

**DIRECTORATE FOR FINANCIAL AND ENTERPRISE AFFAIRS
COMPETITION COMMITTEE**

Working Party No. 2 on Competition and Regulation

HEARING ON THE USE OF TENDERS AND AUCTIONS

-- Issues Note by the Secretariat --

15 December 2014

This document was prepared by the OECD Secretariat to serve as an issues paper for Item IX at the 58th meeting of Working Party No. 2 of the OECD Competition Committee on 15 December 2014.

The opinions expressed and arguments employed herein do not necessarily reflect the official views of the Organisation or of the governments of its member countries.

*More documents related to this discussion can be found at:
<http://www.oecd.org/daf/competition/tenders-and-auctions.htm>*

Please contact Ms. Ana Rodrigues if you have any questions regarding this document [E-mail: ana.rodrigues@oecd.org].

JT03367299

Complete document available on OLIS in its original format

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.



1. Introduction*

1. Auctions¹ and tenders² are used by governments for the sale of government assets or the transfer of their operation. When competition within the market is scarce or non-existing, auctions create competition for the market, e.g. in the allocation of the rights to be the monopoly provider of a service. For public procurement, tenders are often used. The challenge of ensuring quality and incentives to invest adds complexity to tenders and auctions design and often involves trade-offs with price and competition. The purpose of this issues note is to outline some of the concerns and solutions that may improve tender outcomes in terms of government non-monetary goals, at the lowest possible cost, while minimising the sacrifice to competition.

2. An alternative to auctions is direct negotiation.³ Auctions have a higher potential to deliver more competitive outcomes. Bulow and Klemperer (1996) compare theoretical set-ups of an auction with no reserve price and an optimally-structured negotiation with one less bidder. They conclude that the value of negotiating skill is small relative to the value of additional competition. The lower scope for subjectivity and higher transparency helps make the case for auctions as an alternative to negotiations or simple allocation of contracts (sometimes called “beauty contests”).

3. But the mere use of tenders does not ensure an efficient outcome. Their design plays a major role in the procedure’s success, as does implementation, including enforcement of contract terms. Similar auction formats have led to dramatically diverse performance outcomes as a result of different degrees of design to market “adequacy”.

4. The challenges escalate when the government, sometimes acting as a representative for consumers, values non-price attributes such as quality and investment. Concessions can be designed to provide higher incentives to invest, but this may come at the expense of competition. More broadly, competitive tendering has sometimes been perceived as performing poorly in complex procurement and longer concession awards.

5. The best tender design to identify the winning bid when multiple attributes matter may be well defined in theory, but in practice many difficulties can emerge. These include specification issues of the non-price attributes, which can also be difficult to observe and monitor.

6. The key questions that arise are:

- How can tender design help identify the best bid when multiple attributes matter?
- What are the main trade-offs with price and competition under different awarding mechanisms when multiple attributes matter?

* This paper was written by Ana Rodrigues and Sean Ennis of the OECD Competition Division.

¹ An auction is a market institution with an explicit set of rules to determine resource allocation based on the bids of the participants (McAfee and McMillan 1987).

² For the purpose of this paper, a (competitive) tender is a formal, advertised and open auction, in which written submissions are received as bids.

³ Note that the line between auctions and some forms of structured negotiations can be a thin one. If a seller conducts parallel and simultaneous negotiations with more than one potential buyer, that can, in effect, mimic a standard ascending auction (Klemperer 2005).

- How can concession design help ensure that the private operators being awarded:
 - deliver a product/service with appropriate quality; and
 - have the appropriate incentives to invest?
- How can contracts be designed to avoid later renegotiation of the established terms?

7. These issues are addressed in the remainder of the paper, after a general overview of the main features of competitive tendering design.

2. Competitive Tendering

8. Competitive tendering introduces price discipline in the choice of contractors or concessionaires while also preventing distortions, corruption and favouritism.

2.1 Evidence of scope for cost savings

9. Various studies show the scope for efficiency gains in cost allocation from well-designed competitive tendering. Amongst these:

- Estache and Iimi (2008) argue that competition is key in public procurement and find it to be underutilised. Using data covering more than 200 auctions conducted in developing countries for infrastructure development, they estimate cost savings from promoting competition in tendering to amount to 8.2 % of total infrastructure development costs.
- A European Commission Report on the impact and effectiveness of public procurement legislations (2011) estimates cost savings from publishing an invitation to tender and using an open procedure of up to 3.8 % of the final contract value.
- Brunet et al (2002) found that the introduction of mandatory competitive tendering for water concessions in France resulted in an average reduction in water contract costs of about 10 %.
- Iimi (2006) estimates that a 1 % increase in the number of bidders leads to a decrease in the equilibrium bid of about 0.2 %, using a data set of procurement auctions for Japanese official development assistance projects.

10. For more complex projects, there have been some studies casting doubt on the superior performance, in practice, of auctions. Goldberg (1977), Williamson (1976) and Bajari, McMillan and Tadelis (2009) question the adequacy of competitive bidding for complex projects (see Box 1). They highlight the crucial role of information exchange between the parties for formulating specifications. Bajari and Tadelis (2006) argue that competitive bidding can entail poor outcomes when contractual design is incomplete and there are few available bidders. Using data on road and railway concessions in Latin America, Estache, Guasch, Iimi and Trujillo (2009) argue that efficiency can be difficult to achieve when competitive bidding involves multiple criteria. They find that political considerations and renegotiation can hinder the efficiency of the auction.

11. These findings further stress the central role of auction and contract design, as well as implementation, in ensuring the gains from competitive procedures.

Box 1. Private sector use of negotiations vs tenders

While much empirical evidence favours tendering as opposed to direct negotiation, the paradox is that in many cases, the private sector may use direct negotiation more frequently than tendering. One of the alleged benefits of negotiations, as opposed to auctions, is that they better allow for the exchange of information between the parties before the contract. Bajari, McMillan and Tadelis (2009) suggest that the potential advantages might justify why private sector buyers more frequently resort to private negotiations. According to their results, only 18% of private sector building contracts in Northern California from 1995 to 2000 were awarded using open competitive bidding. In contrast, the procedure (which is recommended by the Federal Acquisition Regulation for the public sector) was used in 97 % of public sector building.

Private sector experiences are not necessarily a guide to best practice for government. Public officials may be less qualified for direct negotiation for a variety of reasons, including lack of technical expertise, lack of negotiating skills and unfamiliarity with the market. Public entities may also not have the same incentives as private companies to assure the best financial deal during direct negotiation, to the extent that government entities often have a soft budget constraint and are not equally motivated to ensure costs are reduced.

