

## COMPETITION IN PROCUREMENT MARKETS: THE CASE OF MEDICAL DEVICES IN EUROPE

Francesco Decarolis<sup>1</sup>

**Keywords:** auctions, public procurement, competition, mergers, medical devices

**Abstract:** *This paper analyzes how features of the procurement system laid down by the EU Procurement Directives affect the analysis of competition in public procurement markets. It presents the bidding systems allowed under the EU rules and provides a general framework to assess competition concerns for the public procurement auctions characterizing it. It concludes by applying this analytical framework to the case of the procurement of medical devices in Europe, a sector recently experiencing multiple mergers among the major manufacturers.*

### 1. INTRODUCTION

The growing relevance of auctions and “bidding markets” across various sectors of the economy makes crucial to properly integrate the specificities of these market arrangements in competition analysis. Whether the analysis involves the price effects of a proposed merger or the violation of competition by a cartel, the rules of the auction shape firms’ behavior in

ways that might be crucial to properly assess competition concerns.

The consensus over whether competition concerns are the same in “ordinary” (i.e., non-bidding) and bidding markets has evolved over time. Klemperer (2005) spells out the main arguments of this debate and forcefully argues that, in general, competition concerns are not reduced by the mere fact that the market entails a bidding system. Nevertheless, his analysis also stresses that the exact details of the bidding process are likely to have important effects on how to conduct a competition analysis. This means, for instance, that, when a competition authority will seek to assess the effects of a proposed merger, it will need to conduct an ad hoc analysis of the specific auction environment in terms of the information, actions and payoffs of all the firms potentially participating in the auction. Accordingly, tools that have been fruitfully applied to ordinary markets, like merger simulations, will not be directly applicable absent substantial ad hoc analyses. This situation is obviously problematic given the tight constraints in terms of time and resources under which the authorities typically operate.

The harmonization of the European public procurement system, however, represents a major case where a small and well defined set of auction mechanisms is used to organize a large number of important markets. This harmonization process is currently still ongoing with a new set of EU Procurement Directives

---

<sup>1</sup> Boston University, Boston, and EIEF, Rome

(Directive 2014/24/UE) replacing the previous ones that had been in force since 2004 (Directive 2004/18/EC). The bidding system prescribed by the EU directives matters for nearly all transactions where a European public contracting authority procures goods, services or works. Given the broad set of activities where the public operates - from defense to transportation, from education to healthcare, to name only a few<sup>2</sup> - it is extremely likely that both the DG Comp and the member State competition authorities will face multiple cases where the market is organized under the rules of the EU Procurement Directives.

Furthermore, the pressure toward lower prices exercised by the implementation of a transparent and market-oriented EU public procurement system might trigger an increase in the merger activity in some sectors. In turn, the extent to which firms compete - and so how mergers alter such competition - is a key element for the success of the procurement system laid down in the Directives. Nevertheless, despite these tight connections between the organization of the public procurement system and competition issues, there are still both conceptual and practical challenges to the full understanding of their complex interactions.

The goal of this paper is to contribute to this understanding by describing the set of bidding mechanisms used in the EU procurement

markets and by illustrating a series of elements, specific to this public procurement system, relevant for competition analysis. In particular, the first part of the essay will argue that a useful characterization of the various mechanisms laid down by the Directives is that of reducing them to three types of awarding formats, First Price (FP) auctions, Scoring Rule (SR) auctions and Negotiations (N), and three types of contractual arrangements, Contracts (C), Framework Agreements (FA) and Dynamic Purchase System (DPS).

In the second part of the paper, I will then discuss how each one of these mechanisms induces specific competition concerns. In particular, I will analyze the EU system under the framework put forward by Klemperer (2005). First, I discuss why this system is unlikely to satisfy the special conditions required to make competition concerns less relevant than in ordinary markets. Second, I discuss some specific elements of the system that are often seen as important for competition analysis, such as the special nature of the bidding data (where second choices are often observable), the high risk of collusion and coordinated effects and the role of merger simulations. Within the EU procurement systems, however, several additional factors likely play a relevant role, namely: contract renegotiations, the risk of corruption and the presence of non-standard institutional features leading to sophisticated types of behavior like shill bidding and bid skewing. As it will be clear in the discussion in the text, while some of these elements are relevant for private procurement as well, others are specifically relevant exclusively in the case

---

<sup>2</sup> Indeed, public sector procurement is estimated to account for approximately 20 percent of GDP in developing countries and 10-15 percent in developed countries. Source: World Trade Organization.

of public procurement, which is the focus of this paper.

In the third part of the paper, I conclude by applying the ideas developed in the earlier parts of the essay to analyze the procurement of medical devices in Europe and, in particular, the recent merger between Zimmer and Biomet. This sector is both economically relevant by itself and highly representative of the challenges to conducting a competition analysis in public procurement markets: the reliance on public tendering procedures is highly heterogeneous across countries and, even within country, different auction methods and contractual forms are used. In such a complex environment, a large scale merger like the Zimmer/Biomet one will likely pose competition concerns that will be closely linked to the specifics of the auction formats and contract types used in the markets affected by the merger.

## 2. THE EU PROCUREMENT SYSTEM: CONTRACTS, PROCEDURES AND AWARD CRITERIA

A common element of most public procurement regulations, including the EU ones, is to detail the type of mechanisms that contracting authorities are allowed to use to select private contractors. Among such procedures, auctions typically play a key role. This is due to their well known effectiveness in combining transparent awarding rules that limit the risks of corruption with a

method that, by fostering competition among bidders, can deliver low prices and efficient allocations.<sup>3</sup> Indeed, the tension between these two forces is arguably a major reason for why procurement systems are often complex and allow for the simultaneous presence of different contractual forms, awarding procedures and criteria to select contractors.

This section, describes the award criteria, procedures and types of contractual agreements laid down in the Directive 2004/18/EC. This is the relevant regulation to understand the data on the Zimmer/Biomet merger discussed later. In the final section, I discuss some innovations introduced by the new Directive 2014/24/UE on public procurement, which will replace the Directive 2004/18/EC when Member States will implement it at national level.<sup>4</sup>

A useful starting point to describe the EU system is to look at the different types of contracts between contracting authorities and economic operators that it allows. There are three contractual forms: i) “public supply contracts” (C), ii) framework agreements (FA) and iii) dynamic purchasing systems (DPS). All the three forms discipline the relation between one or more contracting authorities and one or more economic operators regarding the purchase, lease, rental or hire purchase of products goods, services or works. They differ,

---

<sup>3</sup> For an overview of the conditions under which auction mechanisms can deliver such outcomes see Klemperer (2004) and Milgrom (2004).

