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The Law of Small Numbers: Investigating the Benefits of Restricted Auctions for Public Procurement

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Abstract

A commonly accepted view in the academic literature is that dispensing with competition may only be beneficial when tendering complex contracts. However, restricted auctions are frequently used among EU-member states to procure small contracts (OECD, 2010). In this paper, we investigate this paradox. Using an original dataset of 180 contracts used by a local public buyer of social housing between 2006 and 2009, we show that limiting competition may enable economies to be made on transaction costs while the most efficient bidders still come forward, and that abuses such as corruption or favouritism do not result. To our knowledge, this paper is the first to shed light on the advantages of using restricted auctions when tendering small simple contracts.

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1 Introduction

Although public procurement markets represent a major part both of economic activity and public spending (around 19% of European GDP in 2009) [1], few empirical studies have investigated the procurement practices of public buyers. Nevertheless, both theoretical academic papers and regulations are full of recommendations on how to organize such markets. Their advice can briefly be summarized as a general emphasis on the use of open auctions to maximize the number of bidders. Indeed, the academic literature commonly holds that a large number of suppliers must be attracted if quality and price are to be optimized. An open auction is a transparent procedure that provides strong incentives to bidders to reveal their private information, therefore it is assumed to be the preferred method in this regard.

However, as highlighted for instance by Heijboer and Telgen [2002] or Bajari et al. [2009], some buyers deliberately choose to restrict competition (i.e., to restrict the number of competitors) or even to engage in negotiations with a single candidate, which suggests that more competitors may not always be better. The main reason for this is that free entry may lead to inefficient outcomes when the good or service to be procured is technically complex and/or barely contractible (see, e.g. Bajari et al. [2009], Bajari and Tadelis [2001], Kim [1998]). To our knowledge only one empirical study has investigated whether limiting entry might enable relational contracts to be implemented. [2] Those studies usually make the assumptions that, for "simple products", public authorities face markets with a large number of potential suppliers who are well informed and terms

1. See the OECD report, entitled "Performance Measurement" (2011), dedicated to public procurement

2. **?** used Italian procurement data on public works to compare the outcomes of restricted and open auctions, finding that open auctions decrease the probability that the contract of an incumbent firm will be renewed.

of exchange are easy to define. In such circumstances, complete contracts (*i.e.* contracts defining buyers' and sellers' rights and obligations across all future contingences Heinrich [1999] are expected with few renegotiations. Contracting for simple products is supposed to be an easy task [Brown et al., 2010] and selecting a private at a best price is achieved through open auctions.

However, placing the focus on the ability of less competitive procedures to tender complex contracts efficiently only partially captures the practices of public buyers. A recent report by the OECD (OECD [2010]) analyzes the awarding procedures used in EU member states for small contracts below EU thresholds [3] (hereafter thresholds). These contracts are regulated by national, rather than European rules, and the report highlights the fact that auctions with a limited number of invited bidders are common. The OECD report does not detail all the characteristics of the procedures used, but a list of the countries where restricted procedures are used below the thresholds is given explicitly: Austria, Denmark, Estonia, Hungary, Italy, Luxembourg, the Netherlands, Poland, Romania, Slovak Republic, Spain, Sweden. Given that small contracts are generally considered to be rather simple, *i.e.* contracts that may be specified easily and that give rise to few renegotiations, these practices are at odds with the literature, which recommends limiting their use to more complex contracts. Hence, the fact that numerous European countries exploit their freedom to use restricted procedures below the thresholds appears to be a paradox worthy of further investigation via the question: why do public authorities restrict competition when tendering small contracts?

Drawing an analogy between restricted procedures and hybrid organizational forms [Williamson, 1991], we argue that the procedures described above may enable savings to be made on *ex ante* transaction costs while maintaining a high

3. These thresholds vary regularly; over the period of study, they were around 200 000 €.

degree of competition. Given that public buyers must precisely justify their selection criteria and that numerous small contracts still account only for small amounts in terms of value, tendering through an open auction is likely to cause public buyers to spend a large part of their resources on a small part of their activities. In such a context, restricted auctions may be seen as a hybrid form of tendering, between the polar opposites of auction and negotiation; they enable part of the pressure of competitive tendering to be retained while reducing the *ex ante* transaction costs incurred by the buyer, thanks to the smaller number of offers that need comparing. Discretion introduced with such a procedure allows for greater flexibility for the public buyer and, as a result, helps increase efficiencies.

One potential problem with restricted auctions is that they allocate a discretionary power to the buyer when selecting the firms to invite to post an offer. This discretion may be used to improve economic efficiency by optimizing relationships between buyers and firms (which are primarily small and medium-sized enterprises (hereafter SMEs) in the case of small contracts [4]). However, the buyer's discretionary power may also be detrimental to economic efficiency if it is used to manipulate the market (Burguet and Che [2004], Ohashi [2009]).

We herein study the rationality of the selection process in restricted auctions using an original data set containing 180 contracts, awarded via restricted auction between 2006 and 2009 by a local public buyer of social housing in Paris. These contracts deal with services attached to construction works and are associated with short-lived, simple [5], and recurrent transactions. Restricted auctions are used with three to six invited bidders, selected from a list of pre-qualified candidates, which is renewed every two years or so. For each contract and tendering procedure,

4. See, for instance, this extract from European Commission [2010]: *"study confirms that the higher the value of the contract, the less the likelihood that an SME will win the contract. The threshold above which SMEs are seemingly disadvantaged is around 300,000 euros"*

5. The contracts we study are small (43 234 euros on average) and rarely renegotiated.

we have information on 1) all the pre-qualifying firms and their characteristics, 2) the bids of each invited bidder, 3) the winner. This information allows us to determine the probability that a given firm is invited in a given call for tenders, and to assess the impact of the invitation process on the final bids received by the buyer. This procedure reflects contract management capacities of this local authority. It can be analyzed as an organisational innovation in order to mitigate specific problems that can plague the contractual process, reflecting the public authority's willingness to achieve an effective contract management [Brown and Potoski, 2003].

Our main finding is that bidders are not invited randomly: the public buyer uses restricted auctions to share its contracts among firms of good repute. However, some dimensions of the invitation process might remain unobservable to the econometrician while nevertheless having an impact on the efficiency of the procurement. We deal with this issue using a Heckman selection model (Heckman [1979]) to analyze the impact on the competitiveness of the received offers of the observable and unobservable characteristics of the invitation process. Our empirical strategy requires instrumental variables, i.e. variables that affect the probability of invitation but not the firm's (unobservable) performance. We argue that the perception of firm size by public buyers evolved over our period of study, and that both the new Code of public procurement and the small business act (SBA) created exogenous shocks that have added to this perception. We are confident on the fact that those shocks do not affect final fids received by the public authority but only affect the willingness of the public authority to select or not a given firm, knowing that firm have to be selected within pools that have been constituted before Code and the SBA. Our result show that there is a selection bias (*i.e.* the unobservable in our bidder selection model are correlated with the unobservable in our posted bids model). The results suggest that the unobserv-

able at both stages are negatively correlated with each other, which we interpret to be a sign that the freedom of the buyer in the selection process results in lower prices (*i.e.* it does not lead to corruption or favouritism towards inefficient firms). In general, our results suggest that although restricted auctions allow economies in transaction costs, they preserve a high level of competition between the "happy few" firms selected to post bids.

We believe our findings contribute both to the existing literature and to the current debate surrounding the revision of the EU directives on public procurement. Our results highlight the possible benefits of discretion, thereby supporting the view of many practitioners [6]. Our findings also show that mitigating competition may be efficient for simple repeated transactions because it allows a reduction in *ex ante* transaction costs while limiting the comparison of offers to only the most efficient bidders. To our knowledge there has been no previous suggestion of this; the advantages of restricted competition have only been analyzed for complex transactions. Here we provide the first empirical analysis for simple contracts.

The remainder of our paper is organized as follows. In section 1, we investigate the rationale behind the use of restricted auctions to tender small contracts. Section 2 is dedicated to the presentation of our data set and our empirical strategy. In section 3, we present our results and discuss the effect of reduced competition on final bids. We provide conclusions in the final section.

6. See, for instance, the Green Paper related to the revision of EU directives. On page 11 of the synthesis of replies, it is reported that *"a broad majority of respondents from all stakeholder groups consider that the Directive should explicitly allow contracting authorities to take into account their previous experience with one or several bidders"*.