2.2 Keys to achieving better outcomes

12. There are a variety of types and variations of auction design which are described in the OECD Roundtable on Competition in Bidding Markets (2006). The theoretical literature shows that effective auction design should induce bidders to truthfully reveal their valuations by making what they pay not depend entirely on what they bid and maximize the information available to each participant prior to the bidding stage. The main practical concerns are discouraging collusion, promoting entry and deterring predatory behaviour. Successful auction design is summarised by Milgrom (2004):

“[C]lever new designs are only very occasionally among the main keys to an auction success. Much more often, the keys are to keep the costs of bidding low, encourage the right bidders to participate, ensure the integrity of the process and take care that the winning bid is someone who will pay or deliver as promised” Milgrom (2004).

2.2.1 Promoting entry

13. Auctions with few bidders are at higher risk of performing poorly (Bulow and Klemperer 1996), but some features of auction and tender design can promote entry.

14. Keeping bidding costs low can encourage bidder participation. Streamlining and standardising tender procedures (to the extent allowed by tender specificities), reducing bureaucratic requirements and providing centralised information (for example, about the costs and risks associated with the contract up for bid) can reduce preparation costs and information asymmetries.⁴ Avoiding restrictive pre-qualification criteria and technical specifications is also likely to promote weaker bidders participation. Packaging auctions (e.g., of different procurement projects) can dilute fixed bidding preparation costs.

⁴ An example of the potential impact of high bid preparation costs and asymmetries between bidders is the outcome of the 1991 UK sale of television franchises. The only bidders in the Midlands and central Scotland realised that no one else had developed the very detailed region-specific programming plans required for participation, winning the auctions with extremely low bids (Milgrom 2004).

15. As opposed to ascending auctions, sealed bid auctions are more likely to attract entry, including of weaker bidders.⁵ A classic practical example is the discrepancy in outcomes of European 3G licenses auctions. The comparison of the 2000 Netherlands ascending auctions and 2001 Denmark sealed bid auctions is particularly insightful. In the Netherlands, ascending bid auctions were used with equal numbers of incumbents and 3G licenses to be auctioned, jeopardizing participation incentives by new entrants. The strongest potential new entrants established deals with the incumbents and the resulting auction's revenue was far from expectations (particularly given the revenue generated on the previous UK auctions). In contrast, Denmark auctioned four licenses to four incumbents using sealed bid auctions to attract participation by new entrants and revenues exceeded expectations (see Klemperer 2002 b).

16. Other methods to promote participation include set asides (e.g. some licenses or contracts automatically reserved for small enterprises), bidding subsidies/credits and splitting objects (allowing bids on lots or parts of a contract).⁶

2.2.2 *Reducing scope for collusion*

17. One of the first keys to successful auction design is to reduce the scope for collusion. Collusion in tenders and auctions and the instruments to deal with it has been a central concern of the OECD and has been extensively dealt in previous work⁷.

2.2.3 *Reducing the risk of underperformance and contract default*

18. Some governments, when awarding concessions or in complex procurement, want to decrease the risk of having poorly qualified or financially constrained firms winning the tender and failing to deliver the contracted terms or running into financial distress. These concerns are particularly relevant in large infrastructure projects, where costs of default can be enormous.⁸ In pursuing this aim, pre-qualification criteria (related to participants' financial health, adequate experience and managerial capacity) or technical requirements are sometimes imposed.

19. This can, however, come at a cost by reducing competition. Qualification criteria can build an effective entry barrier for new entrants and smaller players. The fear of contracting with incapable or untrustworthy contractors can entail significant increases in procurement costs. As such, governments are often faced with a quality-price trade-off (Estache and Iimi 2009 and 2011). Furthermore, qualification criteria can introduce opacity in the tender, setting more favourable grounds for corruption and favouritism. Restraining the use of these criteria to reasonable levels, proportionate to the ability required

⁵ In the ascending auction (or "English auction") the price is raised until only one bidder remains, and he wins at the final price. In first-price sealed-bid auctions, each bidder submits one bid without knowing the other bids and the highest bidder wins and pays his bid, while in second-price sealed-bid auctions, the highest bidder wins and pays the amount of the second-highest bid.

⁶ Note, however, that splitting objects may promote collusion by creating opportunities for better contract allocation.

⁷ See OECD Council's Recommendation (17 July 2012) and OECD 2009 Guidelines on Fighting Bid Rigging in Public Procurement and the OECD Roundtables on Public Procurement (2007), Competition in Bidding Markets (2006) and Concessions (2006).

⁸ Estache and Iimi (2011) provide two illustrative cases of the potential costs of default: the collapse of a bridge over Mekong River in Vietnam during construction in 2007, with heavy casualties, high costs for the economy and project delay; and the termination, in 2006, of three road contracts established in Madagascar due to unacceptable work quality with their subsequent award to the second lowest bid with a price increase of 36.5 percent reflecting input cost increases since the tender.

to perform the contract, and setting them in a transparent manner, mitigates risks of corruption and favouritism.

20. In addition to the list above, other design issues are also relevant when the government pursues multiple goals in public procurement and concession award. Amongst these are concerns with non-monetary criteria and concession design to ensure incentives to invest. We address these in the following sections.

3. Tender design to achieve appropriate quality and investment

21. In some tenders, price is the only relevant attribute to which the government attaches weight. But frequently, non-monetary attributes are also relevant. This is particularly the case when awarding concessions and in complex procurement. Often, relevant infrastructures, vital to economic welfare and growth, are at stake. The government may be awarding a private party the right to operate an existing infrastructure or resource through a concession. In those cases, the revenue obtained does not exhaust governments' goals. For example, in concessions involving utilities like electricity or water, reliability of the service, security aspects and environmental issues, among others, may prove more relevant than the revenue collected. In contracting work for infrastructure building, time of delivery can be highly valued by the government given the potential high social welfare costs of delays. In general, quality is often relevant in procurement for non-standardized goods and services.

22. In these situations, governments face the challenge of designing auctions and tender processes which identify the optimal bid. This generally entails a trade-off between price and non-monetary attributes. A variety of awarding mechanisms have been used by governments in an attempt to account for quality. That includes simultaneous bid evaluation of all attributes (price and non-price), two-stage evaluation procedures over bids submitted on price and technical criteria, setting minimum quality standards for bidding participation and private negotiations on all dimensions with a number of selected counterparts.

23. The two-stage bidding procedures often entail a first evaluation on whether the bid satisfies some quality requirements and, in a second stage, evaluating the bids based on price alone. Alternatively, quality can be evaluated after price evaluation. This may for example involve quality evaluation of the bids by descending order of their price ranks. Bids which fail to meet the required quality standards will be rejected and the winning bid will be the first to meet the criteria.⁹

24. These procedures, however, entail important trade-offs between entry, quality and competition (Estache and Iimi 2009). Estache and Iimi (2011) estimate that the various participation-price-quality trade-offs of having some substantial technical evaluation reduce bidder participation by 5 to 10 % and increase procurement costs by 25 to 50 %.