<sup>4</sup> By April 2016, Member States must pass the domestic legislation to incorporate the new Directive 2014/24/UE in their systems.

however, in that C disciplines a current transaction, while the other two discipline the terms under which future public supply contracts will be stipulated. DPS are infrequently used, but FA play a major role in many procurement sectors.<sup>5</sup> FA establish the terms governing contracts to be awarded during a given period (not exceed four years, save in exceptional cases duly justified), with regard to price, technical specifications and, potentially, quantity.

To award C, DPS or FA, contracting authorities are required to combine awarding “procedures” and “criteria.” The latter determine what parameters are used to evaluate the bids. The two criteria between which a contracting authority has to choose are: i) the lowest price and ii) the most economically advantageous tender (MEAT). The tender documents must specify the awarding criterion and, if the MEAT is chosen, the list of parameters to be evaluated, their relative weight and the formula to aggregate them into an overall score. Regarding the procedures, these are the methods to conduct the bidding process that contracting authorities are allowed to use. There are three main types of procedures: i) open and restricted procedures, ii) negotiated procedures and iii) competitive dialogue. The former type of procedures require that the contracting authority can fully specify its needs beforehand, so that the bids offer non-renegotiable offers

---

<sup>5</sup> DPS are fully electronic processes set up for commonly used purchases. They have limited duration and are open to all operators satisfying the selection criteria and whose bid complies with the tender specification.

and their evaluation entails almost no discretionary power. Open and restricted (which can be “accelerated” or not) procedures have differences related to how bidders are admitted, but they are overall a fairly homogenous group of bidding systems closely resembling a conventional sealed bid auction process.<sup>6</sup>

The other two procedures, negotiated procedures and competitive dialogue, share the feature that the contracting authority will consult with the economic operators to better define its needs. Negotiated procedures entail discretionary powers for the contracting authority that are justified by their use in situations of urgency or lack of appropriate offers or applicants. The negotiated procedure can be further divided into two sub-procedures depending on whether the procedure takes place with or without the publication of a contract notice. Finally, the competitive dialogue is a procedure intended to be used for particularly complex works.<sup>7</sup> Any firm may request to participate and the contracting authority conducts a “dialogue” with each admitted participant to better define the object of the tender, for which all firms then can bid. Thus, contrary to the open and restricted

---

<sup>6</sup> Relative to open procedures, where all firms admissible to do execute public contracts can bid, restricted procedures entail an initial phase consisting of a prequalification to ascertain requisites and identify the enterprises to invite to bid.

<sup>7</sup> Those for which the administration is objectively unable to define ex ante the technical means needed to satisfy its needs or the juridical and financial structure of the project.

procedures, negotiated procedures and competitive dialogue resemble more the typical process of a negotiation than that of an auction.

In principle, by combining all the possible procedures (and sub-procedures) with the two possible award criteria, we get 15 different procurement formats.<sup>8</sup> Decarolis and Giorgiantonio (2015) propose a categorization of these 15 formats into just three formats that, while neglecting some of the legal nuances of the different formats, captures that major common elements of these formats and, moreover, produces a clear mapping to the economics literature on auctions and procurement. These three formats are:

- i) First price auctions (FP): open procedure or restricted procedure or accelerated restricted combined with the lowest price as the award criteria.
- ii) Scoring rule auctions (SR): open procedure or restricted procedure or accelerated restricted combined with the most economically advantageous offer as the award criteria.
- iii) Negotiations (N): accelerated negotiated or award of a contract without prior tender publication or competitive dialog or negotiated or negotiated without a call for competition combined with either one of the award criteria. Therefore, to summarize the above discussion, a useful schematic representation of the EU procurement system is that of an environment

---

<sup>8</sup> Note that for the competitive dialogue the only applicable award criterion is the economically most advantageous bid.

where three formats (FP, SR and N) are used two award two main types of contracts (C and FA).<sup>9</sup>

### 3. COMPETITION ANALYSIS IN BIDDING MARKETS

This section looks at the two fundamental questions regarding competition analysis in bidding markets as applied to the EU public procurement system. First, are there reasons to consider competition analysis less relevant than in ordinary markets? Second, what features of the EU procurement system should be considered (and how) in a competition analysis?

#### 3.1 Competition concerns within the EU procurement system

Two widely cited studies, Klempeper (2005) and Shapiro (2005), have put forward a general framework for the analysis of competition (and, especially, horizontal mergers) in bidding markets. The key tenant of such framework is that typical bidding markets have enough elements in common with more conventional posted price markets that one should consider the same guiding principles applying in both types of markets. Situations under which bidding systems have features making competition less relevant exist, but they are quite special. Thus, carefully assessing whether

---

<sup>9</sup> In addition to the little economic relevance of DPS mentioned above, it is worth noting that DPS require adopting an open procedure in all the DPS phases.

a market falls under these special conditions or not is a key first step to prevent fallaciously viewing all bidding systems as immune from competition concerns.

According to Klemperer (2005), it has become commonplace for companies competing primarily in bidding markets to argue that there is little need for antitrust scrutiny. Indeed, he reports that “the existence of a bidding market is a commonly cited reason by competition authorities to tolerate the creation or maintenance of highly concentrated markets” (UK Office of Fair Trading 2004a, Para 5.33).<sup>10</sup> In his view, the fallacy of this argument is its attempt to generalize to all bidding markets what is instead possible only under very specific conditions. Indeed, there are three well defined cases when competition concerns will likely not matter. First, there are ideal conditions in which the presence of just two firms is sufficient to guarantee full competition in an auction. Second, there are environments in which the cost and information structure of the firms implies that mergers can be procompetitive since they allow firms to reduce the winner’s curse. Third, the presence of a bid taker power implies that the buyer can modify the rules of the auction to minimize competition concerns in response to changes on the supply side.

---

<sup>10</sup> An example cited in his study comes from the merger of Murray & Roberts Ltd and The Cementation Company Ltd. where the Competition Tribunal of South Africa in its decision to permit a “three-to-two” merger cited approvingly the party’s argument that “in bidding markets ... competition can be as vigorous with two firms as with three or more” (Lexecon (1995)).

