**CHOOSING THE OPEN OR THE RESTRICTED PROCEDURE:
A <u>BIG</u> DEAL OR A BIG <u>DEAL</u>?**

Govert Heijboer and Jan Telgen*

ABSTRACT The legislation in the European Union (EU) regarding contracts to be awarded to third parties allows for a free choice by public agencies between the open and restricted procedure. Empirical evidence shows a high variance in the preference for one of the procedures exists between countries. This preference may be based on cultural phenomena only. Here we develop a quantitative model to calculate which procedure is the most economic. With insights from this model guidelines are given for an efficient policy regarding the choice for the open or restricted award procedure.

INTRODUCTION

In the European Union (EU), Directives (legislation) exist for public procurement (European Parliament and Council 1989, 1992a, 1992b, 1993a, 1993b, 1993c, 1997, 1998). When public agencies want to award a contract with a value above a certain threshold to a third party these Directives have to be followed. These Directives prescribe rules for the award procedures of these contracts. Two award procedures can be followed: the open and the restricted procedure (and in certain specific cases there is the option of the negotiated procedure). The public agency is free to choose one of these two procedures. This article deals with the

----

* *Govert Heijboer, Ph.D. candidate, Faculty of Technology & Management, University of Twente. His research interest is in strategic and tactical procurement, operational research and decision support. Jan Telgen, Ph.D., is a Professor, Faculty of Technology & Management, University of Twente. His teaching and research interest are in public procurement and the interface between procurement and operations research methods.*

question: given a case that has to comply with the EU Directives, which award procedure, the open or the restricted procedure, should be chosen?

To answer this question this paper is divided into a number of sections each addressing a sub-question. The first section deals with the question: what is it exactly that a public agency has to choose between? The EU directives will be described in more detail focusing on the open and restricted procedures, to whom it applies and to what type of purchases it is restricted. The second section deals with the current practice in the EU. Results of research done by the authors on the usage of the two procedures are presented in this section. The difference between countries, the change over time and other relations are investigated.

In addition to the empirical data, existing literature regarding these two procedures and regarding tender (competitive bidding) procedures in general was studied. This was done to answer the third sub-question: what criteria should the choice between the open and the restricted procedure be based upon? With the literature study, advantages and disadvantages of both procedures are identified and an overview is given in the third section.

With the background of the previous sections, an answer to the main question will be given in the fourth section. A quantitative approach was developed for the decision on which procedure to choose. Here the total cost is the estimated costs of the contract (the actual contract price) together with the estimated costs of the procedure itself. A model is presented with which the total costs of both procedures can be estimated, making it possible to choose the most economic procedure.

The model, its validity and implications, as well as possible extensions, are discussed in the fifth section. Finally, conclusions are drawn and recommendations are given.

DESCRIPTION OF THE EU DIRECTIVES FOR PUBLIC PROCUREMENT

The idea of the EU Directives originated from the White Paper by the European Commission on the internal market (European Commission, 1985) as one of the main issues. The aim was to create a

single transparent internal market. However there were two common practices in the EU preventing this (Erridge, Fee & McIlroy, 1998; Uttley & Hartley, 1994): preferential purchasing (preferring certain suppliers not based on economic reasons, discrimination) and protectionism by governments ("buying national" policies). Both practices prevent market competition to a certain extent or even completely. Lack of competition leads to higher prices and less investment in innovation. In other words, the taxpayer's money is not spent efficiently. The potential on public procurement in the EU savings because of this was huge, estimated at up to 0.5 % of the EU GDP (Cecchini, 1988), while the expenditure of public agencies was about 11 per cent of the EU GDP (European Commission, 1996).

The new legislation framework was finished in 1993 (European Parliament and Council 1989, 1992a, 1992b, 1993a, 1993b, 1993c), and EU Directives on Public Procurement were introduced. The Directives are regulated ultimately by the European Court of Justice. The function of the directives is to provide transparency and to give rules of conduct for the whole procurement process: objective specifications, types of award procedures and time limits. To ensure transparency and also enough publicity, all notices about public contracts (the announcement of the contract to be awarded and to whom it is eventually awarded) have to be published in the Supplement to the Official Journal of the European Community and the TED (Tenders Electronic Daily) database.[1]

After 1993 two developments led to a few changes in the legislation. First, in 1996 the existing Directives were evaluated (European Commission, 1996) and it was concluded that compliance with the Directives could and should be improved. This has led to a proposal for new directives with the following improvements (European Commission, 2000): "The main theme to emerge from the Green Paper (referring to European Commission, 1996) debate is the need to simplify the legal framework and adapt it to the new electronic age while maintaining the stability of its basic structure." This is still being discussed in the EU. Secondly, the EU signed the Agreement on Government Procurement (GPA) of the World Trade Organization (WTO) together with 10 other countries one of which was the USA. The GPA is similar to the EU Directives, but less strict and less detailed. From 1998, on the EU

Directives were changed in such a way that they were in agreement with the GPA (European Parliament and Council, 1997 & 1998).

Note that for the utilities sector (energy, water, transport and telecommunications) a separate set of directives exists (similar to the general Directives though), but those will not be discussed here.

The Directives apply to public agencies that plan to award to a third party a contract above a certain financial threshold. The following agencies are defined as public agencies: (a) the State including governmental bodies such as central government (ministries), regional and local authorities (provinces, municipalities, etc); and (b) bodies governed by public law (or associations/cooperations of those bodies), that satisfy all of the following criteria:

- Being established for the specific purpose of meeting needs in the general interest, not having an industrial or commercial character;

- Being a legal entity; and

- Being either financed, for the most part by the State (defined as above) or other bodies governed by public law, or subject to management supervision by those bodies or having an administrative, managerial or supervisory board, more than half of whose members are appointed by the State or by other bodies governed by public law.

In the Directives, distinction is made between three types of purchases (contracts): (a) Public works contracts for construction (buildings, roads, etc), (b) supplies: contracts for physical products and (c) Services: the rest. For each type, a different Directive applies. The Directives only need to be applied when the value of the contract exceeds a certain threshold, which is different for each contract type. Furthermore, since the implementation of the GPA, there are new thresholds for those contracts to which the GPA applies. For the contracts to which only the Directives apply and not the GPA, the old thresholds are still used. The thresholds are shown in Table 1.