3.1 Quality

25. The seminal work by Che (1993) discusses evaluating bids with multiple criteria, inspired by procurement projects such as those led by the U.S. Department of Defence, where competition in terms of technical characteristics, delivery date, and managerial performance often dominate price competition. Che develops a two-dimensional auction, in which firms bid both on price and quality. The optimal outcome is shown to be achieved by a scoring rule designed by the buyer which awards the bid with the highest score. The scoring rule assigns a score to each of the relevant attributes, namely price and other

⁹ Cripps and Ireland (1994) show that the ordering between qualification and price competition is irrelevant for the auction's outcome.

non-monetary dimensions. If the weights are appropriate, the scoring rule will identify the bid that best matches the government preferences.^{10,11}

26. Theoretically, scoring auctions have also been shown to supersede other commonly used procedures for buying differentiated goods, including price-only auctions with minimum quality thresholds, as well as procedures which combine competition with the flexibility in terms of contract specification provided by negotiations (Asker and Cantillon 2008).

27. Governments have frequently addressed the existence of trade-offs between price and quality dimensions by assigning a weight to each type of attribute and adding the different elements to obtain an overall score that reflects trade-offs, or “scoring”. The “most economically advantageous tenders” criteria for award in Directive 2014/24/EU on public contracts (see Box 2) may be the best price-quality ratio, implying a scoring rule weighting price and non-monetary attributes.

28. Empirical assessments on the performance of multi-dimensional auctions are still scarce. While some studies find this type of auction worked well in real settings as predicted by theory (Iimi 2013 b)¹² and Lewis and Bajari 2011), some others highlight difficulties which can compromise auction efficiency for more complex projects with multiple attributes (Estache, Guasch, Iimi and Trujillo 2009, Bajari and Tadelis 2006 and Bajari, McMillan and Tadelis 2009).

Box 2. EU on Public Procurement and Concession Award

Public procurement under European directives represented 3.4% of the EU GDP in 2011 and takes on a central role in the “*Europe 2020 strategy for a smart, sustainable and inclusive growth*”. A reform process aimed at modernizing public procurement rules dating from 2004 led to two new directives being voted by the European Parliament on 15 January 2014 and adopted by the Council on 11 February 2014: Directive 2014/24/EU (procurement in public works, supply and service contracts), replacing Directive 2004/18/EC, and Directive 2014/25/EU (procurement in the water, energy, transport and postal services sectors) replacing Directive 2004/17/EC. At the same time, Directive 2014/23/EU on concession contracts was adopted. The Member States have until April 2016 to transpose the new rules into their national law (except for e-procurement, where the deadline is September 2018). The directives apply to procurement contracts whose value is higher than certain thresholds that vary according to the type of contract. The thresholds remain at the same level but some simplified rules are introduced (e.g., reduced documentation requirements and mandatory use of electronic communication).

To facilitate access by SMEs, the directive on public contracts encourages the division of contracts into lots and limited turnover requirements with respect to the estimated value of the contract. The directives include stronger measures against conflicts of interest, favouritism and corruption and impose stricter monitoring requirements and revised rules regarding contract modifications during their term, so that contracts which can be modified without a new call for tenders can be easily identified.

¹⁰ Branco (1997) expands on this work by addressing optimal auction design when the costs of the bidders are correlated. In this case, it is optimal to have a first stage bid evaluation according to a scoring rule so as to elect one firm for a second round of bargaining with the government.

¹¹ With regards to pre-bidding R&D investment, Che (1993) states that when governments care about investment in quality, further weight should be placed in the quality criteria within the scoring rule. Firms are expected to react by engaging in more investment to improve their design specifications so as to increase the probability of winning (Rogerson, 1990; Lichtenberg, 1988).

¹² Iimi (2013 b) analyses the performance of multi-dimensional service contracts aimed at improving energy efficiency of buildings or facilities in Japan, where investment cost minimisation is preferred but social and environmental benefits may also be weighted.

The award criterion for public procurement is the “most economically advantageous tender” (MEAT), assessed on the basis of the best price-quality ratio, always including a price or cost element. The MEAT can also be assessed on the basis of either price or cost effectiveness alone. Contracting authorities are free to set adequate quality standards by using technical specifications or contract performance conditions. Furthermore, to encourage a greater quality orientation of public procurement, Member States are permitted to prohibit or restrict use of price or cost only to assess the MEAT where they deem this appropriate. While imposing mandatory indication of contract award criteria and the corresponding relative weights, Directive 2014/24 relaxes the obligation when the weighting cannot be established in advance due to contract complexity. In such cases, mandatory criteria indication in decreasing order of importance is nonetheless required.

On the basis of a greater need for additional flexibility in choosing procurement procedures, Member States are able to provide for the use of the competitive procedure with negotiation or the competitive dialogue, where open or restricted procedures without negotiations are not likely to lead to satisfactory procurement outcomes. This broadens the scope for negotiation in complex projects or when “*the needs of the contracting authority cannot be met by an ‘off the shelf’ type of solution*”.¹³

Given that the award of service concessions was not subject to clear and unambiguous provisions at the European level, and in account of specific features of concessions contracts (high-value, complexity, long-term duration, and need for flexibility), the European Parliament and the Council considered that a directive on concession was needed on top of the directives on public procurement. The main elements of the directive are a clearer definition of concession, compulsory publication of the notices in the EU Official Journal if above a certain value threshold and some provisions regarding changes to concession contracts during their term. Certain obligations with respect to award criteria are established to ensure equal treatment of all participants, objectivity and transparency, but contrary to what applies to public procurement, there is no mandatory awarding procedure for concessions (negotiations are always possible).

Concerning the duration of concessions, the directive stipulates it should be limited to avoid restriction of competition. Nonetheless, longer duration may be justified for investment recoupment. For concession lengths greater than five years, the duration should be limited to the period of investment recoupment.

3.1.1 Scoring Rules: An example using time to completion

29. One of the quality dimensions that can be weighted in a scoring rule is time to completion. The contracting environment of highway repair is a recurrent case study as delays in delivery entail substantial welfare losses for highway users. In the U.S., state highway departments have designed mechanisms to award highway work contracts which aim at internalising the cost imposed by delays, among which the so-called “A+B scoring auctions”. The design of these scoring auctions provides incentives to the contractors to shorten the delivery time by weighting both costs and the time to completion (see Box 3). When tested against the empirical data, these auction designs have been shown to deliver welfare enhancing outcomes compared to standard price-only tenders or other commonly used contracting instruments (Lewis and Bajari 2011).

