a later, more profitable procurement auction.

As explained in Section 3.2., bids in simultaneous procurement auctions cannot be conditional on the outcome of any other of the simultaneous auctions or any other of the simultaneous bids. This means that on top of the uncertainties discussed in the previous section, a capacity constrained bidder submitting a bid does not know about the competition in any of the auctions and which bidders are submitting bids for which auctions and at what prices.

We can assume each bidder uses Bayes-Nash equilibrium bidding strategies where they aim to maximise their expected profits while considering all the available information about the other potential bidders. We can also assume, similarly to Bajari and Ye (2003), that the costs to the bidder of executing similar projects are asymmetrical, and that the bidders are aware of these differences in costs. The reason the costs are asymmetrical may come from bidders in different locations having different transportation costs for example. Consequently, capacity constrained bidders who cannot bid in all the auctions would be expected to bid in those auctions where they have competitive advantages over some or all of the other bidders. This is fundamentally different from a consecutive auction setting, as discussed above, where capacity constrained bidders would base their decisions on whether to participate and what to bid on the results of previous auctions. As a result, and leaving aside some special cases, fewer bids would be submitted in simultaneous procurement auctions than in consecutive ones. However, capacity constrained bidders may be motivated to submit bids for those auctions where their cost driven chances of winning are highest, and this should coincide with the auctioneer's objective of achieving the best possible price in each auction.

If capacity constrained bidders have similar cost structures and thus the asymmetries are limited, there is extra motivation to engage in bid rigging. Having similar cost structures would mean profit maximising strategies are similar, making it easier to coordinate any cartel agreements.

3.4. Simultaneous auctions and bid rigging

As discussed in Section 3.2., information about the bidding strategies of competitors becomes especially valuable for each bidder in simultaneous procurement auctions as it addresses the question of economies of scale. The motivation for bidders to engage in bid rigging builds on their wish to be more certain about how much of the procurement will be allocated to each individual bidder so they can assess individual break-even points and consequently design their profit maximising bidding strategies.

It is apparent that if the bidders co-operate and engage in bid rigging, all the conspirators are better off as long as each of them is allocated more than one of the procurement slots auctioned. If any of the bidders knew that it was to be allocated at least two slots, it would gain a competitive advantage over a non-cartel member and could bid at prices even marginally below the average cost level of a given individual slot of the procurement but still earn a profit.

Moreover, if a cartel was formed where every participant was expected to win at least two procurement slots, the cartel members could all provide more competitive bids than any non-collusive bidders, provided there were no significant cost asymmetries with the bidders from outside the cartel. If a bidder knew that it would win more than one slot, the bid price that would guarantee profitability for each slot would be lower than the price that a bidder with no information about the allocation of procurement slots would need to bid. The collusive bidder could bid marginally below the non-collusive bidder's expected bid price, and be successful. At the same time, the bid that guaranteed success would let the corrupt bidder earn possibly quite large profits above the mark-up level of the market.

It follows from this argument that if there are no capacity constraints, two companies would be enough to form an efficient cartel. Where there are capacity constraints, there should be enough members to cover the whole volume of the procurement in all the auctions held simultaneously. However, if there are too few cartel members, there may be a threat that another cartel or cartels could be formed, and for this reason it would be more efficient to form a larger cartel. The optimal number of cartel members depends on cost structures, capacity constraints and the total number of bidders. If there are a large number of market participants, it would be difficult to operate such a cartel efficiently, which is why oligopolies are more exposed to potential bid rigging.

Bid rigging remains harder to detect in simultaneous procurement auctions. It appears from Section 3.2 that it would be natural to expect bidders to bid prices that correspond to the average cost levels for the volumes of the individual auctions. This gives a reasonable justification for why bid prices are relatively high, when in fact such prices may actually be collusive. It is difficult to distinguish between the bids submitted by honest competitors in the light of the uncertainties

surrounding the volume of procurement they may win, and collusive bids that reflect price levels carefully calculated to match market allocation agreements between conspirators.

4. Discussion

As game theory suggests and as is discussed by e.g. Bajari and Summers (2002), cartels are unstable by their very nature, as every individual cartel member would be better off by breaking the cartel agreement and bidding for a larger number of auctions or at a lower price than agreed. If all the cartel members break the agreement, they would all be worse off however. It follows from the argument in Section 3.4. that the motivation of bidders to cooperate is particularly strong in simultaneous procurement auctions, especially when there is an oligopoly. Moreover, it matters little how long the cartel lasts, as the entire volume of the procurement is auctioned simultaneously. However, because it is difficult to monitor whether the cartel agreement is being adhered to by all the members, it is more likely that one or more of the parties will break the cartel agreement, but this does not necessarily mean that the auction results are as favourable for the auctioneer as they would be under fair competition.