TABLE 1
Contract Thresholds* of the Directives

Type of contract	Public agency	New Thresholds in SDR**	New thresholds in Euro	Old thresholds in Euro
Public Works	all	5,000,000	5,358,153	5,000,000
Supplies	central govt.	130,000	139,312	200,000
	other	200,000	214,326	200,000
Services	central govt.	130,000	139,312	200,000
	other	200,000	214,326	200,000

*Value Added Tax is excluded from the threshold amount.

**SDR: Special Drawing Right, issued by the International Monetary Fund (IMF).

Source: TED database.

When the Directives apply, the public agency can choose freely from two award procedures: the open and the restricted procedure. In exceptional circumstances three more procedures are available: the accelerated restricted procedure and the negotiated procedure with and without publication of a contract notice. These special circumstances can be among others: lack of tenders (bids) in the open and/or restricted procedure, extreme urgency, and additional services to a contract that is already awarded.

In both the open and restricted procedure a contract notice and the contract award notice have to be published in the Supplement to the *Official Journal of the European Community* and the TED database. Also, it is possible for the public agency to publish an annual notice indicating certain purchases for the coming year. In both procedures no negotiations with suppliers are allowed. Information has to be shared with all potential suppliers equally. Furthermore the specifications need to be written in such a way that they are non-discriminatory for all suppliers (for details see the Directives).

In an open procedure any interested supplier may submit a quotation in response to the publication of the invitation to tender (contract notice).

With that publication the public agency needs to have all contract and supporting documents (specifications) ready and available. The minimum deadline for the receipt of tenders is 52 days after the publication of the notice. When the purchase is indicated in the annual notice, this minimum deadline is reduced to 36 days. After the deadline the contract is awarded to the supplier with the best bid based on the award criteria.

In a restricted procedure there are two stages. In the first stage any interested supplier may submit a request to participate in response to the publication of the contract notice and will then be considered as a candidate. The minimum deadline for the receipt of requests to participate is 37 days after the publication date. After this stage candidates are selected based on objective criteria (decided upon before the start of the restricted procedure) regarding the supplier such as: grounds on which candidates can be excluded (bankruptcy), financial standing, ability and technical capability, registration in a trade register. The number of candidates to be selected is open for the public agency (but also has to be decided before the start of the procedure), however the minimum is five. If there are fewer than five candidates, then all candidates who meet the criteria have to be selected. In the second stage the contracting authority sends an invitation to tender to the selected candidates and therefore needs to have all contract and supporting documents ready and available at this point. The minimum deadline for the receipt of tenders is 40 days after sending the invitation. After that the contract is awarded to the supplier with the best bid based on the award criteria. A restricted procedure can be accelerated in exceptional cases when objectively proven urgency renders it impossible to respect the normal deadlines (reducing the 37 and 40 days to 15 and 10 days respectively).

In the two negotiated procedures, contracting authorities consult the suppliers of their choice and negotiate with one or more of them the contract conditions. Similar rules on minimum deadlines and notifications apply. Discussing these rules in detail is outside the scope of this article, because a public agency is not free to choose for a negotiated procedure. Negotiated procedures are therefore not often used as can be seen in the next section.

The contracts in the open and restricted procedure are awarded on one of the two award criteria: (a) lowest price and (b) economically most advantageous. The latter award criterion may be composed of several objective criteria that have to be mentioned in the invitation to tender: quality, technical assistance and service, delivery period, price, etc.

## USAGE OF THE AWARD PROCEDURES IN PRACTICE

As stated in the previous section, public agencies have a free choice between the open and restricted procedure. Now it is interesting to know which procedure is preferred in practice. To check this, a study was conducted by the authors using the TED database. In this online database all data of contract and contract award notices from 1995 onward is available.

With this data different parameters were investigated that could be of influence on the preference for one award procedure above the other: (a) the country to which the public agency belongs, (b) the contract type (public works, supplies or services), (c) development over time and (d) contract price.

First, the difference in preference for each country was checked. This was done by looking only at all award procedures (contract notices) that were announced by EU countries in the year 2000 (also award procedures of some other countries are published in the TED database). Furthermore, we excluded the utilities sector, as the EU Directives are somewhat different. Even with these restrictions the number of awards procedure was 79,163, a number that has been steadily growing in the last few years from 53,368 in 1996. Figure 1 shows the award procedures used in percentages for each EU country. They are ordered from the left to the right in the decreasing number of contract notices (from France, 28,734 notices were published, from the Netherlands, only 1,390 notices). Note that the "other" procedures consist of the accelerated restricted procedure and the negotiated procedures. They were grouped together as all these procedures can be chosen only under specific conditions.

There is a noticeable difference between the countries. Although most countries prefer the open procedure, countries like Great Britain

FIGURE 1
Use of Award Procedures in the Countries of the EU in 2000
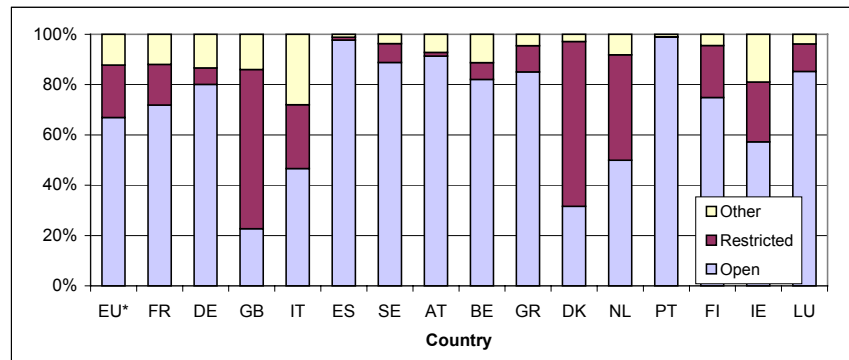

*Sum of all EU countries
Source: TED database.

and Denmark mostly use restricted procedures. An obvious explanation for these differences could be national legislation, which naturally public agencies have to comply with. It could be that only one type of procedure is allowed, explaining why some countries prefer the open procedure in 90% of the cases or more. This issue will be addressed in the discussion section.