¹³ EU Memo “*Revision of Public procurement Directives – Frequently Asked Questions*”, Brussels, 15 January 2014.

Box 3. A Case Study of Scoring Auctions: The A+B Bidding for highway repair projects

A+B bidding is an auction design where participants are invited to submit their bids on labour and materials costs (A) and number of days to completion (B). The scoring rule is calculated as follows:

$$\text{Total score} = A + B * \text{Specified Road User Cost per day}$$

The contract is awarded to the lowest score, calculated according to the scoring rule. This type of auction has been used by some U.S. Departments of Transportation since 1990. As stated in the Californian Department of Transportation directive (2013) encouraging the use of A+B bidding, this mechanism allows each contractor to optimally choose its bid, given the trade-off between time and costs. Additionally, they sometimes have been accompanied by incentive/disincentive provisions by means of payments/penalties to accelerate delivery.

Lewis and Bajari (2011) show that the “B” portion of the scoring rule operates very much like a tax, internalising the costs associated with delay. They find that this contract design can achieve efficient outcomes, in contrast to standard “A” only contracts, which generally entail slower completion times. Using a data set of highway repair works awarded by the California Department of Transport between 2003 and 2008, they conclude that A+B contracts are welfare enhancing, as works were completed 30 to 40 % faster and roads user gains superseded the rise in procurement costs. They estimate welfare gains of up to 22 % of total contracted value, from changing all contracts to A+B bidding.

3.1.2 Multiple criteria and subjectivity

30. When there are multiple criteria to evaluate a bid, the resulting “multi-dimensionality” adds not only complexity to auction design with respect to price-only bids but also some further difficulties. While it is a fact that other awarding procedures such as, for example, negotiations, beauty contests and minimum quality standards are more opaque and subjective, scoring auctions entail more subjectivity than price-only auctions.¹⁴

31. The decision on a scoring rule or any qualification attribute is not only discretionary in nature but also more complex. Specification of the relevant quality attributes and the weight to attach to each of them requires value judgements. Evaluating the willingness to pay for variations in each quality dimension can also pose challenges. The perception of government’s preferences may vary according to the person or people carrying out the evaluation. There may also be quality attributes that are not fully known at the bidding stage and others which may be unobservable, thus jeopardizing verifiability. Successful enforcement of the contract requires that performance relative to quality commitments can be monitored.

32. In the case of concessions, tender design can be particularly challenging. Concessions are typically technically complex, long-lasting arrangements, frequently involving social and economic infrastructure. Government multi-dimensional preferences (quality and investment considerations, as well as further social and environmental criteria) may exacerbate difficulties with auction and contract design (see Box 4 for an example).

¹⁴

Estache and Iimi (2011) review the World Bank’s data on the nature of complaints in development project procurement and conclude that pre-qualification and bid evaluation seem to provide fertile ground for disputes. One recommendation that results from this study are the benefits of having third parties (such as experts or observers) being involved in the selection process.

Box 4. Argentina experience in toll road concessions

In 1990, a series of concession waves (awarded through competitive bidding) was initiated in Argentina. In the first concession wave, the concessionaires were required to undertake maintenance, rehabilitation and capacity improvement plans, which they had to initiate before starting to collect tolls. Further investment obligations were required for achieving service level targets, as measured by an index of road serviceability (state of the pavement). Bidding documents did not specify the level of required investment but rather 50 % of the network repavement in the first three years and full repavement in the remaining nine years. Shortly afterwards (February 1991) concessions were suspended and renegotiated, among other reasons, due to a 50 % increase in tolls and noncompliance with the clause stipulating some investment had to be undertaken before toll collecting. A major revision in the design of the concessions led to a 50 % reduction in tolls, the elimination of a fee initially set to be paid to the government, the grant to concessionaires of a total annual subsidy of USD 57 million and renegotiation of toll booth locations and road works commitments and schedules.

The second wave of concessions, namely for access roads to Buenos Aires in 1992, benefited from lessons learnt from the previous experience. Simple and straightforward concession terms and bidding criteria were designed. Contracts detailed the amount and schedule of investment obligations, service levels, pricing and risk-sharing arrangements between the government and the concessionaires, while making clear there were no guarantees on revenue or traffic or financial support from the government.

While concession outcomes were quite mixed also due to external factors, the experience shows the relevance of simple, unambiguous criteria for bidding, of spelling out rules for renegotiation in the contract and performance monitoring. It also shows that adequate product design is crucial to success.

Source: Carbajo and Estache (1996).

33. Auction design and the rules for weighting quality in the choice of the winning bid provide flexibility in adjusting the quality-price trade-off to align the tender outcome with the auctioneer's preferences. But further design and implementation issues are of high relevance and can work at the level of commitment with pre-specified quality attributes or at providing incentives for delivering quality products and services during the course of the contract/concession.

34. The primary contractual feature for promoting quality is a scheme of penalties or rewards for poor/good performance throughout the contract period. These stick and carrot schemes can drive up incentives to deliver quality while simultaneously inducing self-selection among bidders. Good performance may be measured by commonly accepted outcome measures that are appropriate to the product in question such as timeliness, reliability, survey results and environmental effects. Rewards or penalties can be financial but can also include extensions of contracts for particularly good service or, at times, related contracts. In the case of the London Bus tendering, incentives to invest in quality were introduced by means of concession duration extensions, conditional on favourable performance (see Box 5).

Box 5. London Bus Tenders incentives for quality

Contracts for the provision of bus services in Greater London are awarded through a tender process, managed by Transport for London (TfL) and awarding and contracting are designed with the aim of improving quality of service. Private bus operators bid for contracts to run specific routes for a period of five years. The award criterion is “best value for money”, where quality and safety are valued. Automatic two-year extensions are granted if performance is good on a number of qualitative indicators. Each year, around 15-20 % of the network is subject to tender.

As from 2001, quality incentives have been introduced and progressively generalized – these are mainly gross-cost contracts with an incentive (payments)/disincentive (penalties) scheme based on observed quality. Payments relate to mileage and reliability. Since 2008, further performance payments schemes were introduced, namely relating to driving quality and the presentation of vehicles (evaluated using mystery traveller surveys and vehicle inspections). Quality is measured in a number of dimensions, namely: mileage operated reliability (regularity on high frequency services, punctuality on low frequency services), driver and vehicle quality, engineering quality, customer satisfaction, safety and passenger and staff security, among others. For evaluation, there are a number of monitoring systems, including consumer surveys. For further details, see <https://www.tfl.gov.uk> and OECD (2013).