Applying this analysis framework to the EU procurement system, hence, means starting from an assessment of how relevant these three special cases are within the EU system. As regards the first case, the bidding process is likely to generate a perfectly competitive Bertrand equilibrium if the two firms assumed to be bidding in the auction are identical and operate in an environment satisfying the following assumptions: i) competition is “winner takes all,” ii) competition is lumpy, meaning that each tender is large relative to the bidders’ sales in a period, iii) there is no lock-in, in that every auction entails new competition for each customer. Furthermore, if a fourth assumption, iv) easy entry for new competitors, is also satisfied, then the market is perfectly contestable and even a single firm bidding might suffice to ensure a fully competitive outcome. Although nothing in the EU procurement rules precludes that these assumptions can be satisfied, they are rather unlikely to occur. Regarding i), multiple winners are possible for the awarding both C and FA. Moreover, reselling part of the contract via subcontracting is often a feasible option. Regarding ii), very often auctions involving large amounts of money are broken down into smaller lots. Regarding iii), forms of lock-in are often present and can be incorporated into the auction mechanism in the form of criteria for the SR that advantage certain bidders or in admission criteria, like those based on firm track records.<sup>11</sup> Moreover,

---

<sup>11</sup> The EU Directives forbid explicitly discriminating between bidders, but similar ends can often be achieved using the criteria and weights of SR.

the frequent division of large contracts into smaller lots will tend to violate i), ii) and iii). Finally, regarding iv), entry is potentially not so easy as bidding in public auction often requires obtaining ad hoc certifications, like the anti-mafia certificate required in Italy. As discussed below, all these departures from the ideal scenario are indeed occurring in the medical devices sector.

As regards the second case, the theoretical possibility of pro-competitive mergers is associated with the fact that in, so called, “common value” environments more bidders can be bad news for the procurer. The idea can be easily grasped thinking of an auction to sell the right to explore a marine tract for the presence of oil to extract. Ex post, the value of the tract is the same for all firms as it depends solely on the amount of oil found (and the resale price of oil). Ex ante, however, each bidder has its own geological assessment of the likely amount of oil and, hence, the winner is likely to be the firm with the most optimistic assessment. If all their ex ante forecasts of the amount of oil are equally accurate noisy signals, then the most optimistic estimate is overvaluing the amount of oil. In this sense, winning might be a “bad news” as the winner is overestimating the amount of oil and, the more other bidders he defeats, the more he is overestimating it. In equilibrium, bids will thus need to be corrected so that, the more bidders are present, the less aggressive a firm has to bid. Hence, a merger can help the procurer by

reducing the number of bidders.<sup>12</sup> Whether the common value framework is an appropriate description of a market intrinsically depends on cost and information elements that are market-specific and, typically, outside the domain of what the procurement system can affect. Nevertheless, there are two important remarks. The first is a general result derived in Klemperer (2005) showing that even within common value environments competition concerns often still matter. The second, more specific to the EU procurement system, is that FA are possibly associated with common value environments. The reason is that a characterizing feature of a FA is that bidders do not know exactly how much their product will be demanded in case they win (Albano and Sparro, 2008). If a bidder were to find valuable to learn the demand estimate of another bidder in order to refine its own estimate of demand, then the market has elements of a common value environment.

As regards the third case, it is conceivable that an auctioneer with unlimited freedom to design the auction rule might be able to affect the degree of competition by altering the rules of the bidding process. In this sense, competition concerns can become second order when the procurer has bid-taker power. However, it is clear that the EU regulations pose stringent limits to this bid-taker power. Indeed, a contracting authority can design the rules of the auction only within the limits of the EU

---

<sup>12</sup> More complex effects can happen depending on what one assumes about how the merged entity combines its forecasts.

procurement regulations and its member State procurement legislation. The result is that while some flexibility in choosing between a few auction formats and contract forms exists, the choice set is fairly limited. An illustration of these limitations is evident when considering how the EU procurers can rely on contractors' past reputation to award future contracts. While in the United States Federal Departments and Agencies must record past contractors performance, share it through common platforms and use it for future contractor selection, during the drafting of the new EU Procurement Directives there was substantial opposition to leave such flexibility to rely on reputation. The result is that past reputation has been allowed as a parameter to qualify bidders to enter the auctions, but cannot be used as a parameter in SR to select the contractors.<sup>13</sup>

### 3.2 How do procurement rules affect competition analysis?

Although unlikely to eliminate competition concerns, the EU procurement rules can impact the way firms behave and, hence, how to conduct a competition analysis. In principle, an analysis isomorphic to that performed for ordinary markets can be conducted. Regarding non-coordinated effects, for instance, a profit maximizing supplier considering rising its price bid should trade-off the higher per-unit price in case of victory with a lower probability of winning. As formally shown by Kelmeprer

(2005), among others, the probability of winning is essentially equivalent to expected demand so that this trade-off is essentially to that firms face in ordinary markets.<sup>14</sup> Thus, like in an ordinary market, the forces of substitutability in demand and supply are the key drivers of the price effect of a merger. Moreover, the typical countervailing effects of efficiency and entry will matter as in any ordinary market.

Despite these common aspects, there are, however, at least six features specific to public procurement that are worth special attention in a competition analysis. The first three have already been highlighted by the literature, while the latter three have received less attention in the past, but are relevant for the EU procurement case.

#### *i) Nature of the data.*

Auction data often have valuable features absent in data from ordinary markets. In particular, if the data records not only the winning bid but also the ranking of the losing bids, one might get a clear measure of what the second choice of the buyer would have been. In ordinary data, excluding cases of surveys asking about hypothetical second choices, this information is absent. As argued by Berry, Levinshon and Pakes (2005), second choice

---

<sup>13</sup> See Gordon and Racca and Decarolis, Pacini and Spagnolo (2015).