Secondly, interesting insights emerge by distinguishing the award procedures used for different categories of contracts (public works, supplies, services). Figure 2 shows that difference for the three categories in the year 2000. Again the open procedure is the most common one, but especially for services the restricted procedure is still used in more than 25% of the cases. A reason could be that, on average, specifications for certain contract types are easier to make. Specifying services can be very complex and public agencies may want to focus more on the qualities of the supplier by using a restricted procedure (only selecting a few suppliers with good quality). Furthermore, the picture as shown in Figure 2 has not changed much from the picture of the years before. However, from 1996 a slight trend is toward the use of open procedures; the percentage of open procedures used was 78%, 64% and 41% for public works, and supplies and services, respectively, compared to 83%,
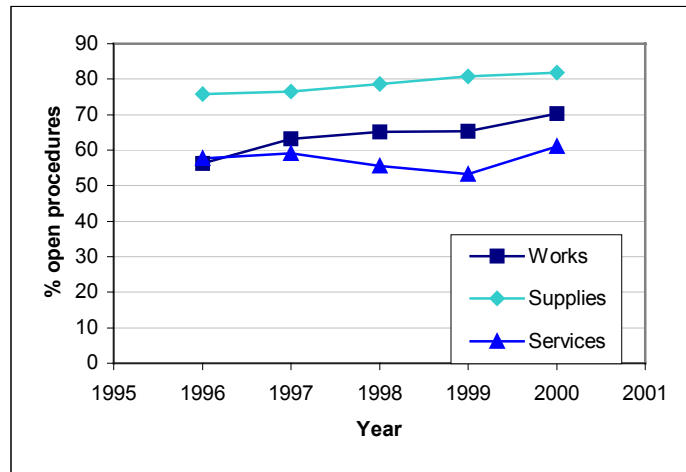
FIGURE 2
Award Procedures Used For Different Contract Types in 2000
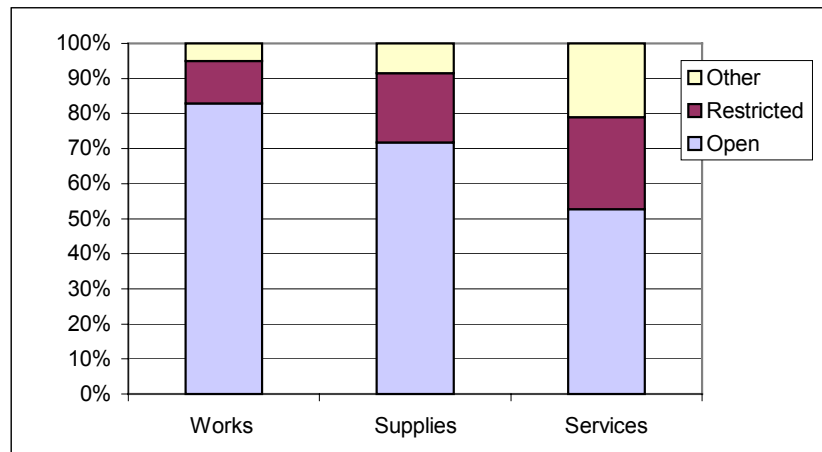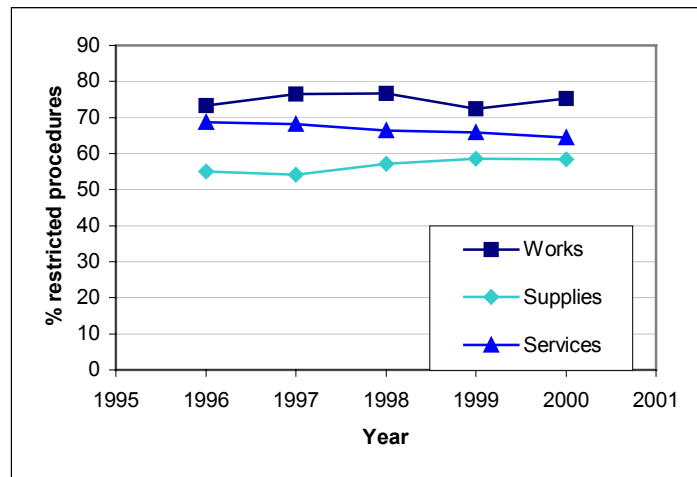

Source: TED database.

72% and 53% in 2000. Thirdly, the development of a few countries over time is taken into consideration: France, United Kingdom and the Netherlands. These three countries are particularly interesting as the first one has a high percentage of open procedures (as most EU countries), the second one a high percentage of restricted procedures and the last one is in between (see Figure 1). Figure 3 shows that for France the percentage of open procedures has been increasing gradually for all types of award procedures. A comparison of Figure 3 with Figure 2 indicates that even more open procedures are used for supplies and services in France than in the EU, but French procedures for public works are equal to those of the EU. The trend for France is typical for most EU countries that have a high percentage of open procedures (like Germany, Sweden, etc). The United Kingdom is the country that deviates most from the EU average. Note that Figure 4 shows the preference for the restricted and not the open procedures. Although the preference for restricted procedures for services is slightly declining, for public works and supplies it certainly is not. The Netherlands has on average not a clear preference for one of the

FIGURE 3
Development in the Preference for Open Procedures in France
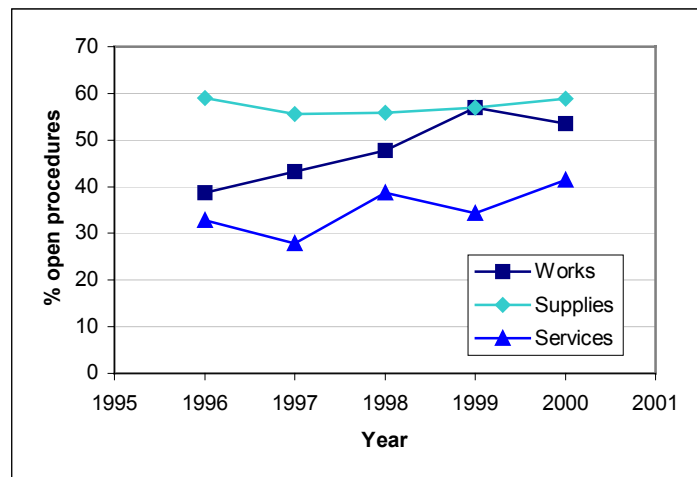

Source: TED database.

FIGURE 4
Development in the Preference for Restricted Procedures in the UK

Source: TED database.

procedures and maybe that is why it has been one of the countries with the greatest changes in preference in the last few years as can be seen in Figure 5. It shows that also here there is a trend toward open procedures, although for Services the percentage of open procedures is still well below 50%, meaning that the restricted procedure is still preferred there (as the percentage of other procedures is small).

FIGURE 5
Development in the Preference for Open Procedures in the Netherlands

Source: TED database.

Finally, we studied the relation between the use of procedures and the contract price. This was done for all public works contract awards in the Netherlands from 1997 until 1999. Figure 6 shows the results. The relation between the use of procedures and the contract price is remarkable. As shown in Figure 5 for public works in the Netherlands, the open procedure has been used more often in the last few years. However, at first, it was hardly used for valuable contracts (less than 10% in 1997). Apparently in most cases the policy was to use the restricted procedure for contracts above a certain threshold price.