3.2 Investment for concessions

35. Investment in long-run assets is one way to ensure that quality is maintained or enhanced. Investment is often a central feature of concessions or privatisations. Investment is here treated separately from quality because there is a special problem of ensuring investments receive an adequate return, related to the long life and potential specificity of assets for a particular concession. When private companies make investments in concessions, they face risks in addition to the normal business risks of an investment, including that they:

- (a) may not recoup all the benefits of the investment (due to periodic re-tendering);
- (b) cannot be guaranteed that if they lose the concession they will be paid the value of the investment; and
- (c) may, in certain cases, be subject to price regulation that could conceivably prevent an adequate return on the investment, due to political desires to obtain the relevant good or service at low prices.

36. Concessions are granted to a private firm entrusting it with the right to operate a defined infrastructure service and to receive revenues deriving from it. Concessions often (but not always) entail the transfer of the ownership of assets to the concessionaire. They do however always imply the transfer to the concessionaire of an operating risk, that includes uncertainty in the ability to recoup investments and costs associated with the concession works or services, even if part of the risk remains with the contracting authority.¹⁵ Concessions therefore differ significantly in nature from one-off purchasing contracts.

37. Concessions frequently entail an allocation of the rights to an economic operator be the monopoly provider of a good or service. A concession could be granted to provide water to a municipality for example. Concessions can also be awarded in markets where there is (or can potentially be) competition in the market, such as electricity generation and telecommunications. In these cases, post-auction market outcomes are relevant. The spur in incentives to invest resulting from competition should not be underestimated. An example are auctions for awarding spectrum licenses, where one of the aims

¹⁵ See Directive 2014/23/EU.

pursued is to foster the development of wireless communications by promoting competition in the market. Among the different instruments to achieve this are spectrum caps, set asides and bidding credits (see Cramton et al 2011 and Klemperer 2002 b) for a review of European, U.S. and other countries' experiences).

3.2.1 *Parameters*

38. There could be many parameters to the concession, including specification of tariffs and price caps, of investment, of levels of service or of fees to be paid to the government. These can be pre-determined targets contractually imposed by the Government or dimensions in which firms can place their bids (e.g. bid on the tariffs to consumers, with the government attaching positive weights to lower tariffs).

39. As addressed in the previous section, having the award criteria weighting performance on quality and investment and having contractually determined targets coupled with incentives/disincentives as a function of the performance-to-target ratio can provide incentives to invest and deliver quality of service. Targets can be set on performance levels for quality of service, but there can also be investment obligations (requirements to undergo certain investment plans).

40. Another instrument proposed for accounting for quality and investment in concessions are hybrid forms of price caps. In certain instances, such as airport regulation, concerns that price caps could hinder safety standards led to the adoption of "lower-powered" cost regulations such as hybrid systems with add-on cost factors to reflect additional costs with safety measures. Estache, Perelman and Trujillo (2007) suggest a system of minimum quality requirements and regularly scheduled tariff revisions where both price and quality take part, aimed at having concessionaires internalising the trade-offs. The system implies penalties/rewards in the form of unfavourable/favourable tariff revisions for underperformance/good performance relative to the established quality standards.

41. The ability to monitor is essential for these incentive schemes to work. Also, inadequately rigid or unreasonable targets should be avoided, allowing some flexibility for the adjustment to changes in market conditions, particularly in more volatile markets or long-lasting concessions. Incentive/disincentive schemes should reflect the welfare benefits/costs with performance/noncompliance so as to align the concessioner's incentives with those of the government.

3.2.2 *Duration and periodic rebidding*

42. Concessions duration is limited in time, typically from 5 to 30 years. The duration of the concession can be pre-specified in the concession contract, it can be one of the dimensions in which participants bid, it can be endogenous to the performance of the concessionaire or conditioned on events out of the concessionaire's control or it can be determined at the discretion of the government.

43. Periodically rebidding the concession can help maintain the outcome of the "competition for the market" stage. In long-lasting concessions, significant time-distance from the competitive tendering moment is likely to fade the effects of competition, making the market more vulnerable to the exercise of market power. Furthermore, periodic rebidding allows avoiding the expense of calculating contingencies since adaptations to changing circumstances or new information can be introduced at the contract renewals (Williamson 1976).

44. Long durations can also lead to foreclosure of the market. Asymmetric information, reputational effects and learning-by-doing grant incumbents a relative advantage in the rebidding stage, particularly for highly specialised contracts, discouraging rivals to participate. Klemperer (2005) illustrates these dominance effects with the example of tendering for the U.K. National Lottery: while there were eight

bidders in the first auction, the winning concessionaire acquired substantial incumbency advantages over the seven-year term and there were only two bidders for the second tender.

3.2.3 *Length of concession, time to recoupment and the competition effect*

45. In a concession, the incentives for the concessionaire to undergo investment, in particular sunk costs, are mainly driven by expectations of recoupment. Longer concessions can create the appropriate incentives for the concessionaire to make long-term investments, including those aimed at asset maintenance near the beginning of the concession. However, this is at the expense of the competition emerging from shorter durations and periodic rebidding. On the contrary, short lived concessions can jeopardize investment incentives by providing little scope for recoupment. This may potentially lead to underinvestment in the assets or service provision, exacerbating the problem of insufficient incentives to make investments near the end of the concession.

46. But there can be other effects. The benefits of higher competition for incentives to invest cannot be underestimated. The prospects of competition in rebidding and the risk that the concessionaire can lose its next tender due to underperformance can drive investment towards the end of the concession (see Box 6).

Box 6. Favourable investment performance in shorter concessions with rebidding: some studies

While there is a general presumption that longer concessions lead to more incentives to invest, the competition effect (e.g. periodic rebidding where investment performance matters) in spurring investment can act as a countervailing factor. There is empirical evidence that, in some circumstances, the competition effect dominates.

Affuso and Newberry (2002) identify this as a possible explanation for their empirical results when analysing the impact of arrangements of rail passenger concessions in Britain over their investment performance. They found that shorter contracts generated higher rates of investment with train operating companies investing towards the end of the concession.¹⁶ Calzolari and Spagnolo (2010) also cast doubt on conventional wisdom concerning the relationship between contract duration and incentives to invest when there is asset specificity. Frequent interaction resulting from shorter contracts can help drive more favourable non-contractible performance, by the threat of exclusion in following bidding processes in the case of bad performance or noncompliance.