2 Why restrict competition in tendering simple contracts?

The economic literature contains few arguments to justify why a buyer should restrict competition when organizing a call for tenders. One general argument, developed by Hallwood [1996], is that candidates compete more seriously when the number of bidders is restricted because their perceived chance of winning the contract is higher than when entry is free. There are, after all, considerable costs involved in assembling a bid. Open auctions may then deter bidders from bidding and/or from working on a tailored bid. However, for simple contracts, this argument is unlikely to justify the use of restricted auctions because simple projects neither need tailored offers nor incur high bidding costs.

The literature on public procurement shows that less competitive awarding procedures (such as negotiation) are efficient when tendering complex contracts, either because they facilitate the dialogue between the parties, thereby reducing contractual incompleteness (Bajari et al. [2014]), or because they ease the implementation of relational contracts (Kim [1998], Doni [2006], Calzolari and Spagnolo [2009]). In such cases, open auctions prove to be inefficient due to the inability of the buyer to specify the contract. However, no argument can be found in the economic literature to explain why a buyer should restrict competition where small contracts are concerned. Because they are considered simple (Bajari et al. [2009], Chong et al. [2011]), small contracts are less prone to specification issues and less likely to generate *ex post* transaction costs. It is therefore surprising to observe their frequent use for tendering via restricted auctions (OECD [2010]).

2.1 The use of award procedures by EU public entities in practice: An overview

There are no official statistics at the European level concerning award procedures used for small contracts. In order to understand the use of award procedures in practice we relied on public procurement data obtained from the EU. Our data set describes public procurement projects published in the supplement to the Official Journal of the EU between 2008 and 2012. These projects are collected electronically in the TED (Tenders Electronic Daily) data base. All public procurement contracts that meet the thresholds shown in table 1 should be notified in the TED. Moreover, our sample also contains some procurement projects with values beneath these thresholds, allowing us an incomplete picture of the award procedures used for small contracts.

Figure 1 shows the share of procurement projects subject to EU directives awarded through different procedures provided under the EU regulations between 2008 and 2012, based on contract and award notices published in the TED database. The data distinguishes eight types of award procedures, covering open and restricted procedures as well as negotiated ones. The figure reveals that the bulk of the procurement projects subject to EU regulations are awarded through open and restricted procedures (about 82,5% of all procurement projects subject to EU Directives). Nevertheless, it is noteworthy that negotiation both with and without prior publication are also used by public entities in the EU: these account for about 13% of all the procurement projects awarded between 2008 and 2012.

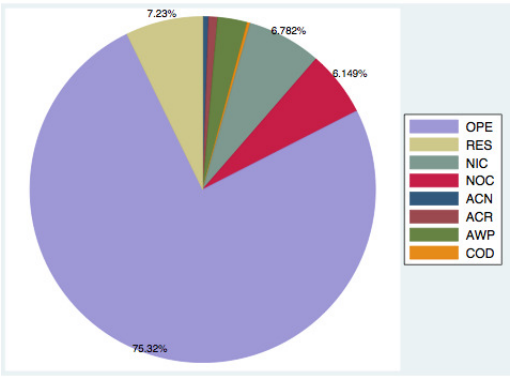
It is interesting to note from figure 2 focusing on low value contracts (less than 200 000 €) that if open procedures are still the most common way to award contracts, restricted procedures are still quite common, and as common as for the whole set of EU procurement projects in figure 1. This leaves open the ques-

Table 1: **Threshold of projects published in the OJEU/TED**

Service & supply contracts	200 000 €
Public works	5 000 000 €
Supplies in the sector of water, energy and transport	400 000 €
Supplies in the telecom.	750 000 €
Contracts falling under GATT agreement	130 000 €

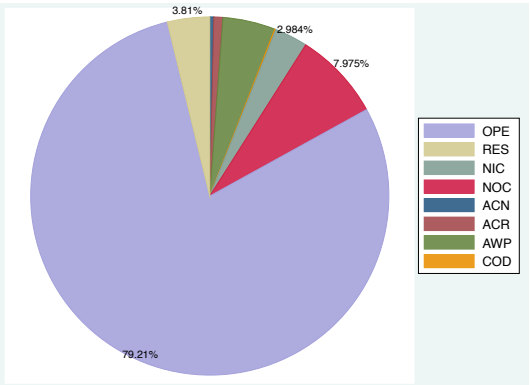
Source: TED, Business Opportunities in Europe or Commission Regulation (EU) no. 1251/2011

Figure 1: **Share of award procedures used in the EU for procurement projects regulated by EU directives, 2008-2012**



Note: Authors' calculation based on 600,026 projects listed in TED. Legend: OPE = Open procedure; RES = Restricted procedure; NIC = Negotiated procedures with prior publication; NOC = Negotiated procedure without prior publication; ACN = Accelerated negotiation procedure; ACR = Accelerated restricted procedure; AWP = Award without prior notice; COD = Competititive dialogue

Figure 2: **Share of award procedures used in the EU for small procurement projects (less than 200 000 €) regulated by EU directives in 2008-2012**



Note: Authors' calculation based on 600,026 projects listed in TED. Legend: OPE = Open procedure; RES = Restricted procedure; NIC = Negotiated procedures with prior publication; NOC = Negotiated procedure without prior publication; ACN = Accelerated negotiation procedure; ACR = Accelerated restricted procedure; AWP = Award without prior notice; COD = Competititive dialogue

tion of the rationale of such award procedures that restrict competition for small contracts.

2.2 Award procedures and *ex ante* transaction costs

Both theoretical (Bajari and Tadelis [2001]) and empirical studies (Bajari et al. [2014], Bajari et al. [2009], Decarolis [2014]) have emphasized the benefits of mitigating competition to tackle contractual incompleteness, thereby reducing *ex post* transaction costs. The same arguments might not apply in the case of small contracts, however, which are supposed to be simple and as a consequence less prone to renegotiation. The rationale behind the choice of restricted auctions for simple contracts might be related specifically to *ex ante* transaction costs, which have not previously been suggested to be a key issue in public procurement.

Indeed, given that public buyers must carry out a precise comparison of offers to be able to justify the selection of a winner, considerable time and administrative resources must be dedicated to tendering a contract through an open auction, regardless of its value. This process may be particularly complex when both price and quality are being assessed because quality is not always easy to evaluate. Therefore, the more offers there are to compare, the more complicated the classification; in other words, the *ex ante* transaction costs are related more to the number of bidders than to the value of the contract. Because small contracts are numerous but together account for only a small proportion of the total value of all contracts awarded [7], a buyer's legal department may spend most of its time and resources on a small part of its activity. This is clearly a problem when resources are limited.

7. For instance, according to the annual report of Paris Habitat-OPH in 2008, the main local public operator in social housing in Paris and the focus of the empirical part of our study, contracts below the EU thresholds account for 55.7% of the total number of contracts, but only 3.6% of the total value

Such a case may explain why a buyer might wish to restrict the number of competitors in an auction. Whether we consider that the marginal cost of bid evaluation is constant or decreases with each new bid, as the marginal gain of each new bid clearly decreases, there is an optimal finite number of competitors in the tendering process (i.e., the effect of competition increases with the number of bidders, but at a decreasing rate [8]). An analogy can easily be drawn with the "make-or-buy" decision and the existence of hybrid forms of organization in the literature on transaction cost economics [Williamson, 1991]. Indeed, at one end of the spectrum, open auctions enable contracts to be procured, mainly relying on competitive incentives. [9] Direct negotiation with one single supplier is the polar opposite method, and is more appropriate when contractual difficulties are likely to arise *ex post* because of the inability of the parties completely to specify their wishes *ex ante* (Bajari et al. [2009]). In such a framework of analysis, restricted auctions correspond to a hybrid form, because they enable part of the competitive incentives of auctions to be maintained, while saving on transactions costs.

In summary, *ex ante* transaction costs may be a particular concern in the case of small contracts. [10] The gains arising from having additional competitors may not be sufficient to compensate for the transaction costs associated with their administrative treatment. It might therefore be more rational for the buyer to economize on *ex ante* transaction costs using restricted auctions, because these limit the number of bids that need evaluating. However, here one of the key questions relates to the organization of the competitive phase, i.e., which competitors should be invited to post a bid? This decision depends on the buyer's discretion,

8. This decreasing rate is apparent in several empirical studies evaluating the impact of the number of bidders on received bids, which conclude that there is an optimal number of bidders (see, for example, Amaral et al. [2013])

9. See, for instance, the works of Demsetz [1968] or Bulow and Klemperer [1996], which formalize the benefits of competition for the market.

10. It should be noted that small contracts usually attract more bidders than more complex ones, strengthening the arguments concerning the cost of organizing calls for tenders and selecting offers as related to the value of the contract.

which gives rise to the possible inefficiencies.