FIGURE 6
Percent Use of Open Procedures Over Time By Contract Price for
Public Works in the Netherlands[*]
(in Dutch guilders; 1 Dutch guilder = 0.45 Euro)
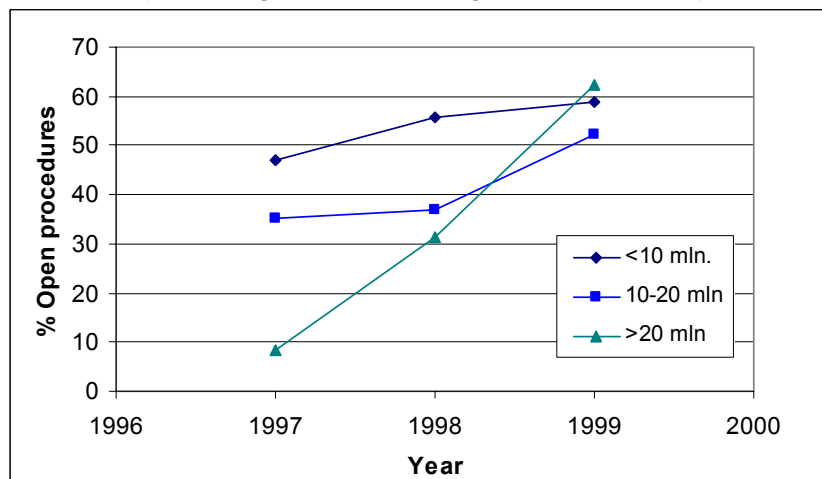
[*]Percentages are based on the award notifications published in a particular year in which the contract price was mentioned (93% of all contract award notifications).
Source: TED database.

However this changed dramatically in two years, as in 1999 the percentage of open procedures hardly differs for the different price categories.

From the practical evidence shown in this section it can be concluded that no uniform policy exists for choosing the open or the restricted procedure. The open procedure is used most and the percentage of open procedures is still increasing in the EU (67% open procedures in 2000 compared to 61% in 1996).

CRITERIA FOR CHOOSING AWARD PROCEDURES FROM LITERATURE

The open and restricted award procedures are two specific cases of tender procedure, a procedure in which a buying party requests tenders

(bids) from suppliers for a certain product or service, evaluates them in a uniform way and gives the contract to the supplier with the most economic bid. The first question to address is: what is the use of tender procedures, why not negotiate or simply buy it at the closest supplier? Having established the use of tender procedures, then the question arises: how to arrange the tender procedure for a specific case (in an optimal way)? Within the limitations of the EU Directives this boils down to the question whether the open or the restricted procedure should be preferred for a specific case.

Starting with the first question, the two main reasons for using tender procedures are to provide public accountability and to obtain the best value for money (Holmes, 1995). The public accountability is especially important for all purchasers from public agencies, as in principle all work done by civil servants has to be publicly accountable. This limits the possibility to use negotiations. In many countries law requires the use of prescribed tender procedures (Smyth, 1997), like the EU with its Directives and the GPA. The EU Directives aim to provide transparency in general and more particular on the following aspects (Netherlands Ministry of Economic Affairs, 1999): (a) contracts notifications and contract awards, (b) more objective specifications, (c) rules of conduct for awarding contracts and (d) rules of conduct about what can be demanded from suppliers.

From an economic point of view using tender procedures is a good way of achieving best value for money. In a tender procedure suppliers need to act competitively. The market mechanism is used to ensure the best price. Hence, when this market mechanism is destroyed to a certain extent, a tender procedure may not be that effective. This can occur with low competition, i.e., there is only one (or a few) suppliers or a collusion of suppliers. Just negotiations with one or two suppliers would probably lead to the same result with much lower costs, considering the efforts it takes for setting up a tender procedure and evaluating all tenders (Holmes, 1995).

Basically, a tender procedure is equivalent to an auction, more specifically a standard sealed-price auction where the lowest bid wins (Beattie & Fearnley, 1998). Much literature on auction theory focuses mainly on the bidder's side: the optimal bidding strategy under certain

conditions, for instance, the independence of bids (for a good overview see Milgrom, 1989). It was already proven by Vickrey (1961) that all auctions which are efficient (the 'lowest' bidder wins) and in which bidders do not base their bid on others (private values) lead to an equivalent result (under a few other conditions).

A phenomenon that has emerged from auction theory is the "winner's curse". It occurs when the winning bid has been made by a bidder that has estimated the costs of the contract inaccurately. From his point of view the bid turns out to be too low, leaving him with a non-profitable contract. This gives an incentive for bad performance and therefore this situation has to be avoided by the buyer. This phenomenon is yet another reason for having a tender procedure (and, particularly, specifications) with high transparency.

Coming back to the second question of the beginning of this section, what should the design of a tender procedure look like to ensure the best bid? Free entry of bidders (open bidding) would naturally give the highest competition. Also, the level of the lowest bid price will be lower on average as the number of bidders increases (Holt, 1979). However free entry of bidders has its disadvantages:

- *Evaluation Costs* Each tender is assumed to be evaluated equally (which is compulsory for public agencies). With free entry of bidders the time spent on sending information, handling queries and reading and evaluating tenders could be enormous, as it increases with the number of tenders received. Furthermore the number of tenders is not known beforehand, so the time that needs to be spent is uncertain (McMillan, 1998).

- *Uncompetitive Bids*. Supplier companies compete more seriously as the number of bidders is restricted as the perceived chance of winning the contract might be very low with free entry of bidders (Hallwood, 1996). Especially if the cost of making the tender for firms is considerable, serious participation could be limited even more.

- *Low Quality Bids*. As the quality level cannot always be put clearly in the contract, with high competition suppliers could take the opportunity to put in a (lower) bid with a lower quality standard in

mind (Kim, 1998). In other words by having competition that is mainly price driven, the quality could be compromised.

To deal with these disadvantages invited bidding can be used instead. A number of suppliers are selected first (creating a shortlist) and only these suppliers are invited to tender. This type of tender procedure is preferred by Leenders and Fearon (1993). According to them the following steps are necessary to ensure a competitive bid in a tender procedure. The first step is to select possible suppliers (who must be qualified, reliable and numerous enough to ensure a competitive bid), but not more than necessary. The second step is to send the inquiry and after receiving quotations the third step is to decide on the winner. Reducing possible disadvantages clearly limits the level of competition of suppliers.