47. In some cases, concession duration is set to be endogenously determined. The concession of the Queen Elizabeth II Bridge in Dartford, U.K., a debt only financed project, is an example. The concession was set to terminate when the concessionaire's cumulative revenue reached the level of outstanding debt or 20 years, whichever the criteria to be achieved first.¹⁷

48. Another instrument to foster incumbents' willingness to invest is to increase the concessionaire's expectation of being re-awarded, granting some sort of bias or favourable treatment to the incumbent in the rebidding. But this advantage can further weaken competition at the rebidding stage, aggravating the entry deterrence effect of asymmetric information and other incumbency advantages. If these effects are strong, rebidding competition is nearly eliminated, rendering the retendering meaningless. The incentives to invest may also be provided through concession duration extensions (shorter than the concession lifespan), which

¹⁶ A reform and privatization of British Rail was undertaken between 1994 and 1997 in Britain. Following public auctions for the operation of passenger railway services, 25 monopoly concession contracts were awarded to twelve train operating companies. Contracted durations varied between seven to fifteen years - longer durations in the case of concessions with higher investment requirements, and seven year life-span for those with little or no investment requirements.

¹⁷ See Kerf (1998) for more details.

delay the rebidding moment but also reduce (but do not eliminate¹⁸) interference and competition distortion in the following tender.

49. These provisions can be designed as a reward to compliance with contractually settled minimum quality standards. More flexibility and further promotion of incentives to perform can be achieved by having the probability of winning the rebid as an increasing function of the quality delivered. In the U.S., broadcasting licenses have been given for a fixed number of years, then subject to renewal. Generally, the renewal is accorded upon request if the license holder has complied with relevant broadcasting rules and regulations throughout the past license period.

50. Regular rebidding and the prospect of a potential transfer of assets (and accompanying investments) from the old to the new concession holder raises issues concerning asset valuation. This is particularly so in the case of asset specificity which gives rise to a concessionaire's "hold-up" problem. Ensuring that incumbents are compensated if they lose the concession, on the investments they made throughout, could help address the hold-up problem and create the appropriate incentives to invest.

51. An example is the model of Argentina power concessions. Transmission and distribution concessions were awarded for a period of 95 years, broken into 10 year management periods (except for the first one, which lasts for 15 years). At the end of each term, the concession is put up for competition. If the current concession holder submits the highest bid, he keeps the concession. Otherwise, a new concessionaire (the one with the highest bid) is chosen and pays the bid price to the previous holder.¹⁹

4. Renegotiation

52. Ex-post renegotiation is an important risk in procurement (in particular complex procurement) and in concession award. Renegotiation is frequent and adaptation costs (i.e., the costs from changes to the contracted terms and conditions driven by renegotiation) are substantial. Renegotiation follows from contractual incompleteness, unexpected changes in circumstances, cost underestimation or overvaluation by the contractor at the bidding stage or strategic behaviour by either party to the contract. Renegotiations often entail adjustments to tariffs, investment plans, cost components, fees paid by contractors to the government, rate of return bases and duration of contracts. The outcome usually favours the contractor (Guasch 2004).

53. Complex procurement and concessions are often more prone to renegotiation due to the higher technical uncertainty commonly associated with infrastructure work and the longer time horizons involved (see Box 7). Inadequate design and contractual incompleteness result in contracts that do not specify every possibility.

54. Competition in the market can reduce the incidence of renegotiation, by decreasing the bargaining power of contractors *vis-a-vis* the government.²⁰ Thus, auction design which promotes competition in the market contributes to reduce the ex-post renegotiation risk.

¹⁸ Extensions, by augmenting the duration of a concession, might still aggravate the incumbency advantages in the rebidding stage (e.g., increasing asymmetric information, reputational effects).

¹⁹ Klein (1998) argues that this design can entail an infinite preference for the incumbent, who can secure the concession by bidding extremely high (sum which it pays to himself). If the incumbent bids his valuation for the assets and loses the concession to a higher bid, the benefits of the willingness to pay of the new concessionaire are fully appropriated by the old concessionaire.

²⁰ Guasch (2004) studies renegotiation incidence in concessions granted in Latin American and Caribbean region from 1985 to 2000, and found that in telecommunications and energy, where often concessionaires

4.1 *Evidence of frequency and impact*

55. According to Guasch, Laffont and Straub (2006), in Latin America, and excluding telecommunications, as much as 41 % of infrastructure concessions have been renegotiated. The incidence rises to 55 % and 75 %, if covering only transportation and water and sanitation concessions, respectively. Guasch (2004) estimates that these renegotiations were on average undertaken 3.1 and 1.6 years after the initial concession award on the infrastructure.

Box 7. An example of a concession renegotiation

Post-signature renegotiations are likely to have more significant impacts when contracts are long. Williamson (1976) provides a good example of the impacts of renegotiation in a concession environment. In Williamson's example, a cable operation was tendered in Oakland, California. The winning tender involved a very low price to the community and high level of service. The winner had to build out the cable system for Oakland within a specified timeline. However, after being chosen, the winner quickly began to argue that its price offer was too low and its promised level of service too high. The local government ultimately agreed to a major revision of the conditions of the contract (including adjusting performance targets downwards, increases in franchise fees, reduction in the daily penalty rate for noncompliance and deferring time to completion), so that the initial bidding through tendering had no binding value.

56. Bajari, Houghton and Tadelis (2014) address the value of the economic costs of ex-post adjustments driven by renegotiation in highway paving contracts in the state of California. They estimate that these costs accounted for 7.5-14 % of the winning bid.

4.2 *Winner's curse, strategic low-balling and renegotiation*

57. One reason for renegotiation may be that bidders overestimated the value of the object at auction (the so-called "winner's curse"²¹). Concessions and complex procurement often make it harder for bidders to estimate the associated costs. As a result, the "winner's curse" might plague this type of contracts more frequently. If the contract is awarded to a bidder who underestimated the associated costs, claims for renegotiation to avoid contract default are more likely to emerge.

58. But renegotiation might also follow from strategic bidding behaviour by the contractor. If bidders expect to be able to renegotiate their contract, they may strategically place an overly optimistic bid to win the contract with an expectation to later opportunistically renegotiate the terms – the so-called "low-balling strategy".

59. Iimi (2013 a) shows that if firms foresee ex-post adjustments, they react strategically by undercutting their bids. As a result, auctions might award the bidders who are most confident on their renegotiation ability rather than the most efficient ones. The unrealistically low prices make these contracts more prone to cost overruns and delays, causing a vicious circle of low-balling and renegotiation.

are not the only providers in the market, renegotiation was less frequent than in other concessions to sole providers of products and services.

²¹ The "winner's curse" arises in common value auctions, (i.e., when access to competitors' information or opinions influences a bidder's own belief with regards to the value of the auctioned object). The winning bidder, when knowing he won the auction, realises his rivals valuations were lower and revises down his estimate of the object's value.

60. In auction design, it is particularly important to ensure that winners will be able to complete their obligations, even if they were subject to the winner’s curse, and limit the scope for renegotiation.