---

<sup>14</sup> While ex post the adjustment in market shares is discrete with the bidder either winning or losing the tender, prices are formed before the auction outcome is known so that it is the *ex ante* perspective with its smooth trade-off that shall matter. This analogy has suggested that the same tools used to quantitatively assess the potential effect of a merger are the same in auction and bidding markets.



data can be enormously important to estimate credible substitution patterns. In practice, if firms A and B are merging, this type of data can allow to estimate, for all the instances in which A (or B) won, whether B (or A) were ranked second. This is a rather direct measure of demand substitutability. Although the exact ranking is not always available, several real world procurement auctions entail multiple phases that admit gradually fewer and fewer bidders. Shapiro (2005) has argued that, in such environments, it is appropriate to look at the set of firms that are shortlisted in the final round to assess who are the closest competitors. While appealing in general, it is worth emphasizing that in environments where submitting a bid entails a high cost (for instance due to the need to formulate a detailed project) even the initial entry decision is likely to be informative of which firms are close substitutes.

*ii) Coordinated effects and the detection of collusion.*

Auction mechanisms with their transparency help cartels observing deviations from coordinated strategies and, thus, make sustaining the cartel agreement easier. A similar argument holds for coordinated effects. This feature has been extensively discussed in the literature (see, among others, Froeb (1988)) and is indeed the reason often cited to explain why a large majority of antitrust cases in the US involve auction markets. Regarding the EU case, it is interesting to observe how explicit attempts have been made by local antitrust authorities to highlight the risks that are

specific to public procurement markets. For instance, the Italian Antitrust Authority has recently released a Vademecum<sup>15</sup> to help contracting authorities to detect and deal with collusion in public procurement auctions.<sup>16</sup> A commonly held view is that collusion should be easier to sustain in FP than in SR or N due to the ease of coordinating on price only. Indeed, it is mostly on FP that also the literature has focused, leading to the flourishing of a literature on screens for collusion (i.e., statistical tests to detect collusion, see Abrantes-Metz and Bajari (2012)).<sup>17</sup>

*iii) Merger simulations.*

There is a small, but growing literature that seeks to extend the methodology of merger simulations to auction markets. A major difficulty of this literature, however, is the

---

<sup>15</sup> See

[http://www.agcm.it/component/joomdoc/allegati-news/Delibera\\_e\\_Vademecum.pdf/download.html](http://www.agcm.it/component/joomdoc/allegati-news/Delibera_e_Vademecum.pdf/download.html).

<sup>16</sup> The Italian authority is currently experiencing a surge in the number of cases involving bidding markets as it evident from the list of ongoing and past cases reported on its web site [www.agcm.it](http://www.agcm.it).

<sup>17</sup> Methodologically, this literature has made important contributions in this area that can be used to study either coordinated effects or outright collusion. There are two major strands in which the empirical literature can be divided: the studies of collusion practices in markets where the presence of cartels has been proved by a court and the studies that try to devise methods to distinguish competition from collusion when collusion is only a possibility. Conley and Decarolis (2015) is an example of a paper that takes an intermediate approach in that they use information from public procurement auctions for roadworks in Italy where collusion was proved, but do so in order to devise an empirical methodology that allows them to assess the likelihood of groups in markets where their presence was not yet proved.

inherent complexity and the typical lack of closed form solutions of equilibrium models where bidders are asymmetric. Since mergers will in most cases make bidders asymmetric, this is an obstacle that almost any useful model has to face. Moreover, merger simulations will differ depending on the type of auction mechanism analyzed (Werden and Froeb, 2005). A recent study on merger simulations in auctions, that also surveys the earlier literature, is Miller (2015). An interesting aspect of his model is that it can be applied even with fairly limited data and to study the awarding of ordinary supply contracts not just under FP, but also under SR or N.

*iv) Specificities linked to the mechanisms rules.*

Apparently small details in the auction rules might have major impacts on firm entry and bidding choices. For instance, in public procurement auctions for construction works, it is very common to find that the mechanism used is a variation of the first price sealed bid auction in which prices that are “too low” are eliminated and the awarding goes to the lowest non-eliminated price. The concern with excessively low bids is that they might come from firms that either did not properly assess the cost of the project or that are intentionally low-balling under the expectation of being able to renegotiate or default ex post. This type of auction is widely used in many EU countries and previous research on Italy (Decarolis, 2014) has shown that this auction is conducive to manipulations: since the determination of which bids are “too low” is endogenous (it is made relative to an average of the bids submitted), bidders create “shill firms,” legally sound but essentially fake firms formed for the

sole purpose of having more bids with which to manipulate the average. Indeed, the data reveal that the number of firms bidding in the auctions drops from an average of 60 to an average of 7 when this modified first price auction is replaced by a standard first price auction. Thus, in this case the high number of bidder should not be seen as representative of a very competitive environment, but as the response to the incentives created by the auction. Another example comes from the auctions used in the United States by Medicare to procure durable medical equipment (the so called DEMPOS auctions). The auction mechanism in this case is a multi-unit, uniform price auction with a clearing price set equal to the median of the winning bids and where bidders can ex post withdraw their bid after learning the clearing price. As shown by Merlob et al. (2012), the equilibrium prices offered are disconnected from firms’ cost. Hence, trying to assess demand substitutability by looking in the data at the frequency with which their bids are close would make no sense. A common element of these two examples is that, in both cases, the regulations describing these auction mechanism tend to refer to them as simply first price auctions, in the first case, and uniform-price multi-unit auction, in the second case. However, what the respective regulations seem to introduce as small modifications of the baseline mechanism, drastically alter the firms behavior and, hence, how the data produced by these auctions should be interpreted to conduct a competition analysis.

*v) Ex post contract changes.*

Winning bids are often just the initial step of a contractual relationship that can end up with the contracting authority paying a different price or having to modify some other features of the project. As discussed in Racca and Cavallo Perin (2015), this is a source of great concern from a competition perspective as it potentially changes the preference over bidders and this is why the 2014 Directives have devoted attention to this issue. In practice, it depends on what is the source of the renegotiation. If enterprises do not have reliable information on the final cost of a work, price competition in bidding may, in certain cases, result in greater risk of renegotiation, possibly even withdrawal from the contract. In fact, when there is such uncertainty during the auction, the enterprises with lower costs for breach of contract are at an advantage, as they can “bet” that the execution of works will not be costly. Where completion of the works proves to be very burdensome, these enterprises will prefer to withdraw and pay breach of contract costs rather than carry the project through. In FP auction price is the only criterion and this one-dimensionality prevents the mechanism from optimally selecting the enterprise with the lowest production costs while simultaneously rejecting those with the highest risk of non-completion. Instead, the incentives inherent in this format imply that the least reliable firms are those with the best chance of winning the award. Overall, from a practical perspective one can say that whenever the awarding system is particularly competitive, like a FP, then it is of paramount importance to work with the final price. In this sense,

assessing substitutability based on awarding stage data only might be misleading.