2.3 Organizing the competition phase

In order to restrict the number of competitors as efficiently as possible, the buyer may either decide to invite bidders randomly or to follow simple rules. In determining these rules, it must be remembered that restricted auctions for small contracts primarily attract SMEs. The contracts are usually short term and recurrent. The literature and regulations describe some specific constraints when dealing with SMEs; one important determinant in the choice of invited bidder is the capacity of such firms to do the work required of them. Given that SMEs rapidly reach their capacity, one way of maintaining competition between SMEs is for buyers to organize invitations on a rotational basis.

Another determinant of the choice of invited bidders is likely to be their reputation. As emphasized in the literature on cooperation and alliances between firms, preserving a reputation might be a motive for cooperation. It is indeed in the interest of bidders to foster and maintain a good reputation (i.e., a reputation for reliability) because it increases the value of their ongoing relationships and improves their chances of developing future business opportunities. In practice, each partner's reputation can be used as a bargaining tool to secure the on-going relationship (Williamson [1983]) and avoid any mutual distrust prompted by fears of opportunistic intentions. Because one major concern for SMEs is their basic survival (Kim et al. [2008]), this hostage effect is likely to be particularly relevant: SMEs may indeed be interested in entering the secured and ongoing relationships typically enabled by restricted auctions (Coviello2017).

In general, because of the constrained capacities of SMEs and the uncertainties concerning their survival, we argue that buyers should use their discretionary

margins to select different firms to post bids and should use the information obtained from previous interactions to invite the most efficient bidders. However, as noted above, discretion in public procurement, particularly in the award process, may also lead to corruption and/or favouritism. The lack of transparency in market access conditions (Ohashi [2009]; Evenett and Hoekman [2005]) allows room for abuses in terms of the discretion applied. Whether this discretion will result in the capture of particular buyers, in favouritism towards inefficient firms, or in greater efficiencies of procurement all remain open questions, which we investigate in our empirical section.

3 Data and empirical strategy

In order to investigate the impact of award procedures with restricted competition on procurement efficiency, we analyze data from the main local public operator of social housing in Paris, Paris Habitat-OPH. Managing 119 294 residential units, 3 895 commercial premises and 40 885 parking spaces, Paris Habitat-OPH awards around 500 contracts per year and was the first social landlord in Europe. This buyer uses restricted auctions to tender some small contracts; hence, we first describe the procedure used. Because this procedure allows some discretion, we go on to describe the data we collected to investigate the rationale behind the invitation procedure before then presenting our empirical strategy.

3.1 The restricted auction procedure

The buyer restricts access to auctions in the following way (see figure 3). First, for each of the different types of architectural activity [11] managed through

11. For example, woodworking, isolation, etc.

restricted auction, the buyer pre-qualifies candidates who then belong to a pool of short-listed suppliers for a fixed period.[12] On average, more than 24 firms are candidates for a pool but only 10 firms actually pre-qualify. Candidates pre-qualify according to various criteria including skills, experience, and past performance (where they have previously interacted with the buyer). Several pools are constituted simultaneously by the buyer, depending mainly on the types of activities for which the buyer is seeking future contracts.[13]

Figure 3: **The restricted auction procedure**

PHASE 1	1 - Publicity	Firms are informed the buyer wants to constitute a pool of candidates
	2 - Pre-qualification phase	A stable pool of candidates is constituted
PHASE 2	3 - Invitation phase	For each contract, at least three firms *from the pool* are invited to post a bid
	4 - Reception phase	Invited firm's offers are received by the buyer
	5 - Selection of the winner	The contract is awarded to the candidate posting the most economically advantageous offer

We term the pre-qualification phase "phase 1", and we term the steps that are then repeated for each call for tenders "phase 2". In this second phase, for each call at least three candidates chosen from the pool are invited to post a bid. The number of invited candidates ranges from 3 to 6; on average, only 3.4 candidates are invited (See $Nb\_Candidates_j$ in table 3). The winner posts the best offer according to price and quality criteria; the lowest bid in terms of price is not necessarily the winning bid. We have no precise information on the reasons why the buyer short-lists a firm (Phase 1). Given that the buyer can disqualify firms depending on their past performances when building the pools, the past performances of short-listed firms might be more or less equivalent at the time of pre-qualification. We therefore assume that whatever the reasons for

12. The pools are generally renewed every two years.

13. 10 categories of activity are identified by Paris Habitat-OPH. We analyszed 24 different pools; on average there are 9 contracts per pool and 18 contracts per category of activity.

the buyer selecting a firm in a given pool, all firms in the pool are set equal, and we only investigate the buyer's propensity to invite a pre-qualified firm, in other words, we only investigate phase 2. Thus when analyzing the link between a firm's reputation and its probability of being invited to bid, for example, we only care about firms' past performances within a given pool.

3.2 Data

The data used herein refer to 180 service contracts awarded via restricted auction between January 2006 and July 2009. All the contracts studied are short-lived and recurrent, and relate to small architectural activities. The average estimated value [14] of these contracts is 46 336 euros and their average duration is around one year. 9% of the contracts deal with multiple geographic locations and the value of renegotiations only accounts for 0.7% of the estimated value of the contracts, which illustrates that we are dealing with simple transactions.

We possess information about the auctions' outcomes and the short-listed firms invited to post a bid at least once during the period of interest. This allows us to construct the set of variables presented in table 3.

3.2.1 Dependent variables

In the following empirical models, we aim to understand the determinants of the invitation phase and to assess the impact of the invitation process on the received bids. We therefore have two dependent variables, namely the probability of invitation and the value of the received bids; we describe these two variables below.

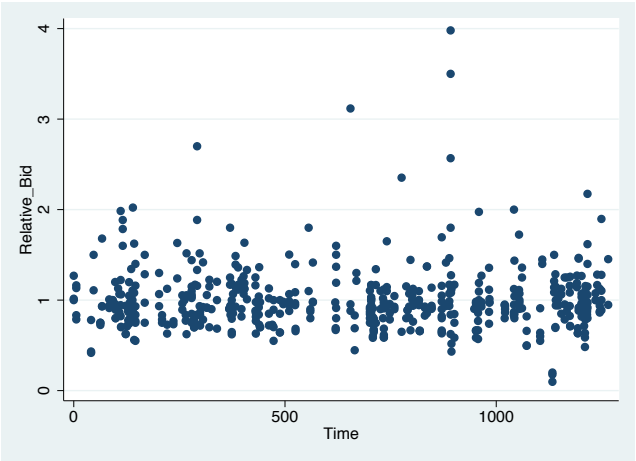
14. For each project, the buyer makes his own estimate.

Table 3: **Descriptive statistics**

Variable	Description	Mean	Std. dev.	Min	Max	N
	Selections and auctions' outcomes					
$Selected_{ijt}$	Equals 1 if the candidate i is invited to post a bid for contract j at time t, 0 otherwise	0.25	0.43	0	1	2476
Bid_{ijt}	Posted bid of candidate i for contract j at date t (in euros)	45 014	42 283	2 250	404 500	530
$Relative\ Bid_{ijt}$	Posted bid of candidate i for contract j at date t / buyer's estimated value	1.00	0.36	0.1	4	530
$Insufficient_{ijt}$	Equals 1 if posted bid by candidate i is the lowest for contract j and considered as technically insufficient at date t, 0 otherwise	0.10	0.30	0	1	530
	Contracts' characteristics					
$Estimate_j$	Buyer's estimated value of the contract j (in euros)	46 336	42.576.55	2 500	204 300	180
$Duration_j$	Buyer's estimated duration of the contract j (in months)	12.57	7.40	1	36	180
$Multisite_j$	Equals 1 if contract j deals with more than one geographical site, 0 otherwise	0.09	0.29	0	1	180
$Nb\ Candidates_j$	Number of firms invited to post a bid for contract j	3.4	0.62	3	6	180
	Firms' past performances					
$No\ Response\ Rate_{it}$	Number of past call for tenders for which the candidate i has not posted a bid at time t / number of time the candidate has been selected	0.07	0.22	0	1	2476
$Rate\ Insufficient_{it}$	Number of past technically insufficient low bids of the candidate i at time t / number of past offers	0.06	0.18	0	1	2476
$Market\ Share_{it}$	Value of on-going* contracts won by candidate i at time t / Overall (past and future) value of contracts attributed in the pool	0.02	0.06	0	0.69	2476
	Firms' size					
$Small_{ij}$	Take the value 1 if the number of employees of firm i is below the median number of employees of the firms belonging to the pool in which contract j is tendered, 0 otherwise	0.47	0.50	0	1	2476
$Employee_i$	Number of employees in firm i	12.81	70.12	1	887	2476
	Time and legal evolutions					
$Code_{jt}$	Equals 1 if contract j is awarded after September 2006, 0 otherwise	0.74	0.44	0	1	180
SBA_{jt}	Equals 1 if contract j awarded after June 2008, 0 otherwise	0.24	0.43	0	1	180
$Time_{jt}$	Calculates the number of days between February 2006 (the date in which the first contract we study started) and the date in which contract j started	641.19	380.27	0	1265	180