For invited bidding, the question arises of how many suppliers should actually be invited to submit a bid. This question has already been investigated in a quantitative way (De Boer, Van Dijkhuizen & Telgen, 2000; Lansdowne, 1996). Inviting more suppliers will increase the costs of the whole evaluation process as more hours need to be spent on the tenders (tendering or evaluation costs). However inviting more suppliers increases competition. This will increase the chance of receiving a better bid. Hence, there is a trade off between the increasing tendering costs and the best-expected bid (decreasing with the number of suppliers). For a certain number of bids the total costs (adding up the best expected bid and tendering costs) are optimal (see Figure 7).

This optimal number of suppliers is defined as the Economic Tender Quantity (ETQ) (De Boer et al., 2000). In the De Boer et al. article, a mathematical model is presented for calculating this ETQ along with the minimum expected total costs. An important finding in that article is that under the assumptions made, the ETQ does not depend on the expected price of the contract, but on the expected spread in the bids. In practice however a policy that is often used, increases the number of bidders to invite when the contract is more valuable. De Boer et al. showed that this policy does not make sense from a cost perspective.

FIGURE 7
Trade-Off between the Tendering Costs and the Costs of the Best
Offered Bid
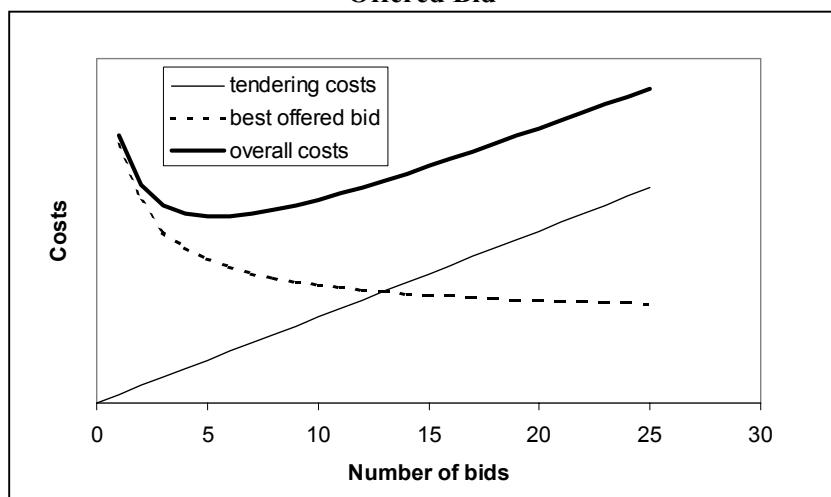
Source: Adapted from De Boer, Van Dijkhuizen & Telgen (2000).

Clearly the open procedure allows free entry of bidders, whereas the restricted procedure uses invited bidding. Hence the same advantages and disadvantages of the two different ways of bidding apply to the two different award procedures. With this background knowledge abouttender procedures in general, criteria can be defined for choosing between the open and the restricted procedure:

- *Expected Level of Competition*. The level of competition in the market is indicated by two variables: the expected spread in the bids received and the expected number of tenders for the open procedure/participation requests for the restricted procedure to be received. The higher the level of competition is, the higher the savings can be by maintaining a high level of competition using the open procedure or the restricted procedure with a large number of selected suppliers. Obviously, if the spread in the bids is high, receiving more tenders will be more useful than when the spread is low (having all suppliers quoting more or less the same price).

- ***Expected Tendering Costs***. These costs (mainly consisting of time spent by employees) can be split up into two parts: fixed and variable costs. Fixed costs include the costs of setting up the award procedure. These costs could be different for both procedures, but in practice they are similar as the same documents need to be made (specifications, invitation to tender, supporting documents). Variable costs include the costs related to each tender and in case of the restricted procedure also the costs related to each request for participation. The variable costs could be considerably less for the restricted procedure compared to the open procedure, as the number of tenders is limited and known.

- ***Available Time***. The open procedure seems more favorable from a time perspective the minimum time involved is 52 days. The restricted procedure is 77 days (37 days for the first stage and 40 days for the second stage). However the exact specifications have to be ready at the start of the open procedure, but for the restricted procedure they only have to be finished after the selection of suppliers (first stage). Thus selecting suppliers and making the specifications at the same time may save the extra time. Of course this only holds when enough resources are available to do both jobs simultaneously. Furthermore, after the last deadline the round-up of the restricted procedure may go faster than the open procedure because usually fewer tenders have to be evaluated. The time involved for each procedure is illustrated in Figure 8.

- ***National Legislation and Cultural Differences***. As stated previously national legislation could prohibit the use of one of the procedures. Moreover, policies within the public agencies could exist that state how the procurement process should be executed (using one of the award procedures), reflecting the culture of the agency.

QUANTITATIVE ANALYSIS OF THE DECISION BETWEEN THE OPEN AND THE RESTRICTED PROCEDURE

The first two criteria at the end of the previous section (the expected level of competition and the expected tendering costs) have been combined in a quantitative model (extending the ETQ-model by De Boer

FIGURE 8
Timeline for the open and restricted procedure
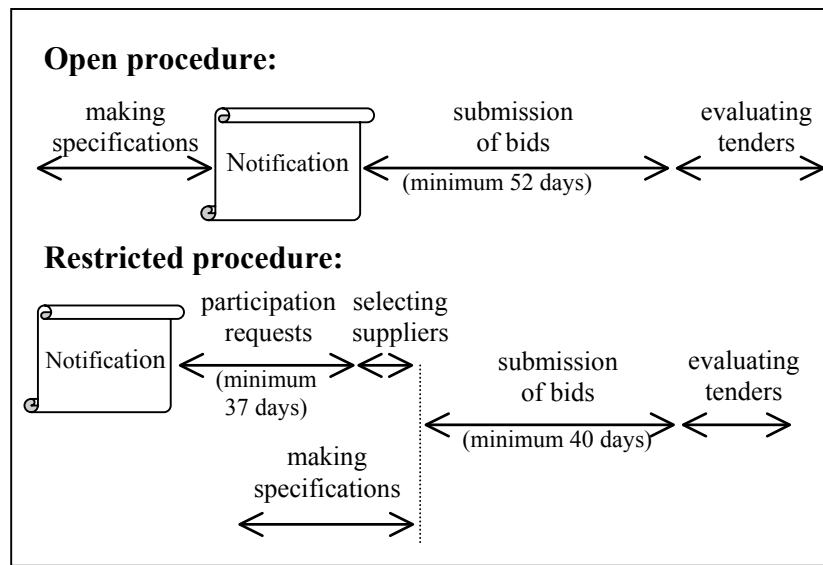
et al., 2000) to find how the costs of the best offered bid and the tendering costs (see Figure 7) is reflected in the choice between the open and the restricted procedure. To be clear about the decision problem, a public agency has the following choices for purchases that have to comply with the EU Directives before starting the award procedure: (a) choose either the open or the restricted procedure and (b) choose the number of candidates to be selected in case of the restricted procedure.