*vi) Corruption concerns.*

Although it is not typical for antitrust authorities to deal with corruption concerns, the risk of corruption is necessarily a first order issue whenever public procurement is involved. The literature suggests that the risk of corruption is reduced if: i) the discretionary powers of the administration are limited; ii) there are more controls both on the agents of the administration and on the enterprises; iii) there is adequate transparency. This makes it evident that the effects of the EU auction formats on corruption and collusion are diametrically opposed. The FP auctions with the endogenous elimination of abnormally low tenders, for instance, is highly vulnerable to collusion but is potentially most effective against corruption, as the award is a sort of lottery and a corrupt procurer would find it difficult indeed to favor any given firm. All the other formats make it easy for a corrupt procurer to favor its preferred firm. This is obvious for SR and N, where the procurer has great discretionary powers, and it also goes for typical FP auctions, in that judgments of bids’ “reliability” can be used to exclude the rivals of the favorite. In addition, the FP auction could be open to the corruption of the PA engineers who control the execution of the work. A controller could ensure that the favored firm wins the auction with such a low price that not even the most efficient enterprise could compete. The corrupt agent would then allow the firm to renegotiate the price after the fact and make a profit. This scheme does not work for AB auctions (where the allocation is

random), but it is applicable to SR and N. For the latter two formats, moreover, an additional source of risk is the possibility of a corrupted administrator tailoring the procedure to a specific firm's characteristics. For example, in an SR auction, the manager could impose a weighting of attributes to favor one firm over others. This is impossible in FP and AB, with their price-only criterion. Finally, it is important to stress that while the above discussion points to collusion and corruption as being nearly opposite phenomena, a different set of theoretical studies identifies a connection between collusion and corruption in which the corrupt public agent is part of the firm's collusive scheme (e.g. Celentani and Ganuza (2002) and Compte et al. (2005)). This view is particularly important because, while the focus is on the new empirical. This is likely linked to either illegal activities requiring certain firm types, or the need to use the public agent to coordinate actions and make the cartel sustainable, or the greater ease to corrupt once extra profits are secured via collusion. This is also closely connected with the observation that firms engaging in corruption and collusion are often part of well defined criminal organizations. An implication of this view, for which empirical evidence is, to the best still missing, is thus that collusion and corruption are two different manifestations of the activity by a group of firms that changes the degree to which it engages in corruption depending on the procurement formats faced.

#### 4. THE EU PROCUREMENT OF MEDICAL DEVICES AND THE ZIMMER/BIMOET MERGER

The considerations developed in the previous sections can be substantiated by applying them to the case of the procurement of medical devices. The medical devices sector is a major component of the EU healthcare industry producing a total turnover of more than €70 billion per year. From a competition perspective, this sector is particularly interesting due to the wave of mergers recently occurring among major producers, including Johnson and Johnson's \$19.7bn acquisition of Synthes, which was integrated with the DePuy franchise to establish the DePuy Synthes Companies of J&J in June 2012; Smith & Nephew's \$1.7bn takeover of AthroCare in February 2014; Medtronic acquisition of Covidien for \$42.9bn in January 2015; and, most recently, the \$14bn acquisition of Biomet by Zimmer in June 2015.

When a medical device is used for procedures financed from the public budget, it is typically the case that the purchase must follow national and EU procurement rules. More precisely, the EU Procurement Directives applies to medical device purchases involving the award of contracts exceeding €200,000. Given this relatively low threshold, a large share of medical devices sales in Europe occur under the framework described in section 2. To quantify the relative importance of the different procurement formats, publicly available data from TED database can be used. This is the database version of the Supplement to the Official Journal of the European Union

dedicated to European public procurement. These data report the type of awarding procedure and criterion used, the contractual type, the product description, the auctioneer, the winner(s) and various other features of the awarding stage. To narrow down the analysis, I focus on the period 2009-2014 and I retain only tenders involving the procurement of knee, hip or trauma devices.

Table 1 reports the frequency with which the different contractual schemes and auction formats are used. Out of a total of 8,687 awardings, worth in total approximately €9 billion,<sup>18</sup> price-only auctions (FP) are used in 66 percent of the cases, multi-criteria auctions (SR) are used in 21 percent of the cases and negotiations (N) are never used. For 13 percent of the awardings, however, the data are not reliable enough to assess the awarding procedure used. In terms of the contractual form, 75 percent of the cases involve ordinary supply contracts (C), while 11 percent of the cases involve framework agreements (FA).

Table 2 offers a breakdown of the data by country. The five countries holding most of the tenders in the data are Poland (67 percent), France (16 percent), Italy (5 percent), Romania (3 percent) and Denmark (2 percent). All other countries hold less than 1 percent of the auctions. These vast differences indicate that some countries rarely rely on public tenders.

---

<sup>18</sup> The data record a variable measuring the total value of the awarded contracts. However, since in FA the final value of the contract depends on the quantity demanded during the life of the contract, it is hard to use the information in the data to compare the euro value of the tenders.

Moreover, countries also differ in terms of the contract types used (for instance, the majority of awardings in Denmark, France and Romania are for framework agreements, while they are for ordinary contracts in Italy and Poland) and in terms of the auction format used (nearly all auctions are SR in Denmark, France and Italy, but almost all auctions are FP in Poland and Romania).

Table 3 splits the data by the winner's identity. It lists (in alphabetical order) the 8 firms obtaining more awardings: Aesculap (i.e., B. Braun Melsungen AG), Biomet, Depuy (J&J), Medtronic, S&N, Stryker, Synthes and Zimmer. Given that the sample period runs from 2009 to 2014, the merger between Depuy (J&J) and Synthes occurs toward the mid of the sample. These top 8 firms tend to win both in FP and SR auctions and in both C and FA. It is important to emphasize that the numbers in the table should not be taken in any way as reliable estimates of the market shares. Indeed, the DG Comp would have likely not challenged any two-firm merger since no combined market share reaches 35 percent (the critical threshold that, together with a market share increase by more than 1 percent, has been used in the past to select markets deserving in depth scrutiny for competition concerns). The low market concentration apparent in Table 3 is likely driven by pooling together products and geographical areas that a proper market definition analysis would treat as separate markets. Indeed, on the basis of the publicly available results on the J&J/Synthes and Zimmer/Biomet cases, the DG Comp considered the relevant markets to be at the national level and involving rather narrowly

defined product categories (for instance, total knee implants are a different market relative to partial (unicondylar) knee implants).