As previously mentioned, the variables $NoResponseRate_{it}$, $RateInsufficient_{it}$ and $MarketShare_{it}$ are calculated independently for each pool.
* We assume contracts are completed linearly day by day

Figure 4: **Relative bid and time**



On average, the value of the received bids was 45 014 euros. The value of the variable $RelativeBid_{ijt}$, which is the bid divided by the buyer's estimated value of the contract, shows that these bids are very close from the buyer's point of view. Figure 4 reports the distribution of the relative bids over time: observations seem independent and uniformly distributed, which suggests that the buyer's estimates are realized quite well over the period. Nevertheless, we note some extreme values that could contribute to a degree of bias in our estimates (for eight observations the relative bid exceeds 2). We also note that around 10% of the lowest posted bids did not win contracts because of their technical inadequacy. These low bids may be considered strategic, aiming to increase the probability of winning while decreasing the buyer's satisfaction. We will discuss this additional point when evaluating the impact of invitation on the competitiveness of bids.

Regarding the invitation phase, we note that pre-qualified firms have a chance of one in four of being invited to bid (see the variable $Selected_{ijt}$). For each pre-qualified firm, we know some structural characteristics, as well as the number of invitations to bid, the bids' value, the number and value of the successful bids, the number of bids disqualified for technical reasons, the number of times the invited firm voluntarily decided to decline and post no bid. This information allows us to build variables related to firms' structural characteristics as well as their past performances.

3.2.2 Firms' characteristics

Firms' past performances According to our literature review, firms' past performances may affect their probability of invitation. We first construct the variable $MarketShare_{it}$, which measures the current value of the contracts already won by firm i at time t in comparison with the total value of the contracts attributed to

firm i's pool. Our procedure includes a pre-qualification phase, thereby sending a clear signal to short-listed firms that future business is possible because the buyer commits to commission firms only in this pool for the near future. This signal may be especially helpful to SMEs worried about their survival and wishing to do business in secure, repeated ways. At the same time, the buyer might be concerned about sharing out contracts among pre-qualified firms. In other words, it is not impossible that even very successful firms, which we expect to have high market shares, will not systemically be invited, firstly to avoid reaching their capacities, and secondly to maintain the availability of a sufficiently large set of potential suppliers. We therefore expect that the higher the market share of a firm, the lower its probability of being invited to bid again.

Two additional variables are used to assess the determinants of bidders' invitations: $NoResponseRate_{it}$ and $RateInsufficient_{it}$. The first captures the fact that short-listed firms that are allowed to post a bid may refuse to do so and may thus have a low rate of response. Because some firms are explicitly disqualified at the pool-setting step having previously turned down several invitations [15], we argue that a firm with a low response rate has a bad reputation; hence, it may be less frequently invited to bid than firms with a higher response rate. The second variable, $RateInsufficient_{it}$, measures the proportion of low but technically insufficient bids posted by firm i at time t. Aggressive bidding is an issue frequently discussed in the literature on public procurement; it can be deliberate or not, in that it may be a firm's strategy to maximize its chance of winning a contract and then renegotiate (see, e.g., Guasch [2004]), or it may derive from an insufficient amount of information about the "true" value of contracts (Hong and Shum [2002]; De Silva et al. [2009]). Given that the contracts studied here are rather simple, these issues should not concern us. [16] Nevertheless, 10% of the contracts

15. We only have this information for the most recently constituted pools.
16. Hong and Shum [2002] are focusing on winner's curse effect associated with common

studied were not awarded to the lowest bidder, leading us to conclude that low but unsatisfying bids may still be common. One explanation is that some SMEs do not keep enough spare capacity to investigate the value of a contract that well, leading them to post bids that are not appropriate. Whatever the explanation, we argue that when firms frequently post unsatisfactory low bids, this send a negative signal to the buyer. These firms then suffer a loss of reputation and may be less frequently invited to post a bid thereafter.

Firms' structural characteristics We collected information on firms' structural characteristics [17]. The average number of employees in the 109 pre-qualified firms is 29. For the sub-sample of 86 firms for which data are available, turnover is on average 4.6 million Euros. Figure 5 shows the distribution of these two variables. According to EU reports [18], a firm is classified as an SME if its turnover is below 50 million euros and it employs less than 250 people. With the exception of two firms that are slightly larger than these limits allow, we note that all the pre-qualified firms are SMEs.

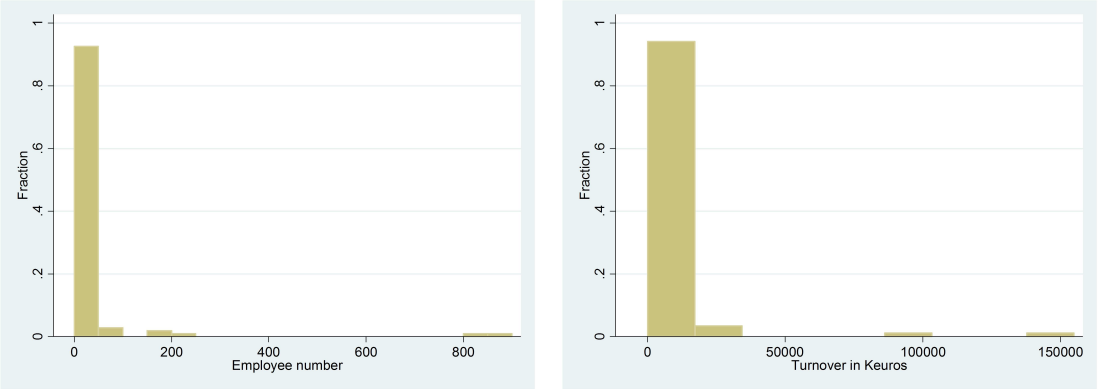
The size of the pre-qualified firms varies from 1 to 877 employees, and there are some disparities across pools regarding the median number of employees. To measure firm size in absolute terms, we first build the set of variables $Employee_i$, which indicates the number of employees in firm i . We then construct the dichotomous variable $Small_{ij}$, which takes a value of 1 if the number of employees of firm i is below the median number of employees of the firms in the pool in

value auctions that often lead contracts to be renegotiated ex post. We are concerned in this paper with private value simple auctions. The main reason why the public authority (in our case) is restricting the number of bidders is not because of winner's curse effect but because they want to reduce ex ante transaction costs (ex post renegotiations are not an issue in our simple contracts data set)

17. Some of these data were obtained from the internal database of the buyer concerned, while other data were obtained from on-line sources, thanks to websites that gather information on firms' characteristics (such as societe.com, manageo.com for instance).

18. See Evaluation of SMEs' Access to Public Procurement Markets in the EU (2010)

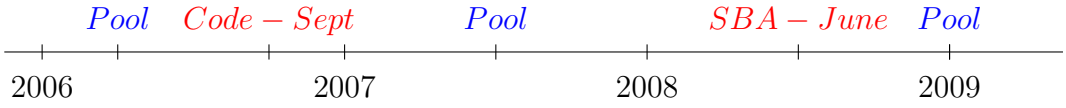
Figure 5: **Pre-qualified firms' turnover (in thousand euros - Keuros) and number of employees**



which contract j is tendered and takes a value of zero otherwise. This last variable depends on firm i but also on the pool in which contract j is awarded; a firm can be "big" in one pool but "small" in another.

We are mainly interested in investigating how the firms' size is perceived by the buyer depending on exogenous changes in the institutional framework. The empirical strategy we present in the next section indeed requires instrumental variables, *i.e.* variables that affect the probability of invitation but not the firm's (unobservable) performance. Given that in recent years much has been done to encourage SMEs to participate in public procurement, the propensity of public buyers to promote certain types of firm may have varied, regardless of the intrinsic performance a given size may generate in a given sector. The main development is the implementation of the "2006' French Public Procurement Code" (hereafter the Code), in September 2006, which offers some possibilities for helping the participation of SMEs in public procurement. As an example, the Code allows public buyers to invite a minimum number of SMEs to bid. We use the variable $Code_{jt}$ to account for this change. The second key development is the adoption of the "European Small Business Act" (SBA) and the "European Code of Best Practices facilitating access by SMEs to public procurement contracts", in June 2008, which sets out some principles for facilitating the participation of SMEs in

Figure 6: **Institutional changes and pool-building**



Over the period we study, there are three phases of pool-building: in March 2006, in June 2007, in January 2009.

the European economy and in public procurement. We use the variable SBA_{jt} to account for this change.