In our extended model a few assumptions will be used from the ETQ-model (De Boer et al., 2000). Relevant for the applicability of the extended model, they are listed here:

- Only price is considered. Of course all award criteria that can be translated into a price, like distance (costs of delivery) can be included easily. Also, it means the contract will be awarded to the supplier with the lowest bid.

- Each supplier bids independently (no collusion).

- Each supplier is indistinguishable. Each bid is a random pick from the same (given) probability distribution. The mean of this distribution is the average bid to be expected and variance can be used as an indicator for spread in the bids.

- The variable tendering costs are proportional to the number of tenders and/or the number of participation requests.

To extend the ETQ-model for the decision between the open and the restricted procedure, the different tendering costs for both procedures have to be modeled. First the fixed tendering costs have to be taken into account. For the decision only the difference between the fixed costs for both procedures is relevant.

For the variable costs we start by defining the (proportional) costs per tender for the open procedure as K. In the restricted procedure there are two evaluation/selection processes: selecting the candidates in the first stage and evaluating the tenders in the second stage. For the first stage these costs per participation request are defined as $\alpha \cdot K$. Here α will typically be near 0, something like 0.1, because evaluating a supplier based on a few criteria in the first stage is much less work than evaluating the whole tender. For the second stage the evaluation costs per tender is defined as $\beta \cdot K$. Here β will be typically near but lower than 1, because evaluating the tender after the first stage will still be almost as much work as that without the first stage as seen in the open procedure. Furthermore typically $\alpha + \beta$ will be somewhat larger than 1 as splitting up the evaluation for a tender in the restricted procedure will result in more work than doing it all at once, as is happening in the open procedure.

Another extension of the model is that the number of suppliers that will submit a tender has to be estimated. This number could depend on the procedure used. This can be caused by the fact that it is easier (cheaper) to submit a participation request than a complete tender. Also, suppliers might have different perceptions with respect to the chances of winning the contract depending on the procedure used. The expected number of tenders in the open procedure is defined as T_o and in the restricted procedure the expected number of participation requests as P_r. These expectations can be modeled by a probability distribution. In the

restricted procedure the public agency can decide itself on how many suppliers to invite for submitting a tender. This number is defined as T_r. With the expected number of tenders the expected lowest bid can be calculated.

Choosing the open or the restricted procedure now boils down to calculating which procedure has the lowest total costs. The expected total costs TC are defined as the sum of the expected lowest bid (the actual contract price) and the expected total tendering costs. Given the input above the TC of the open procedure (TC_o) can be calculated, whereas for the restricted procedure these TC are still dependent on the choice of T_r (number of candidates). However, given the input above the optimal T_r (the ETQ for the restricted procedure or ETQ_r) can be determined by using the ETQ-model. Then TC_r are the total costs of the restricted procedure choosing the ETQ_r.

To illustrate how the model works an example is given below. Here it is assumed that all bids are a random pick from a uniform probability distribution between a minimum *a* and a maximum *b*. The difference between *a* and *b* (b-a) is defined as the bid spread. Given N tenders, for a uniform distribution the expected minimum bid B_{min} is (De Boer et al., 2000):

$$B_{\min} = a + \frac{bidspread}{N+1} \tag{1}$$

The fixed tendering costs are omitted as we assume they are the same for both procedures. For the open procedure expecting T_o tenders, the expected total costs in this case are:

$$TC_o = K \cdot T_o + a + \frac{bidspread}{T_o + 1} \tag{2}$$

For the restricted procedure with P_r participation requests and ETQ_r selected candidates the expected total costs are:

$$TC_r = \alpha \cdot K \cdot P_r + \beta \cdot K \cdot ETQ_r + a + \frac{bidspread}{ETQ_r + 1} \tag{3}$$

The ETQ_r can easily be determined by minimizing TC_r, taking first and second differences with respect to ETQ_r:

$$\frac{\partial TC_r}{\partial ETQ_r} = 0; \quad \frac{\partial^2 TC_r}{\partial ETQ_r{}^2} > 0 \qquad (4)$$

The result for the optimal number of candidates to select is:

$$ETQ_r = -1 + \sqrt{\frac{bidspread}{\beta \cdot K}} \qquad (5)$$

Here ETQ_r is taken as a continuous variable, to be more precise the actual ETQ_r is an integer, so either the integer value just above or below the value found with (5). And of course at least one tender is required, thus ETQ_r is at least 1. As a rough indicator consider the case where the bid spread is in the order of 10-100% of the contract price, while the costs per tender are in the order of 1% of the contract price (and y close to 1). ETQ_r will then range from 1 to 10.

If the number of participation requests is below the value found in (5) then selecting ETQ_r candidates is not possible, only fewer can be invited. In that case, selecting as much as possible (as close to ETQ_r as possible), thus all P_r suppliers will give the minimum expected total costs for the restricted procedure. Furthermore if ETQ_r is below five, than it has to be taken equal to five because of EU Directives (or equal to the number of participation requests if that is below five). In summary, preference for either the open or the restricted procedure will depend on the difference between (2) and (3), hence depending on: α, β, T_o, P_r and the ratio of the bid spread to K.

To give an idea of which procedure should be preferred, we take α and β fixed and we assume that the number of expected tenders in the open procedure is equal to the number of participation requests in the restricted procedure ($T_o = P_r$). This leaves only two dimensions and makes a graphical representation possible as can be seen in Figure 9. A borderline divides the plot area into two parts: the right lower part with the lowest expected TC for the open procedure and the left upper part for the restricted procedure, assuming that the optimal number of suppliers is

selected (therefore subdividing the left upper part for different ETQ_r).
What also can be seen in Figure 9 at the arrow is the effect of the EU
legislation requiring the invitation of at least five candidates in the
restricted procedure (the dotted line would apply when this rule did not
exist). Logically as the number of candidates in the restricted procedure
cannot be chosen optimally, the open procedure gains some territory.