Box 8. “Abnormally Low Tenders”

Concerns with auctions awarding overly optimistic bids have generated a number of attempted solutions aimed at addressing the so-called “Abnormally Low Tenders” (“ALT”) or bids which are “too good to be true”. These include alternative auctions, such as average bid auctions²² in which the bidder closest to the average of the bids wins, or variations of this format that share the same conceptual idea. These procurement formats are used, for example, in Taiwan, Italy, Peru, the Florida Department of Transportation and the New York State Procurement Agency. In some cases, automatically eliminating from the tender the bids considered abnormally low (e.g., in Italy) while in others identifying ALT but not automatically eliminating them (see Decarolis 2010).

There is no underlying economic theory to these formats and there is little empirical evidence to assess their performance. They may entail deviation from the auction’s efficient outcome. A theoretical and empirical analysis carried out by Decarolis and Klein (2012) suggests they are problematic and induce substantial gaming by firms. Strategic bidders are expected to strategically adjust to the rules.

Rather, solutions aimed at the source of the problem, namely lack of commitment, asymmetric information and renegotiation prospects may address the problem more directly.

4.3 Multiple attributes, contractual incompleteness and renegotiation risk

61. The risk of renegotiation is higher in the case of tenders with multi-dimensional evaluation. These added risks follow from the difficulties in tender design and implementation previously discussed: difficulty in specifying criteria, higher subjectivity, lower transparency, limited observability, limited verifiability and poor monitoring. Estache et al (2008) findings on road and railway concessions in Latin America are in line with multiple award criteria increasing the risk of renegotiation in infrastructure concessions.

62. In complex procurement and concession awards, where quality and investment are often relevant dimensions, the risk of renegotiation is thus higher. Of the Latin America and the Caribbean concession contracts analysed in Guasch (2004), the frequency of renegotiation was higher for contracts with investment requirements than for those with performance targets.

63. Klein (1998) argues that the complexity and long duration of concessions pose a serious renegotiation risk, which can render tenders almost useless as the benefits of competitive bidding could be lost. When the risks are too high, Klein questions whether it may be better for the government to ensure that a trustworthy and experienced contractor is selected using negotiations. He also argues for caution in contract design, highlighting the relevance of careful specification of performance targets, having a good balance between incentives and risk sharing and strong bonds committing the parties to the contract.

4.4 Reducing the likelihood and impact of renegotiation

64. While the empirical literature highlights the pitfalls of tenders in complex procurement and concessions, they clearly point the path of improvement. The main problem being contractual incompleteness, inadequate cost estimation and strategic bidding in the form of low-balling, efforts should be placed in tender and contract design which incorporate and reduce the risk of renegotiation.

²² This auction format was proposed by Ioannou and Leu (1993), in the engineering literature.

65. With the aim of achieving long term efficiency and compliance with agreed terms, contract and concession design can benefit from governments:

- seeking information which might help in product design specification and cost estimation;
- obtaining independent expert advice, if market information is highly complex;
- providing adequate time for bid offer preparation, particularly in technically complex projects;
- adopting reasonable quality requirements and targets, otherwise lack of adjustment may trigger renegotiation later on;
- introducing investment requirements only when contracted performance targets on output or quality are not adequate or feasible;
- providing incentives for the contractor to complete the work in line with what was specified in the contract, such as penalties associated with failure to deliver. Their adequate pre-bidding disclosure can help discourage strategic bidding;
- spelling-out, in the contract, the circumstances potentially leading to renegotiation;
- including clauses of no-renegotiation except in the pre-determined eligible circumstances;
- allowing for the needed flexibility, including adjustments for unforeseen circumstances which may jeopardise the sustainability of the contracted terms, but specifying the terms of the revision (e.g. defining tariff review procedures in case of relevant unforeseen events or having tariff reviews at certain intervals of time);
- establishing guidelines for the renegotiation process in the contract;
- adopting a parsimonious attitude towards renegotiation requests and committing to the contractual rules for renegotiation - allowing for renegotiation only in pre-determined circumstances and for adjustments within the specified terms/guidance.

66. A strong attitude by governments towards renegotiation can also create a reputational effect which might discourage future strategic behaviour by contractors. Throughout the implementation of the contract, a transparent attitude towards renegotiation processes (e.g., public disclosure of the outcome of renegotiation) and the involvement of independent experts for government advice can contribute to efficient outcomes.

5. Conclusions

67. Infrastructure has an enormous impact on economic growth and development, which is well documented empirically. A 1 % increase in infrastructure assets can increase gross domestic product growth by 0.2 %age points (for a review, see Guasch, 2004). Infrastructure investment needs coupled with constrained government budgets, has made private sector investment in infrastructure a primary goal in many countries across the globe. Privatization processes, concession awards and complex procurement are procedures by which private participation can contribute to the development and efficient operation of economic and social infrastructure. In these procedures, specifications aimed at short term gains (e.g., in terms of the revenue obtained) which simultaneously compromise efficient long-term structural solutions should be avoided.

68. Furthermore, inadequate design of the award procedure and contracts can lead to:

- inefficient outcomes;
- underperformance in terms of quality; and
- underinvestment.

69. As such, concerns with maintaining the incentives to deliver quality with cost efficiency and to invest in maintaining/developing the infrastructure are key in tender design. Different approaches have been implemented in practice in the attempt to reach these aims in public procurement and concession award.

70. Well-designed competitive procedures and contracts, with efforts placed in product design and specification, provisions to ensure incentives to deliver quality and investment with clauses aimed at ensuring commitment and compliance, together with adequate monitoring of contract implementation contribute to favourable outcomes. Measures seeking to allow time for bid offer preparation, to reduce information asymmetries between bidders and to design renegotiation proof contracts can help prevent underperformance and contract default due to incorrect cost/value estimates and strategic bidding behaviour.