We suspect that the perception of firm size by public buyers evolved over our period of study, and that both the Code and the SBA created exogenous shocks that have added to this perception. Because these shocks did not occur during the building of some pools (See figure 6), we argue that if a causal effect exists, it should be visible in the invitation phase: the other conditions under which the competition takes place (the characteristics of the rival pre-qualified firms, for instance) remain the same before and after the shocks. Hence, these shocks may have changed public buyers' perceptions of small pre-qualified firms as attractive, rather than their performances per se. In other words, we expect that crossing the variables related to firm size with the variables related to time and shocks may help to explain the invitation, but not the bids of firms. This finding may then allow us to build instrumental variables. Additional details of the empirical strategy are given in the following section.

3.3 Empirical strategy

3.3.1 Who are the invited bidders?

In order to investigate which bidders are invited to bid, we herein use the following probit model, which estimates the probability of inviting a firm:

$$Selected_{ijt} = 1\Big[Selected^{*}_{ijt} = \gamma_1 + X_{it}\gamma_2 + Employee_i\gamma_3 + Small_{ij}\gamma_4 + U_{jt}\gamma_5 + (\tilde{Employee}_i * U_{jt})\gamma_6 + (Small_{ij} * U_t)\gamma_7 + C\gamma_8 + e_{ijt} > 0\Big] \quad (1)$$

where 1 is the indicator function, which takes a value of 1 whenever the statement in brackets is true, and zero otherwise; $Selected_{ijt}$ is the binary variable that indicates whether firm i is selected to bid for contract j at time t ; X_{it} contains covariates related to candidate i's characteristics at time t; $Employee_i$ and $Small_{ij}$ are variables that capture the size of firm i; U_{jt} captures dimensions related to the institutional context in which contract j is awarded.

We use $\tilde{Employee}_i$ to represent the demeaned value of the variable $Employee_i$ [19]. Then, to capture the change in the buyer's propensity to invite certain types of firms, we construct the interaction terms between the institutional context and firm size: we cross $\tilde{Employee}_i$ and $Small_{ij}$ with each variable in U_{jt}.

We also add C in some specifications, which includes several fixed effects. First, we do not observe the fixed effects of pools able to control for biases due to phase 1: some pools might consist of more numerous or better performing firms than others. Second, because we know the identities of the 66 employees of Paris Habitat-OPH who manage the auctions, we can add employee fixed effects: these employees might differ in terms of their ability or in terms of their propensity to be captured. More details are given in the second step of our econometric analysis regarding the interpretation of these fixed effects. [20]

19. $\tilde{Employee}_i = Employee_i - \overline{Employee}$. See pages 68-69 of Chapter 4 of Wooldridge [2001] for an explanation of the need to use demeaned variables when using interaction terms.

20. Table 3 also contains information about the characteristics of the contracts. Given that our first concern is to assess the impact of firm characteristics on the probability of being invited to post a bid, characteristics of contracts are excluded from the invitation phase estimates. Moreover, integrating these characteristics in the selection phase has no significant effect either on the invitation phase or on our main findings regarding its impact on the bidding phase.

Finally, e_{ijt} captures unobservable determinants of the invitation, depending on the fixed effects we add. These unobservable determinants might rely on the buyer's willingness either to improve economic efficiency or to manipulate market attribution. The second part of our empirical analysis enables us to discriminate between these two scenarios.

3.3.2 Invitation Process and Received Bids

Assessing the overall impact of the invitation phase on procurement efficiency requires an appropriate criterion of procurement efficiency and a method of obtaining the correlation between the residual of equation (1) and the criterion of efficiency.

In order to assess the competitiveness of received bids, we use the variable $RelativeBid_{ijt}$. We argue that this indicator captures the overall quality of the award process. Over the 180 contracts studied, the average value of renegotiations accounts for only 0.7% of the estimated value of the contracts. In other words, renegotiation is not a major issue and low bids are more likely to reflect competitiveness than opportunism. [21]

We then investigated whether the discretionary power of the buyer is used to generate competitive bids. Part of this discretionary power is observable and incorporated into the selection equation. However, we might not observe all the determinants of the selection process, which are captured by the residual e_{ijt} in equation (1). To account for this, we use the full information likelihood model of Heckman [Heckman, 1979], which enables us to capture any correlation between the unobservables of the selection and the outcome equations: if this correlation is significant, we may conclude that the unobserved heterogeneity between invited

21. Additional specifications were run and are explained below regarding the quality of low bids.

and non-invited bidders generates significant differences in terms of bid competitiveness. In other words, it would mean that the buyer's discretion results in a non-random invitation. The sign of the correlation indicates whether or not this non-random invitation is efficient: if it is positive, the unobserved determinants of the invitation generate fewer competitive bids; if it is negative, the unobserved determinants of the invitation generate more competitive bids.

In light of the foregoing, we estimate the following model:

$$\begin{aligned} RelativeBid_{ijt} = \beta_1 + X_{it}\beta_2 + Employee_i\beta_3 + Small_{ij}\beta_4 + U_{jt}\beta_5 + Z_j\beta_6 \\ + C\beta_7 + \epsilon_{ijt} \end{aligned} \tag{2}$$

where the variable $RelativeBid_{ijt}$ is observed only if $Selected^*_{ijt} > 0$; X_{it} contains covariates related to candidate i's characteristics at time t; $Effectif_i$ and $Small_{ij}$ are variables that capture the size of firm i; U_{jt} captures dimensions related to the institutional context in which contract j is awarded; Z_j is a vector of variables capturing the characteristics of contract j; ϵ_{ijt} are the error terms. We also add some fixed effects C as in our selection estimates.

In comparison with our first empirical model that focuses on the selection process, we now add control variables for each contract (See Z_j). Some characteristics of contracts are likely to impact on the competitiveness of received bids; we therefore control for contracts dealing with multiple geographic locations and contract duration. We also add a control variable to capture the effect of a larger number of invited firms (see the variable $NbCandidates_j$) on the level of the received offers.

When estimating the Heckman models, special care must be taken regarding some of our fixed effects. Specifications without employee fixed effects leave het-

erogeneity across employees in the residuals: if any selection bias exists, it might come from the prevalence of either over-performing or under-performing employees (for the latter, an issue of capture might exist). For example, if there are two types of procurement manager, the first type in the majority are corrupted and the second in the minority are not, specification without fixed effects will result in a positive correlation between both stages (on average, the most invited firms post higher bids). However, when adding employee fixed effects, the propensity of procurement managers to invite inefficient firms is removed from the residual and the correlation could cease to be positive. Therefore, if the selection bias significantly differs across specifications, this lends support to a particular distribution of employee characteristics.

It should also be noted that our Heckman models deliberately have no firm-fixed effects. Because we aim to assess the impact of invited firms' unobservable characteristics on the posted bids, the addition of firms' fixed effects remove these unobservable effects from the residual, preventing us from assessing their impact on the received bids: their impact would indeed appear in the form of a succession of fixed effects, which can only be interpreted on a case by case basis.

Moreover, Heckman models require at least one instrument. To be valid, an instrumental variable has to fulfil two conditions. First, the relevance condition implies that the instrument must be significantly correlated with the probability of being invited. Second, the instrument must respect the exogeneity condition, *i.e* it must be uncorrelated with the errors of the posted bids. In presenting our data, we argue that the crossed variables between firm size and changes in time might respect these conditions. We therefore use the 6 crossed variables as instruments.

4 Results and discussion

4.1 Candidate selection

The results regarding the way candidates are invited are presented in Table 5. Pool fixed effects are incorporated when switching from model 1 to model 2, and employee fixed effects from model 2 to model 3. We also ran a fourth model with firm fixed effects to clarify some of our findings. The results are stable whatever the specification, however, and suggest that the buyer does not invite firms to bid randomly.