Even under a narrow definition of the market, if the merger involves firms that meet mostly in bidding markets, under the special conditions described in section 3, the merger might not pose competition concerns. However, the fact that the March 2015 DG Comp decision to approve the Zimmer/Biomet merger imposed remedies motivated by competition concerns, even for countries like Denmark, France, Italy and Poland extensively relying on public procurement auctions, indicates that the DG Comp considered the EU public procurement system unlikely to eliminate competition concerns. Without seeking to perform a comprehensive competition assessment like that performed by the DG, it is useful to think what consideration might have driven such a choice, in the light of the framework discussed in section 3.

#### **4.1 The Zimmer/Biomet Merger within the EU Procurement Rules**

As discussed in section 3, there are three sets of conditions under which a merger is unlikely to pose competition concerns. For the case of the Zimmer/Biomet merger, the first set of conditions - that of an ideal Bertrand-like bidding market - is very unlikely to apply to the EU procurement markets. For many countries, a large amount of sales occurs outside the public procurement system. However, even for cases where public auctions are the main procurement mechanism, the conditions listed in section 3 tend not to be satisfied. First,

competition is not winner takes all. The TED data reveal many instances of multisourcing (i.e., multiple firms winning the same auction). A concrete example is that of a €5.3 million FA awarded in Italy by the Azienda Ospedaliera Bolognini di Seriate for the supply of orthopedic and cement prostheses for the period 01/07/2014-30/06/2018. All of the 13 lots in which the tender is divided entail multiple winners from which the hospitals participating in the FA will be able to subsequently purchase at the conditions set in the auction. In this tender, Zimmer is listed among the winners for 11 of the 13 lots. For 7 of the lots won by Zimmer, Biomet is also listed as a winner. This is indicative of a potential for Biomet to be a competitive constraint for Zimmer and is in clear contrast with the winner takes all idea.

Second, competition is often not lumpy. Although there is a tendency for buyers to centralize and form large group purchasing organizations, the data still reveal the presence of a plethora of procurements, often entailing amounts that are small relative to the revenues of firms like Biomet or Zimmer. Third, lock-in is likely to be a relevant feature of the market. The intensity of lock-in likely depends on several factors, but it is certainly fueled by elements such as surgeons often having a preference for the devices they are more familiar with, the presence of a documented increase in medical risk when a surgeon begins using a new device and, finally, the use in certain Scandinavian countries of evidence-based medicine emphasizing the role of product track records.

Fourth, entry seems hard for a number of reasons. As alluded above, Scandinavian countries use product track records to set eligibility standards to participate in the auctions. Moreover, in addition to the regulatory approvals required to introduce a new product,<sup>19</sup> entering a market requires substantial investments to build a local salesforce capable of inducing surgeons reluctant to take the risks associated with a new product to switch to it.

The second set of reasons under which competition would potentially not matter entail the presence of a common value environment. The most interesting aspect emerging from Table 1 above is that FA account for 11 percent of all the tenders in the data. These tenders typically also have an average awarded amount that is larger than ordinary supply contracts. Given this non negligible role of FA, it is relevant to point out that their usage can imply the presence of relevant common value elements through the shared uncertainty about realized demand. In particular, if the variability of firm profits is affected more by this common demand uncertainty than by an idiosyncratic uncertainty about private costs, then the common value element might be

---

<sup>19</sup> Note that in principle, in order to be sold on the EEA territory, orthopedic medical devices must simply be manufactured according to the ISO 13485121 and ISO 9001122 standards (referring to medical devices, quality management systems and requirements for regulatory purposes). Furthermore, they have to obtain a CE marking<sup>123</sup> which provides a presumption that the device complies with the essential requirements of the MDD and enables it to freely circulate within the EEA territory.

dominant. This seems potentially the case for medical devices where uncertainty about the demand arriving from hospitals might be much larger than the uncertainty about the manufacturers' cost. An additional potential signal of the presence of common value elements is also the presence in the data of instances of joint bidding. While firms might decide to pool together and submit a single bid as a temporary joint venture for various reasons, an often cited one is the benefit from aggregating information about uncertain future contractual outcomes.<sup>20</sup> Thus, although a precise assessment of the relevance of common value motives goes beyond the scope of this paper, it seems that this aspect would require a close scrutiny in a competition analyses of the medical device sector.

The presence of bid taker power is the third, and last, reason for reduced competition concerns. However, both the discussion in section 3 and the evidence from Table 1 make clear that the bid taker power is substantially constrained in this market. Not only Table 1 shows that exclusively two formats are used, but these are also the ones entailing the less discretionary power out of those allowed by the Directives. While the bid taker power could be exercised in subtle ways - as, for instance, the Scandinavian countries seem to do by requiring track records - it is unquestionable that this is not a context with a high degree of discretionary power. Indeed, track records are admissible for setting eligibility requirements,

---

<sup>20</sup> See also Albano, Spagnolo and Zanza (2001).

but they would not be an acceptable selection parameter in a scoring rule auction.

To conclude this discussion, having assessed that competition concerns ought to be considered in the EU procurement of medical devices, I now turn to the six auction-specific features mentioned in section 3 as possibly relevant in a competition analysis.

*i) Nature of the data.*

Publicly available data on the bids and identity of the firms bidding in the various auctions allow us to get rather direct measures of closeness of competition between Zimmer and Biomet. Without any intention to offer a reliable quantification of their closeness of competition, but for the sole purpose of illustrating the type of information available in the bid data, I report in Table 4 the outcomes of a public tender. The procurer is the local health unit of a northern Italian region (AUSL Romagna) and the tender, published in August 2013, regards the awarding of 99 lots for the 3-year supply of various orthopedic prosthesis products for a maximum value of €10 million. This is a FA type of contract, awarded via a SR auction. Out of the 99 lots, Zimmer participated in 10 and Biomet in 42. Table 4 shows that out of the 10 lots where Zimmer entered, Biomet entered in 6. This can be benchmarked by looking at the other major manufacturers: S&N also enters in 6 of these auctions, Depuy in 7 and Stryker in 9. Evidence of this kind could be used to build an argument for why Biomet is a relevant competitive constraint for Zimmer, albeit possibly less so than other major firms. Information on who won and who was second could also be used for a similar purpose. However if one has to

believe the previous argument about the complexity of entering into new markets, then it seems reasonable that even participation decisions should be given serious consideration to assess closeness of competition.