   To overcome the limitations of graphic representation and to
facilitate practical use the model has been implemented into a DSS. A
screenshot can be seen in Figure 10. Different scenarios (values of the
input parameters) can be checked quickly and also other probability
distributions for the bids (like the triangular one) can be chosen.
Interesting to see is that with the numbers used in Figure 10 there is
about a 10 % difference in the expected total costs for both procedures.
This is a typical percentage that can be found giving an idea of the
savings that can be achieved by making the most economic decision.

FIGURE 9
Choosing between the Open And Restricted Procedure For A
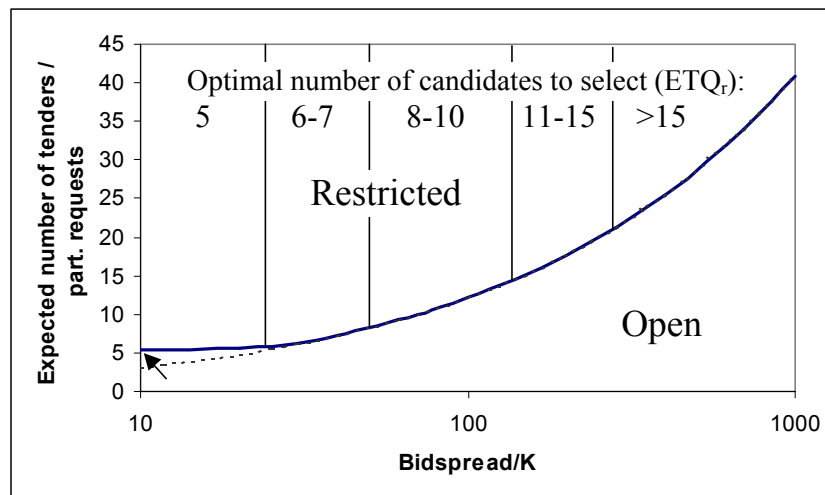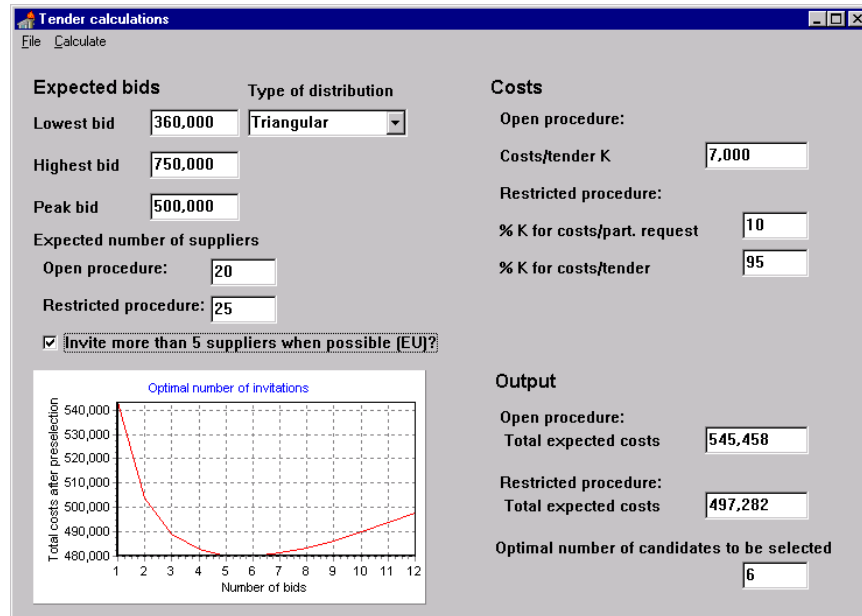**Uniform Distribution ($\alpha = 0.1$; $\beta = 0.95$; $T_o = P_r$)**

FIGURE 10
Screenshot of the DSS for Choosing between the Open and
Restricted Procedure

DISCUSSION

The model presented in the previous section gives a good insight to the trade-off between costs and benefits for both award procedures. However the merit of actual outcome (the numerical values) depends on the quality of the estimation of the input parameters. The expertise of the (tactical) purchaser is needed for that (knowledge of the market, knowledge of his/her agency's own purchasing process). Preliminary research results indicate that estimating the distribution of the bids beforehand was difficult, whereas estimating the tendering costs (average number of working hours allocated to each tender) was easier (Heijboer & De Boer, 2001).

Furthermore, as the model only presents expected total costs, the eventual realization might be different, as it is based on estimated

parameters. Therefore the model must be seen as an indicator for which procedure to use. Again the expertise of the purchaser will be needed to see to what extent the model is applicable in a particular situation.

Clearly the model promotes using a differentiated policy, i.e., basing the actual decision on the characteristics of each case separately and not having a general rule of, for instance, always using the restricted procedure with a fixed number of candidates. Also preferring one procedure above a certain threshold value of the contract award does not make sense, as it is not a variable that influences the decision in this model. But the expected spread in the bids is. And the absolute value of the bid spread could be more for contracts with a higher value.

It is good to realize that only the contract price and the costs are included in the model. Other criteria, like the time involved and quality of the contracts are not taken into account. Considering these other factors may lead to a different decision. The same holds when the underlying assumptions of the model do not apply or only hold to a certain extent.

First, it is not clear yet whether it is reasonable to assume that each bid will be offered from the same probability distribution. The model could be extended to let each bidder choose from its own probability distribution. Secondly, the assumption that all bids are independent is very important in this model, because it is the reason that the lowest expected bid will be lower for more suppliers. When there is a collusion of suppliers, the price mechanism is completely different. For instance the model shows that the EU rule of having to select at least five suppliers in the restricted procedure does not make sense, as it only increases the total expected costs. However it may be a necessary precaution to reduce the chance of the market mechanism being compromised. Thirdly, the tendering costs have been taken linear with the number of tenders, but in principle any cost function can be included just as easily.

We plan to test the practical use of the model (with the DSS) in the near future. It should aid the purchaser of a public agency in deciding between the open and the restricted procedure in such a way that it leads to a more efficient decision. Also it should facilitate communication of

those decisions to others, because tools like this add to the objectivity of the decision by not having based every decision on the experience and knowledge of the purchaser alone.

Finally, although the model here specifically addresses the award procedures in the EU, it can be generalized to deciding between open and invited bidding, because the open and restricted award procedure are just an example of these two types of bidding. With this generalization the practical use of the model is not limited to the public sector only, as private companies are free to arrange the bidding procedure as they like.