Table 4: **firms' invitation**

	Model 1 Probit $Selected_{ijt}$	Model 2 Probit $Selected_{ijt}$	Model 3 Probit $Selected_{ijt}$	Model 4 Probit $Selected_{ijt}$
$RateInsufficient_{it}$	-0.318*	-0.238	-0.262+	-0.541**
	(0.174)	(0.176)	(0.176)	(0.231)
$NoResponseRate_{it}$	-0.249*	-0.450***	-0.524***	-0.882***
	(0.132)	(0.139)	(0.145)	(0.214)
$MarketShare_{it}$	0.584	0.191	0.151	-1.012*
	(0.437)	(0.482)	(0.478)	(0.566)
$Small_{ij}$	-0.113	-0.249*	-0.272*	-0.790***
	(0.141)	(0.148)	(0.147)	(0.230)
$Employee_i$	0.003	-0.010**	-0.012***	-0.363
	(0.004)	(0.004)	(0.005)	(0.378)
$Code_{jt}$	-0.055	0.067	0.014	0.002
	(0.150)	(0.166)	(0.212)	(0.226)
SBA_{jt}	0.130	0.134	0.025	-0.036
	(0.167)	(0.187)	(0.235)	(0.248)
$Time_{jt}$	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.001)
$Code_{jt} * Small_{ij}$	-0.271	-0.354+	-0.432*	-0.581**
	(0.234)	(0.244)	(0.253)	(0.264)
$SBA_{jt} * Small_{ij}$	-0.406+	-0.501**	-0.569**	-0.834***
	(0.249)	(0.243)	(0.246)	(0.273)
$Time_{jt} * Small_{ij}$	0.001*	0.001**	0.001**	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
$Code_{jt} * \tilde{Employee}_i$	-0.015**	-0.020***	-0.029***	-0.040***
	(0.006)	(0.006)	(0.009)	(0.011)
$SBA_{jt} * \tilde{Employee}_i$	-0.008	-0.015***	-0.021***	-0.041***
	(0.009)	(0.004)	(0.006)	(0.012)
$Time_{jt} * \tilde{Employee}_i$	0.000*	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
$Intercept_{ijt}$	2.146	1.343	-2.389	-1.833
	(4.404)	(6.989)	(8.821)	(10.351)
$Pool\_FE$	No	Yes	Yes	Yes
$Employee\_FE$	No	No	Yes	Yes
$Firm\_FE$	No	No	No	Yes
N	2476	2476	2476	2458

+ $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; robust standard errors in parentheses

Firstly, the past failures of firms affect the buyer's choice. As expected, a firm

that frequently turns down invitations or frequently posts unsuccessful low bids has a low probability of being invited again. Secondly, the results of models 1, 2 and 3 show that a high market share does not alter the probability of invitation. It is only when adding firm fixed effects that we find the expected impact (see model 4). A high market share in absolute terms does not matter; what matters is the market share for a given pool and firm. This suggests that the buyer shares out contracts taking into account firms' capacities. While these first estimates suggest that our buyer uses restricted auctions to invite the most efficient bidders, we still ran a second round of estimates to assess the impact of invitation on bids. This is possible because our 6 crossed variables are highly significant (especially in models 2, 3 and 4), satisfying the relevance condition of instrumental variables. Regarding these variables, we note that our buyer invites "medium" firms from each pool with a greater frequency (not the smallest, and not the biggest firms, see the variables $Small_{ij}$ and $Effectif_i$).

4.2 The competitiveness of received offers

Table 5 shows results on the competitiveness of received offers. The first two models are simple OLS, while the other four account for selection bias using a Heckman model. Indeed, the unobservable variables in our bidder selection model might be correlated with the unobservable in our posted bids model, leading to classical selection bias. One main issue is to determine whether the unobservable in both stages are negatively, positively or not correlated with each other. If there is a positive correlation, the selection process is affected by variables that we do not observe, increasing the probability of a firm being selected, also increasing the value of the final bids received by the buyer. Such a positive correlation would suggest that some kinds of favouritism are an issue in such restricted auctions. If there is a negative correlation, however, this would suggest that the discretionary

margins of the buyer's employees, which we do not capture in our variables, increase the probability that a firm is selected but also decrease the value of the final bids received by the buyer. [22]

Table 5: **Posted bids and selection's effect**

	Model 5 Ols $RelativeBid_{ijt}$	Model 6 Ols $RelativeBid_{ijt}$	Model 7 Heckman $RelativeBid_{ijt}$	Model 8 Heckman $RelativeBid_{ijt}$	Model 9 Heckman $RelativeBid_{ijt}$ θ	Model 10 Heckman $RelativeBid_{ijt}$ θ
$RateInsufficient_{it}$	-0.152**	-0.099	-0.132*	-0.024	-0.073	0.130
	(0.073)	(0.073)	(0.072)	(0.100)	(0.090)	(0.126)
$NoResponseRate_{it}$	0.008	-0.053	0.049	0.091	0.087	0.151
	(0.093)	(0.075)	(0.088)	(0.108)	(0.092)	(0.126)
$MarketShare_{it}$	0.025	-0.169	0.004	-0.286	0.002	-0.234
	(0.235)	(0.190)	(0.227)	(0.233)	(0.240)	(0.240)
$Small_{ij}$	0.003	0.017	0.006	0.026	0.008	0.034
	(0.030)	(0.031)	(0.030)	(0.032)	(0.032)	(0.039)
$Employee_i$	0.000	0.000**	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Code_{jt}$	-0.024	-0.008	-0.030	-0.031	0.000	0.041
	(0.068)	(0.075)	(0.067)	(0.084)	(0.076)	(0.092)
SBA_{jt}	-0.067	-0.010	-0.073	-0.028	-0.104	0.010
	(0.095)	(0.081)	(0.093)	(0.089)	(0.099)	(0.101)
$Time_{jt}$	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$NbCandidates_j$	-0.040+	-0.010	-0.040*	-0.004	-0.021	0.043
	(0.025)	(0.030)	(0.024)	(0.028)	(0.030)	(0.034)
$Duration_j$	-0.005*	-0.001	-0.005**	-0.002	-0.005*	-0.001
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
$Multisite_j$	0.105**	0.028	0.104**	0.009	0.088*	0.004
	(0.049)	(0.047)	(0.048)	(0.053)	(0.051)	(0.061)
$Intercept_{ijt}$	-0.376	-0.805	-0.598	-1.314	-1.911	0.735
	(3.574)	(3.273)	(3.510)	(3.621)	(3.842)	(4.091)
ρ			-0.306	-0.832	-0.318	-0.893
P-value indep. test (ρ=0)			0.024	0.053	0.037	0.044
$Pool\_FE$	Yes	Yes	Yes	Yes	Yes	Yes
$Employee\_FE$	No	Yes	No	Yes	No	Yes
N	530	530	530	530	477	477
$R2$	0.10	0.43				

+ $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; robust standard errors in parentheses
θ Regressions on sufficient received offers only

The first four models were run on the entire set of received offers, while the last two regressions were run on the set of "sufficient" received offers (in other words, bids that are disqualified by the buyer are excluded *i.e.* if the variable $Insufficient$ is equal to 1). We replicated the estimations of models 7 and 8 after dropping the insufficient offers to check whether the lowest bids were a result of an increase in low quality bids. In other words, if the invitation process leads to the selection of more firms that post low but technically insufficient offers, the decrease in prices is driven by a decrease in the quality of the proposed bids.

22. We do not include firm fixed effects in our second stage regressions. Firms' unobserved heterogeneity is left in the residuals and can be interpreted with Heckman models: these models provide statistical information regarding the relationship between unobservable variables of both stage. Thus, results show that firms' unobserved heterogeneity is negatively / positively correlated between both stages and we can conclude that the firms which are the more likely to be invited are those who post the lower / highest bids.

We first observe that a selection bias exists and that the coefficients of our explanatory variables are weakly affected by it, by comparing models 7 and 8 with models 5 and 6. An interesting finding then concerns the impact of the selection bias on received offers: the selection bias is negative (see ρ, which captures the correlation between the unobservables of equations (1) and (2)) and significant (see the p-value of the Wald test: ρ=0), which shows that the selection process leads to lower bids whatever the specification. The selection bias persists if the insufficient offers are dropped, leading us to conclude that the increase in competitiveness permitted by the invitation phase does not result in lower quality bids. More precisely, the average sample selection effect, which shows by how much the received bids are shifted downwards on average due to the selection effect, indicates an effect of -13% if we consider model 7 in table 5. Overall, this suggests that the invitation process enables us to obtain more competitive bids, leading us to exclude the possibility that it is used to manipulate market attribution. Moreover, we find that the significance of the selection bias persists when employee fixed effects are added: while employees' identities explain a large part of the unobserved heterogeneity across bids (see the increase in R2 when switching from Model 4 to Model 5), the selection bias is not due to the prevalence of over-performing employees (i.e., to the prevalence of employees able to detect the best performing firms or to obtain better performances from firms).