*ii) Coordinated effects and collusion.*

It would be far too complex to try to enter into a detailed discussion of coordinated effects and collusion. However, two elements that emerge from the tender data and that seem highly relevant for this point regard multiple sourcing and the role of SR. Multisourcing is present in various tenders in the data, involving between two to five winners. Its existence is likely due to the presence within the hospital of multiple surgeons with different needs/preferences and to the need for the hospital to minimize the risk of discontinuity in supply. Multisourcing, however, is potentially conducive to a lessening of competition and the more so the more firms can be selected as winners. Together with the frequent partitioning of the tender into small lots, this practice likely makes substantially easier to sustain collusion (tacit or not). An opposite force, however, is due to the systematic use of SR auctions. This mechanism makes firms compete on multiple margins, thus complicating the task of sustaining the collusive agreement. This is particularly true since in this market price considerations seem often less relevant than quality aspects or certainty of supply. Since multisourcing and SR auctions respond in part to the same needs and, accordingly, are often used together, their opposite effects on the risk of collusion might balance out.

*iii) Merger simulations.*



I am not aware of any merger simulation exercise conducted for this industry. Provided with detailed bid-level data such analysis is, in principle feasible. However, a risk of this type of analysis is that it could miss a key element such as the negative impact of the merger on the level of innovation. If the acquisition of Biomet eliminates one of the major innovators in the market, then a static analysis simulating the price effect of the merger might be highly misleading. However, solving and simulating an auction model inclusive of dynamic investment incentives is at the boundary of the research literature and entails approaches that are still too speculative and, possibly, not suitable for a court case.

*iv) Specificities linked to rules.*

The fine details of how the EU procurement system is applied in practice in the various countries can induce sophisticated responses by firms in terms of their bid and entry choices. This problem requires a close look at a large amount of documentation and, hence, will often not be possible to address it within the rigid time limits of a merger assessment. Nevertheless, the academic literature can offer a useful guidance as to where to search. For instance, “bid-skewing” (Athey and Levin, 2001) is a phenomenon documented in price-only auction where the bid used to rank firms comes from the summation of many unit prices offered by the firm multiplied by given, item-specific quantities (estimated by the contracting authority). An example of this type of FP auction in the data is the November 2014 awarding by the Udine Hospital in Northern Italy of a FA for the 36-month supply of cemented hip prostheses. Zimmer resulted as

the first classified and its offer was calculated by aggregating together the unit prices offered for 22 items with the associated estimated quantities. The price of the “typical implant” is estimated to cost €600. But since there is a unit price for each item, bid skewing might be happening: the firm can offer a relatively low price on items that it expects to be in little demand (relative to the estimated quantity), while bid a high price for items that it expects to be in high demand (relative to the estimated quantity). This implies that by estimating profit margins using the bids placed in the auction, one runs into the risk of severely underestimating margins and to consider the market to be more competitive than what it truly is.

*v) Contract changes.*

A different, but closely connected phenomenon to bid skewing is that of contract renegotiations. The same logic applied above suggests that if firms are submitting particularly low bids to win the contract, but expect (and do obtain) generous renegotiations, then a competition assessment based on bid data might be misleading. Data on contract renegotiations is not available in the TED database, and this study cannot quantify this phenomenon for the specific industry. However, a relevant insight from the academic literature is that the amount of renegotiations might be linked to the competitiveness of the auction format chosen. In this regard, using FP relative to other, less competitive formats, might foster a perverse low-ball bidding by the least reliable firms (see Decarolis, 2014).

*vi) Corruption.*

Together with the extensive use of FA, another feature characterizing the public procurement of medical devices in Europe is the major reliance on scoring rule auctions. Both features suggest that this area of procurement tends to be characterized by greater flexibility relative to conventional procurement of public works that almost always entails FP auctions. Given the major importance of procuring high quality devices, discretion is useful if used correctly, for instance to advantage contractors with a reliable track record. Nevertheless, major concerns have recently emerged concerning abuses of this discretion by corrupted public officials. The World Health Organization (WHO) estimates that worldwide 10-25 percent of public procurement spending in medical devices and pharmaceuticals is lost to corrupt practices. In Europe, an extensive study commissioned by the EU Commission Study on Corruption in the Healthcare Sector (HOME/2011/ISEC/PR/047-A2) has indicated specifically the procurement of medical devices as one of the areas of the healthcare system most vulnerable to corruption phenomena and identified various corruption scandals involving medical device procurement.<sup>21</sup> It is ex ante ambiguous how a merger between two players affects the risk of corruption in the EU procurement auctions and this suggests that, ideally, an in-depth competition assessment should aim to include accounting for this risk.

---

<sup>21</sup> See also the study by the EU Anti-Fraud Office: Identifying and reducing corruption in public procurement in the EU.