REFERENCES

- Affuso, L and David Newberry (2002) “The Impact of Structural and Contractual Arrangements on a Vertically Separated Railway”, *The Economic and Social Review*, vol. 33(1), pp. 83-92.
- Asker, J and Estelle Cantillon (2008) “Properties of Scoring Auctions”, *RAND Journal of Economics* vol. 39(1), pp. 69-85.
- Bajari, P.; Houghton, S. and Steven Tadelis (2014) “Bidding for Incomplete Contracts: An Empirical Analysis of Adaptation Costs”, *American Economic Review*, 104(4), pp. 1288–1319.
- Bajari, P.; McMillan, R. and Steven Tadelis (2009), “Auctions versus Negotiations in Procurement: An Empirical Analysis”, *Journal of Law, Economics, and Organization* 25(2), pp. 372–99.
- Bajari, P. and Steve Tadelis (2006) “Incentives and Award Procedures: Competitive Tendering vs. Negotiations in Procurement” in N. Dimitri, G. Piga, and G. Spagnolo (Eds.) “Handbook of Procurement” by Cambridge University Press.
- Branco, F. (1997) "The Design of Multidimensional Auctions", *RAND Journal of Economics*, vol. 28, pp. 63-81.
- Brunet, E.; Guérin-Schneider, L. and Frédéric Bonnet, (2002) “Impact of a new Legislation on the Water Market and Competition in France”, ENGREF Working Paper.
- Bulow, J. and Paul Klemperer (1996) “Auctions Versus Negotiations”, *The American Economic Review*, vol. 86(1), pp. 180-194.
- Bulow, J. and Paul Klemperer (2002) “Prices and the Winner's Curse” *The RAND Journal of Economics*, vol. 33(1), pp. 1-21.
- Calzolari, G. and Giancarlo Spagnolo (2009) “Relational Contracts and Competitive Screening”, CEPR Discussion Paper No. 7434.
- Carbajo, J. and Antonio Estache. (1996) “Designing Toll Road Concessions – Lessons from Argentina”, Public Policy for the Private Sector, The World Bank Group, note 99.
- Che, Y. (1993) "Design Competition through Multidimensional Auctions", *RAND Journal of Economics*, vol. 24, pp. 668-680.
- Cramton, P.; Kwerel, E.; Rosston, G. and Andrzej Skrzypacz (2011) “Using Spectrum Auctions to Enhance Competition in Wireless Services”, *Journal of Law and Economics*, vol. 54, pp. 167-188.
- Cripps, M. and Norman Ireland (1994) “The Design of Auctions and Tenders with Quality Thresholds: The Symmetric Case”, *The Economic Journal*, vol. 104(423), pp. 316-326.
- Decarolis and Klein (2012) “Auctions that are Too Good to be True”, Working Paper Series, Frankfurt School of Finance & Management, 186.
- Decarolis (2010), “When the Highest Bidder Loses the Auction: Theory and Evidence from Public Procurement”, mimeo.

- Estache, A.; Guasch, L.; Iimi, A. and Lourdes Trujillo (2009) "Multidimensionality and Renegotiation: Evidence from Transport-Sector Public-Private-Partnership Transactions in Latin America", *Review of Industrial Organisation* 35, pp. 41–71.
- Estache, A. and Atsushi Iimi (2011) "The Economics of Public Infrastructure Procurement in Developing Countries: Theory and Evidence", Centre for Economic Policy Research.
- Estache, A. and Atsushi Iimi (2009) "Auctions with Endogenous Participation and Quality Thresholds: Evidence from ODA Infrastructure Procurement", Policy Research Working Paper 4853, The World Bank.
- Estache, A. and Atsushi Iimi (2008) "Procurement Efficiency For Infrastructure Development and Financial Needs Reassessed", Policy Research Working Paper 4662, The World Bank.
- Estache, A.; Perelman, S. and Lourdes Trujillo (2007) "Measuring Quantity-Quality Trade-Offs In Regulation: The Brazilian Freight Railways Case", *Annals of Public and Cooperative Economics*, 78(1), pp. 1-20.
- European Commission (2011) "Impact and Effectiveness of EU Public Procurement Legislation", Commission Staff Working Paper of 27.6.2011.
- Goldberg, V. (1977) "Competitive Bidding and the Production of Precontract Information", *The Bell Journal of Economics*, vol. 8(1), pp. 250-261.
- Guasch, L. (2004) "Granting and Renegotiating Concessions: Doing it Right", The World Bank.
- Guasch, L.; Laffont, J. and Stéphane Straub (2006) "Renegotiation of Concession Contracts: A Theoretical Approach", *Review of Industrial Organization* 29, pp. 55–73.
- Iimi, A. (2013 a) "Testing Low-Balling Strategy in Rural Road Procurement", *Review of Industrial Organization* 43, pp. 243–261.
- Iimi, A. (2013 b) "Multidimensional Auctions for Public Energy Efficiency Projects: Evidence from the Japanese ESCO Market", Policy Research Working Paper 6485, The World Bank.
- Iimi, A. (2006) "Auction Reforms for Effective Official Development Assistance", *Review of Industrial Organization* 28, pp. 109–128.
- Ioannou, P. and Sou-Sen Leu (1993) "Average-Bid Method - Competitive Bidding Strategy", *Journal of Construction Engineering and Management*, 119, 1, pp. 131-147.
- Kerf, M. (1998), "Concessions for Infrastructure: A Guide to Their Design and Award", World Bank Technical Paper No. 399, The World Bank.
- Klein, M. (1998) "Bidding for Concessions", Policy Research Working Paper Series 1957, The World Bank.
- Klemperer, P. (2002 a), "What Really Matters in Auction Design", *Journal of Economic Perspectives*, vol. 16, no. 1, pp. 169–189.
- Klemperer, P. (2002 b) "How (not) to run auctions: The European 3G telecom auctions", *European Economic Review*, Elsevier, vol. 46(4-5), pp. 829-845.

- Klemperer, P. (2005) "Bidding Markets", United Kingdom Competition Commission, June.
- Lewis, G. and Patrick Bajari (2011) "Procurement contracting with time incentives: Theory and evidence", *The Quarterly Journal of Economics* 126(3), pp. 1173–1211.
- Lichtenberg, F. (1988) "The Private R&D Investment Response to Federal Design and Technical Competitions", *American Economic Review*, vol. 78(3), pp. 550-559.
- McAfee, R. and John McMillan (1987), "Auctions and Bidding" *Journal of Economic Literature* 25, pp. 699-738.
- Milgrom, P. (2004), *Putting Auction Theory to Work*, Cambridge University Press.
- OECD Roundtable on Methods for Allocating Contracts for the Provision of Regional and Local Transportation Services DAF/COMP (2013).
- OECD, Council's Recommendation on Fighting Bid Rigging in Public Procurement (17 July 2012).
- OECD, Guidelines for Fighting Bid Rigging in Public Procurement (2009).
- OECD, Roundtable on Public Procurement, DAF/COMP (2007).
- OECD, Roundtable on Competition in Bidding Markets, DAF/COMP (2006).
- OECD, Roundtable on Competition in Concessions, DAF/COMP (2006).
- Rogerson, W. (1990) "Quality vs. Quantity in Military Procurement", *American Economic Review*, vol. 80, pp. 83-92.
- Williamson, O. (1976), "Franchise Bidding for Natural Monopolies - in General and with Respect to CATV", *Bell Journal of Economics*, vol. 7(1), pp 73-104.