Regarding observable past performances, we find that firms that frequently post unsuccessful low bids tend to be aggressive bidders, whereas firms that frequently turn down invitations post higher bids; these latter firms might not be that interested in participating in the auctions anyway, and consequently do not bid competitively.

4.3 Discussion

One potential limitation of our results is that abuses in discretion do not occur at the invitation stage but at the constitution of the pools, which is a phase that we did not study. In other words, we cannot exclude the possibility that invited firms appear more efficient because the buyer voluntarily pre-qualifies inefficient firms in addition to firms that have corrupted him.

If we concede that there are some long-standing corrupt deals, one way to detect for these is to investigate whether the same firms frequently pre-qualify. Although we have no exhaustive information regarding the pre-qualification phase, we compared the composition of two successive pools (for each of the sectors studied), and it appears that around 76% of the firms that pre-qualified at T+1 were not pre-qualified at T. As a consequence, if there is a capture issue at the pre-qualification stage, it might involve a minority of firms within each pool.

Let us assume, however, that only a few firms within each pool actually corrupted the buyer and that the other firms are pre-qualified because they are especially inefficient. Since each pool consists of around 10 firms, three of the pre-qualified firms may have corrupted the buyer, which is close to the average number of invited firms. For this scenario to be consistent with the decrease in price we observe thanks to the invitation phase, the buyer might invite the (three) firms that have corrupted him far more frequently. For the capture to be relevant, the firms that have corrupted the buyer might have higher market shares. However, our results are not compatible with such a story. First of all, when analyzing the invitation phase effect, we found that the buyer may aim to limit the average market shares of invited firms or at least, not invite more firms with higher market shares. In other words, being engaged in corruption would not be rational if it does not simultaneously allow an increase in market share

and access to new contracts. Moreover, even if we consider only the second part of our results, *i.e.* the effect of the invitation phase on the posted bids, we find that a higher market share does not lead firms to post bids that are significantly more competitive: it is not compatible with the statement that firms engaged in corruption (which may rationally have higher market shares in order to make corruption relevant) are more efficient than firms that are not (which may have lower market shares). Finally, we argue that the scenario of a few firms engaged in corruption at the pre-qualification stage does not fit our findings.

5 Conclusions

In this article our aim was to understand a paradox that we had observed previously, that public buyers decide to use restricted auctions to tender small contracts. We found evidence to suggest that this paradox is not anecdotal; in fact, the practice is widespread among public buyers in EU member states (OECD [2010]). We therefore investigated the phenomenon that could be termed "the law of small numbers".

Previous authors on this topic have advised enhancing competition in order to tender small contracts efficiently: they are generally rather simple and, as a consequence, *ex post* transaction costs, resulting from contractual incompleteness, should not be a matter of concern (Bajari and Tadelis [2001], Brown et al. [2010]). Nevertheless, we show that the characteristics of some public buyers characteristics means that the systematic use of open auctions may lead them to spend most of their resources on a very small part of their overall activity. Therefore, a primary aim of restricted auctions is to save on *ex ante* transaction costs by limiting the number of offers to be compared.

However, in such a scheme the organization of the competition is left to the buyer's discretion. The question of whether this discretion should be increased or not is hotly debated in the academic literature (Spagnolo [2012]), but also among lawmakers (see, for instance, the Green Paper related to the revision of EU directives): on the one hand, it tends to favour anti-competitive behaviour such as corruption or favouritism (Ohashi [2009]); on the other, a lack of discretion may be responsible for poor contract enforcement (Kelman [1990]). Contract enforcement is certainly not a major issue in the particular case of small contracts; we nevertheless argue that the buyer's discretionary power at the bidder invitation stage can help to increase competition among SMEs. In order to discriminate between these two scenarios, we used a data set of 180 contracts awarded via restricted auctions between January 2006 and December 2009. We find some support for the contention that the buyer's strategy is to share out contracts among pre-qualified firms of good repute. In addition, the unobservable characteristics of this invitation phase decrease the final received bids. We interpret this result to be a sign that the freedom of the buyer in the selection process does not result in higher prices. Overall, our results suggest that restricted auctions, while economizing on transaction costs, preserve a high level of competition between the "happy few" firms selected to post a bid.

Nevertheless, there is still one major open question we do not particularly address here: why does discretion not result in costly abuses? The literature argues that one method of limiting the adverse effects of discretion is to increase the transparency of the award procedures (See, for instance, Boehm and Olaya [2006]; Amaral et al. [2009]). The 2004 reform of the French Public Procurement Code, corresponding to the implementation of EU directives, drastically increased the obligations of public buyers regarding, for instance, the information they must communicate to losing candidates. This type of reform probably partly explains

the way discretion is used: the growing possibility that firms can challenge the probity of the award process reduces the occurrence of abuses in discretion, in that they are now more likely to be detected. In other words, an increase in freedom and discretion may be compensated by an increase in accountability. As pointed out by Girth [2014], because anyone dissatisfied with discretionary decisions can allege complaint, corruption or favoritism against the public authority in charge of the contract, legalism or red tape [Pandey and Scott, 2002] can have a tendency to prevail over more cooperative approaches. Accountability through an increase of the transparency of the awarding procedure might thus both develop discretion when it is needed and restrain unwanted behaviors.

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Appendix

We performed various checks on robustness in order to assess the sensitivity of our results. These are discussed below.

Logarithm of the final bids Table 6 is a repeat of table 5, in which the relative bids have been replaced by the logarithms of the final received bids. This is an alternative specification of the bid prices we find in the literature[23] (The logarithm of the estimated value of the contract is added as a control variable).

23. See, for instance De Silva et al. [2009], which use both measures

Regardless of the variable considered, the results are comparable and the selection bias persists.

Two-step Heckman method The two-step Heckman model is an alternative to the Heckman model we used here (sometimes called the "Full Information Maximum Likelihood" model, hereafter FIML). While this two-step strategy is more robust than the FIML estimator that we used, it is considered less efficient, and is also used less because of computational difficulties. In Table 7 we show the last four models of table 5, instead using a two-step Heckman method. This shows a slight decrease in the significance of the selection bias. The bias is still negative and generally remains significant, which confirms that our results are not that sensitive to the specification used.

Extreme values Furthermore, we repeated our models of table 5, this time dropping the potential extreme values (the offers that are more than double the buyer's estimate); the results are very similar, as shown in table 8.

Fixed effects To save space in table 5, we did not run the Heckman models with no fixed effects (i.e., no pool and no employee fixed effects): in these models, the selection bias is still negative and significant at a confidence level of 1%. Moreover, in our models in table 4 and 5, we could have added year fixed effects to control for unobserved changes over time. We decided to not include these variables to avoid issues of collinearity between changes over time and the year fixed effects; their omission ensures that we retain enough variation over time to identify the causal impact of these changes in the law. In any case, adding year fixed effects has no effect on our results (neither the invitation phase estimates nor the Heckman models). Moreover, the pool fixed effects that we included in

most of our specifications might already partially control for unobserved changes over time, given that a pool lasts around two years.

The Effect of Competition The impact of the number of firms participating to the auction on the outcomes could be captured with the number of candidates (i.e. the number of firms invited by public authority to participate to the auction) as we did in the paper. However, one would wonder why we don't use the number of bidders (i.e. the number of firms that actually post a bid) as an alternative way to measure competitition. [24] To assess whether those two alternative measures have a significant impact on our results, we replicated our Heckman model by including in our regressions the number of bidders. Results of these new estimates are provided in table 9. This new specification does not alter our main finding that is that invited firms are more efficient than non-invited ones.