## 5. REFERENCES

- ABRANTES-METZ R. – BAJARI P., «Screens for conspiracies and their multiple applications», *CPI Journal*, 8, 2012.
- ALBANO G.L. – SPARRO M., «A simple model of framework agreements: Competition and efficiency», *Journal of Public Procurement*, 8, 356–378, 2008.
- ALBANO G.L. – SPAGNOLO G. – ZANZA M., «Regulating joint bidding in public procurement», *Journal of Competition Law and Economics*, 5(2):335–360, 2009.
- ATHEY S. – LEVIN J., «Information and Competition in U.S. Forest Service Timber Auctions», *Journal of Political Economy*, 109(2), 375-417, 2001.
- BERRY S. – LEVINSOHN J. – PAKES A., «Differentiated Products Demand Systems from a Combination of Micro and Macro Data: The New Vehicle Market», *Journal of Political Economy*, 112(1), 68-104, 2005.
- CELENTANI M. – GANUZA J., «Corruption and competition in procurement», *European Economic Review*, 46, 1273-1303, 2002.
- COMPTE O. – LAMBERT-MOGILIANSKY A. – VERDIER T., «Corruption and Competition in Procurement», *Rand Journal of Economics*, 1, 1-15, 2005.
- CONLEY T. – DECAROLIS F., «Detecting Bidders Groups in Collusive Auctions», *American Economic Journal: Microeconomics*, forthcoming.
- DECAROLIS, F., «Awarding Price, Contract Performance and Bids Screening: Evidence from Procurement Auctions», *American Economic Journal: Applied Economics*, 6(1), 108-132, 2014.
- DECAROLIS F. – GIORGIANTONIO C., «Public Procurement of Healthcare in Europe: The Case of Medical Devices», *Rivista di Politica Economica*, April/June, 7-36, 2015.
- DECAROLIS F. – PACINI R. – SPAGNOLO G., «The Role of Reputation when Awarding Contracts: Evidence from a Vendor Rating System», mimeo.
- DIMITRI N. – PIGA G. – SPAGNOLO G., «Handbook of Procurement», Cambridge University Press, 2006.
- FROEB L., «Auctions and Antitrust», Economic Analysis Group Discussion Paper n.8, 1988.
- GORDON D.I. – RACCA G., «Integrity Challenges in the EU and U.S. Procurement Systems», *Integrity and Efficiency in Sustainable Public Contracts. Corruption, Conflict of Interest, Favoritism and Inclusion of Non-Economic Criteria in Public Contracts*, G. Racca and C. R. Yukins, eds., Bruylant.
- KLEMPERER, P., «Competition Policy in Auctions and “Bidding Markets”», *Handbook of Antitrust Economics* (ed. Buccirossi, P.) MIT Press, Cambridge, MA, USA, 2005.
- KLEMPERER, P., *Auctions: Theory and Practice*, Princeton University Press, 2004.
- MERLOB, B., C. PLOTT, Y. ZHANG, «The CMS Auction: Experimental Studies of a Median-Bid Procurement Auction with Nonbinding Bids», *Quarterly Journal of Economics*, 127 (2): 793-827, 2015.

MILLER N., «Modeling the Effects of Mergers in Procurement», *International Journal of Industrial Organization*, 37, 201-208, 2014.

MILGROM P., *Putting Auction Theory to Work*, Cambridge University Press, 2004.

SHAPIRO C., «The 2010 Horizontal Merger Guidelines: From Hedgehog to Fox in Forty Years», *Antitrust Law Journal*, 77(1), 49-108, 2010.

WHO – WORLD HEALTH ORGANIZATION, «Compendium of innovative health technologies for low resource settings», [http://www.who.int/medical\\_devices/innovation/compendium/en/](http://www.who.int/medical_devices/innovation/compendium/en/), 2013.

WERDEN G. – FROEB L., « Unilateral Competitive Effects of Horizontal Mergers,» in *Handbook of Antitrust Economics* (Ed. Buccirossi, P.) MIT Press, Cambridge, USA, 2005.

**Table 1: All Tenders for Knee, Hip and Trauma Devices**

	FP	SR	Not	Total
Contract	61.18%	14.87%	-	76.05%
Framework	4.35%	6.27%	-	10.62%
Not	-	-	13.32%	13.32%
Total	65.53%	21.14%	13.32%	8,687 awardings

**Table 2: Tenders by Country**

	Contract		Framework		Not Specified	Total
	FP	SR	FP	SR		
BG	0.00%	0.07%	0.00%	0.00%	0.02%	0.09%
CZ	0.00%	0.01%	0.00%	0.00%	0.07%	0.08%
DE	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%
DK	0.00%	0.00%	0.00%	1.22%	0.51%	1.73%
ES	0.00%	1.15%	0.01%	0.69%	1.00%	2.85%
FI	0.00%	0.00%	0.00%	0.08%	0.17%	0.25%
FR	0.00%	3.50%	0.58%	3.33%	8.61%	16.01%
GR	0.17%	0.00%	0.00%	0.00%	0.18%	0.36%
HU	0.43%	0.21%	0.00%	0.00%	0.12%	0.75%
IT	0.00%	2.84%	0.00%	0.51%	1.23%	4.58%
LT	0.25%	0.00%	0.00%	0.00%	0.00%	0.25%
LV	0.00%	0.21%	0.00%	0.00%	0.01%	0.22%
MT	0.03%	0.00%	0.00%	0.00%	0.00%	0.03%
NL	0.00%	0.00%	0.00%	0.01%	0.01%	0.02%
NO	0.00%	0.00%	0.00%	0.13%	0.00%	0.13%
PL	59.69%	6.41%	0.31%	0.00%	0.51%	66.92%
PT	0.01%	0.26%	0.00%	0.01%	0.09%	0.38%
RO	0.00%	0.00%	2.96%	0.07%	0.23%	3.26%
SE	0.00%	0.14%	0.00%	0.09%	0.12%	0.35%
SK	0.56%	0.00%	0.13%	0.08%	0.00%	0.77%
SL	0.03%	0.00%	0.37%	0.00%	0.01%	0.41%
UK	0.00%	0.07%	0.00%	0.06%	0.41%	0.54%
Total	61.18%	14.87%	4.35%	6.27%	13.32%	8,687 awardings

**Table 3: Tenders by Awardee's Identity**

	Contract		Framework		Not Specified	Total
	FP	SR	FP	SR		
Aesculap	3.27%	0.25%	0.02%	0.00%	0.06%	3.60%
Biomet	7.24%	0.94%	0.13%	0.37%	0.31%	8.99%
Depuy	4.98%	0.84%	0.09%	0.26%	0.43%	6.61%
Medtronic	0.63%	0.18%	0.01%	0.13%	0.06%	1.01%
Smith&Nephew	2.52%	0.71%	0.03%	0.30%	0.40%	3.97%
Stryker	7.99%	1.50%	0.49%	0.53%	0.90%	11.41%
Synthes	13.10%	3.07%	0.21%	0.85%	5.59%	22.83%
Zimmer	0.00%	0.67%	0.02%	0.32%	0.64%	1.66%
Partnership Top 8	0.00%	0.01%	0.00%	0.25%	0.03%	0.30%
Others	21.45%	6.69%	3.34%	3.26%	4.89%	39.62%
Total	61.18%	14.87%	4.35%	6.27%	13.32%	8,687 awardings

**Table 4: Auctions Won by Zimmer**

	Number of Lots Entered	Number of Lots Won
Biomet	6	1
Depuy Synthes (J&J)	7	3
Smith e Nephew	6	0
Stryker	9	2
Total	10	10