The motivation for bidders to collude depends on how the total procurement volume is divided into individual auctions. If the division does not follow the patterns in the competitive advantages of the bidders, their uncertainties about the behaviour of the other bidders and about the auction outcome are greater, and so the motivation to engage in bid rigging would be increased. Equally, if the individual auctions are of similar size, the risks of bid rigging may be higher as it makes it easier for bidders to allocate parts of the procurement.

We have assumed so far that the simultaneous bids are organised as a sealed-bid procurement auction, meaning that when individual competitors submit their bids they are not aware of the others' bids. In practice, this assumption may not hold true if another type of fraudulent activity occurs and one or more of the bidders becomes aware of the bids submitted by the others before they submit their own. This would result in informational asymmetries between the bidders, giving immense advantages to those who have information about the behaviour of the others (see

Hendricks and Porter, 1988; and Hendricks et al., 1994). If a procurement is conducted through simultaneous auctions, the adverse effects of any possible fraudulent informational asymmetries would be more serious than in the case of consecutive auctions, where tests for potential informational asymmetries could be conducted after each auction.

Even though a rise in the market price of the goods seems an inevitable result of bid rigging, it is not only higher profits that motivate companies to collude (Doree, 2004). Studies on a major case of collusion in the Dutch construction industry detected in 2002 revealed that conspirators very much appreciated the stable and predictable market environment that collusion created. According to the members of that cartel, the collusion made their business less vulnerable to predatory pricing and helped them avoid the winner's curse whereby bidders accidentally or deliberately make an offer that does not cover their actual costs, and it allowed them to reduce the uncertainties about their future workload.

There is a growing trend for public purchases to be aggregated and centralised across the EU in the hope of benefitting from economies of scale that can lead to lower procurement prices and lower transaction costs. At the same time though, it is recommended that contracting authorities monitor the aggregation and centralisation of purchases to avoid excessive concentration of purchasing power and tender collusion. Excessive aggregation and centralisation are thought to create a serious barrier to entry for small and medium-sized companies, but the same can happen if the contracting authority chooses a procurement strategy that does not consider the structure and the specifics of the market. As shown in this paper, simultaneous auctions may not be the best strategy for oligopolistic markets, as uncertainties and a lack of transparency may encourage dominant companies to collude.

To offer a positive end note, the total purchase volume in simultaneous procurement auctions is larger than the individual volumes of consecutive auctions would be, so there is greater temptation for companies to break a cartel agreement and enjoy the relatively large short-term gains made from cheating and succeeding in more auctions than agreed than there is in consecutive auctions,

where the short-term gains for the defector would be smaller. This is of course not an argument in support of simultaneous auctions.

5. Conclusion

A simultaneous procurement auction occurs when a party seeking to purchase some goods splits the amount to be purchased into several slots and calls for separate bids for each of the slots simultaneously, as opposed to asking for the bids consecutively one by one. Calling for simultaneous bids appears to be common practice in the EU member states and in the OECD countries as it has been argued that splitting large scale procurements into smaller parts may attract additional competition.

The conceptual argumentation in this paper reveals that calling for similar bids simultaneously may give extra motivation for collusion among bidders, while holding several consecutive procurement auctions could be a better way to reduce the potential for bid rigging. Moreover, simultaneous procurement auctions may result in the cost of supply becoming relatively high as the uncertainties are larger for the bidders, and this in turn can encourage collusion between potential bidders. Consecutive auctions provide more transparency as the competitors can consider the conditions of the winning bid in one slot when competing for the next slot. They also let bidders plan for capacity and scale effects so they do not run into capacity constraints. However, consecutive auctions may be technically more challenging and time-consuming for the contracting authority to arrange than simultaneous procurement is.

The choice of the auction method and awareness of the structure of the supply market is as crucial for a good outcome to a procurement as the right award criteria are. A contracting authority, especially one faced with stable and predictable demand, that arranges simultaneous sealed-bid procurement auctions with lowest price as the main award criterion may easily tempt oligopolistic market players to collude in order to reduce the uncertainties that worry them more than being caught and its consequences does.

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