CONCLUSION

In the EU different ideas exist about which kind of award procedure to use for different situations. This is probably the reason why there is a free choice between two procedures and not just one procedure that has to be followed. Empirical evidence shows that preferences vary in different countries, for different contract types and are changing over time, the last few years more and more toward the open procedure.

According to the literature, the preference for either the open or restricted award procedure should be based on the following criteria: the expected level of market competition, expected tendering costs and time that will be involved. The values of the criteria are different for each specific case and it is therefore recommendable for a policy to be effective that these criteria and values are encorporated in it. And of course legislation and existing policies within public agencies have to be taken into account, but those can be changed (the latter one more easily than the first one, obviously). Especially as the preference nowadays is still closely tied to the specific country, it seems that cultural differences are more important than the other criteria mentioned above.

A quantitative approach to this decision problem has led to a model and a DSS calculation of the expected total costs of both procedures based on the level of competition and the tendering costs under certain conditions. The practical applicability still has to be proven, but this tool already gives a good indicator of the most efficient procedure in general. Extensions already indicated in the discussion and based on feedback from practice will increase applicability (like allowing for a certain level

of collusion of suppliers, including more dimensions with regard to the contracts, i.e., not only price but also quality, service level, etc)

Concluding, to award contracts efficiently, it is necessary to vary the award procedure used. Thus observing this variance in preference in practice is a good sign. At this point we can only hope it is based on the correct analysis.

NOTES

1.   This database can be found at www.ted.eur-op.eu.int.

REFERENCES

Beattie, V., & Fearnley, S. (1998). "Auditor Changes and Tendering; UK Interview Evidence." Accounting Auditing & Accountability Journal 11(1), 72-98.

Cecchini, P. (1988). The European Ahallenge 1992: The Benefits of a Single Market. Aldershot, United Kingdom: Wildwood House.

De Boer, L., Van Dijkhuizen, G., & Telgen, J. (2000). "A Basis for Modeling the Costs of Supplier Selection: The Economic Tender Quantity." Journal of the Operational Research Society 51(10), 1128-1135.

Erridge, A., Fee, R., & McIlroy, J. (1998). "European Union Public Procurement Policy and Electronic Commerce: Problems and Opportunities." European Business Review 98(5), 252-259.

European Commission. (2000). Proposal for a Directive of the European Parliament and of the Council on the coordination of Procedures for the Award of Public Supply Contracts, Public Service Contracts and Public Works Contracts. Luxembourg: European Community.

European Commission. (1996). Public Procurement in the European Union: Exploring the Way Forward (Green Paper). Luxembourg: European Community.

European Commission. (1985). Completing the Internal Market (White Paper COM(85) 310). Luxembourg: European Community.

European Parliament and Council. (1998). Directive 98/4/EC Amending Directive 93/38/EEC Coordinating the Procurement Procedures of Entities Operating in the Water, Energy, Transport and Telecommunications Sectors. Luxembourg: European Community.

European Parliament and Council. (1997). Directive 97/52/EC Amending Directives 92/50/EEC, 93/36/EEC and 93/37/EEC Concerning the Coordination of Procedures for the Award of Public Service Contracts, Public Supply Contracts and Public Works Contracts Respectively. Luxembourg: European Community.

European Parliament and Council. (1993a). Directive 93/36/EEC Coordinating Procedures for the Award of Public Supply Contracts. Luxembourg: European Community.

European Parliament and Council. (1993b). Directive 93/37/EEC Concerning the Coordination of Procedures for the Award of Public Works Contracts. Luxembourg: European Community.

European Parliament and Council. (1993c). Directive 93/38/EEC Coordinating the Procurement Procedures of Entities Operating in the Water, Energy, Transport and Telecommunications Sectors. Luxembourg: European Community.

European Parliament and Council. (1992a). Directive 92/13/EEC Coordinating the Laws, Regulations and Administrative Provisions Relating to the Application of Community Rules on the Procurement Procedures of Entities Operating in the Water, Energy, Transport and Telecommunications Sectors. Luxembourg: European Community.

European Parliament and Council. (1992b). Directive 92/50/EEC Relating to the Coordination of Procedures for the Award of Public Service Contracts. Luxembourg: European Community.

European Parliament and Council. (1989). Directive 89/665/EEC on the Coordination of the Laws, Regulations and Administrative Provisions Relating to the Application of Review Procedures to the Award of Public Supply and Public Works Contracts. Luxembourg: European Community.

Hallwood, C.P. (1996). "A Market in Action; Fuzzy Information and Trade-Offs between Operating Rules in the Invited Tender-Bid Procurement Auction." Journal of Economic Studies 23(3), 34-43.

Heijboer, G. J., & De Boer, L. (2001). "Optimal Number of Tenders in Practice." Proceedings of the 10th International Annual IPSERA Conference, 473-484.

Holmes, G. (1995). "To Tender or to Negotiate: the Buyer's Dilemma." Journal of Marketing Practice: Applied Marketing Science, 1(3), 7-17.

Holt, A. (1979). "Uncertainty and Bidding for Incentive Contracts." American Economic Review, 69, 697-705.

Kim, I.G. (1998). "A Model of Selective Tendering: Does Bidding Competition Deter Opportunism by Contractors?" Quarterly Review of Economics and Finance, 38(4), 907-925.

Lansdowne, Z.F. (1996). "Extensions of Bidding Theory: Concealed Bidding, Optimal Number of Bidders and Follow-on Contracts." Omega International Journal of Management Science, 24(1), 107-104.

Leenders, M.R., & Fearon, H.E. (1993). Purchasing and Materials Management. Chicago, IL: Irwin.

McMillan, J. (1998). "Competition in Government Procurement." (Working paper). San Diego, CA: University of California.

Milgrom, P. (1989). "Auctions and Bidding: a Primer." Journal of Economic Perspectives, 3(3), 3-22.

Netherlands Ministry of Economic Affairs. (1999). Europees Aanbesteden: Haal Pegels uit die Regels (European Tendering: Get Money out of those Rules). Available at: www.minez.nl.

Smyth, J.D. (1997). "Competition as a Means of Procuring Public Services: Lessons for the UK from the US Experience." International Journal of Public Sector Management, 10(1/2), 21-46.

Uttley, M.R.H., & Hartley, K. (1994). "Public Procurement in The Single European Market: Policy and Prospects." <u>European Business Review</u> <u>94</u>(2), 3-7.

Vickrey, W. (1961). "Counterspeculation, Auctions and Competitive Sealed Tenders." <u>Journal of Finance, 16</u>, 8-37.