24. We thank an anonymous referee for pointing this out.

Table 6: **Posted bids and selection's effect on log(bid)**

	Model 11 Ols $Log(Bid_{ijt})$	Model 12 Ols $Log(Bid_{ijt})$	Model 13 Heckman $Log(Bid_{ijt})$	Model 14 Heckman $Log(Bid_{ijt})$	Model 15 Heckman $Log(Bid_{ijt})$ θ	Model 16 Heckman $Log(Bid_{ijt})$ θ
$RateInsufficient_{it}$	-0.112*	-0.107*	-0.065	-0.059	0.022	0.063
	(0.068)	(0.065)	(0.077)	(0.074)	(0.084)	(0.081)
$NoResponseRate_{it}$	0.054	-0.001	0.163*	0.097	0.189**	0.120*
	(0.074)	(0.055)	(0.086)	(0.068)	(0.092)	(0.065)
$MarketShare_{it}$	-0.099	-0.102	-0.145	-0.148	-0.114	-0.086
	(0.233)	(0.156)	(0.211)	(0.160)	(0.216)	(0.162)
$Small_{ij}$	-0.027	-0.004	-0.013	0.004	-0.008	0.013
	(0.025)	(0.024)	(0.028)	(0.024)	(0.030)	(0.027)
$Employee_i$	0.000	0.000**	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Code_{jt}$	0.058	0.061	0.043	0.047	0.093	0.110+
	(0.055)	(0.063)	(0.063)	(0.065)	(0.068)	(0.068)
SBA_{jt}	-0.070	0.005	-0.072	-0.009	-0.092	0.026
	(0.087)	(0.074)	(0.087)	(0.074)	(0.091)	(0.078)
$Time_{jt}$	0.000	0.000	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$NbCandidates_j$	-0.000	-0.013	-0.009	-0.009	0.015	0.038
	(0.024)	(0.028)	(0.021)	(0.026)	(0.025)	(0.029)
$Duration_j$	0.008**	0.004*	0.005**	0.004*	0.005**	0.004*
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$Multisite_j$	0.136***	0.065+	0.131***	0.054	0.113***	0.050
	(0.040)	(0.040)	(0.040)	(0.040)	(0.042)	(0.040)
$Log(Estimate_j)$	0.844***	0.895***	0.862***	0.891***	0.867***	0.889***
	(0.026)	(0.022)	(0.020)	(0.020)	(0.020)	(0.020)
$Intercept_{ijt}$	-0.134	-0.246	-0.648	-0.414	-1.402	1.449
	(2.931)	(2.986)	(3.259)	(2.935)	(3.377)	(3.072)
ρ			-0.782	-0.772	-0.796	-0.820
P-value indep. test (ρ=0)			0.000	0.013	0.000	0.001
$Pool\_FE$	Yes	Yes	Yes	Yes	Yes	Yes
$Employee\_FE$	No	Yes	No	Yes	No	Yes
N	530	530	530	530	477	477
$R2$	0.90	0.94				

+ $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; robust standard errors in parentheses
θ Regressions on sufficient received offers only

Table 7: **Posted bids and selection's effect: the two-step Heckman method**

	Model 17 Heckman $RelativeBid_{ijt}$	Model 18 Heckman $RelativeBid_{ijt}$	Model 19 Heckman $RelativeBid_{ijt}$ θ	Model 20 Heckman $RelativeBid_{ijt}$ θ
$RateInsufficient_{it}$	-0.074	-0.052	0.010	0.098
	(0.133)	(0.102)	(0.168)	(0.130)
$NoResponseRate_{it}$	0.159	0.045	0.181	0.091
	(0.151)	(0.106)	(0.153)	(0.113)
$MarketShare_{it}$	-0.065	-0.198	-0.054	-0.125
	(0.294)	(0.230)	(0.300)	(0.246)
$Small_{ij}$	0.017	0.027	0.019	0.033
	(0.037)	(0.029)	(0.040)	(0.032)
$Employee_i$	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
$Code_{jt}$	-0.047	-0.019	-0.005	0.049
	(0.086)	(0.083)	(0.092)	(0.094)
SBA_{jt}	-0.092	-0.019	-0.128	0.021
	(0.093)	(0.100)	(0.099)	(0.110)
$Time_{jt}$	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
$NbCandidates_j$	-0.039+	-0.013	-0.020	0.035
	(0.027)	(0.034)	(0.031)	(0.039)
$Duration_j$	-0.005**	-0.001	-0.005**	-0.001
	(0.002)	(0.003)	(0.002)	(0.003)
$Multisite_j$	0.102*	0.025	0.086+	0.026
	(0.056)	(0.055)	(0.059)	(0.056)
$Intercept_{ijt}$	-1.185	-0.688	-2.346	1.482
	(3.980)	(3.955)	(4.256)	(4.443)
$Lambda$	-0.427	-0.260+	-0.401	-0.310*
	(0.307)	(0.166)	(0.311)	(0.175)
$Pool\_FE$	Yes	Yes	Yes	Yes
$Employee\_FE$	No	Yes	No	Yes
N	530	530	477	477

+ $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
θ Regressions on sufficient received offers only

Table 8: **Posted bids and selection's effect: are the results driven by extreme values?**

	Model 21 Ols $RelativeBid_{ijt}$	Model 22 Ols $RelativeBid_{ijt}$	Model 23 Heckman $RelativeBid_{ijt}$ θ	Model 24 Heckman $RelativeBid_{ijt}$ θ
$RateInsufficient_{it}$	-0.107*	-0.104+	-0.076	-0.084
	(0.064)	(0.070)	(0.070)	(0.067)
$NoResponseRate_{it}$	-0.010	-0.053	0.051	-0.009
	(0.062)	(0.056)	(0.064)	(0.052)
$MarketShare_{it}$	-0.092	-0.139	-0.134	-0.157
	(0.195)	(0.161)	(0.178)	(0.147)
$Small_{ij}$	-0.025	-0.008	-0.019	-0.003
	(0.023)	(0.023)	(0.024)	(0.021)
$Employee_i$	0.000	0.000*	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
$Code_{jt}$	0.063	0.041	0.053	0.035
	(0.053)	(0.068)	(0.055)	(0.062)
SBA_{jt}	0.069	0.010	0.062	0.004
	(0.071)	(0.078)	(0.071)	(0.070)
$Time_{jt}$	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
$NbCandidates_j$	-0.008	-0.011	-0.009	-0.011
	(0.020)	(0.027)	(0.020)	(0.024)
$Duration_j$	-0.003*	-0.002	-0.004**	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)
$Multisite_j$	0.082**	0.057	0.079***	0.055
	(0.032)	(0.042)	(0.031)	(0.038)
$Intercept_{ijt}$	3.724	-0.420	3.348	-0.461
	(2.748)	(3.158)	(2.845)	(2.856)
ρ			-0.601	-0.460
P-value indep. test (ρ=0)			0.000	0.020
$Pool\_FE$	Yes	Yes	Yes	Yes
$Employee\_FE$	No	Yes	No	Yes
N	522	522	522	522
$R2$	0.14	0.42		

+ $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; robust standard errors in parentheses
θ Regressions on sufficient received offers only

Table 9: **Replacing the variable $NbCandidates$ by the variable $NbOffers$**

	Model 25 Heckman $RelativeBid_{ijt}$	Model 26 Heckman $RelativeBid_{ijt}$	Model 27 Heckman $RelativeBid_{ijt}$ θ	Model 28 Heckman $RelativeBid_{ijt}$ θ
$RateInsufficient_{it}$	-0.132*	-0.027	-0.066	0.120
	(0.072)	(0.099)	(0.091)	(0.123)
$NoResponseRate_{it}$	0.053	0.091	0.090	0.146
	(0.088)	(0.107)	(0.093)	(0.122)
$MarketShare_{it}$	-0.011	-0.287	-0.014	-0.241
	(0.226)	(0.233)	(0.239)	(0.242)
$Small_{ij}$	0.006	0.025	0.008	0.035
	(0.030)	(0.033)	(0.032)	(0.039)
$Employee_i$	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
$Code_{jt}$	-0.029	-0.031	0.001	0.043
	(0.068)	(0.083)	(0.075)	(0.091)
SBA_{jt}	-0.062	-0.022	-0.109	-0.004
	-0.062	-0.022	-0.109	-0.004
$Time_{jt}$	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
$NbOffers_j$	-0.022	-0.010	0.006	0.019
	(0.019)	(0.020)	(0.022)	(0.021)
$Duration_j$	-0.005**	-0.002	-0.005*	-0.001
	(0.003)	(0.002)	(0.003)	(0.002)
$Multisite_j$	0.103**	0.007	0.088*	0.008
	(0.048)	(0.053)	(0.051)	(0.061)
$Intercept_{ijt}$	1.247***	1.006***	1.158***	1.032***
	(0.148)	(0.248)	(0.155)	(0.267)
ρ	-0.306	-0.832	-0.322	-0.890
P-value indep. test (ρ=0)	0.0221	0.0517	0.0346	0.0395
$Pool\_FE$	Yes	Yes	Yes	Yes
$Employee\_FE$	No	Yes	No	Yes
N	530	530	477	477

+ $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; robust standard errors in parentheses
θ Regressions on sufficient received offers only