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Contract Enforcement and Discretion: An Application to Public Procurement

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Foreword

This Ph.D. dissertation, entitled "Contract Enforcement and Discretion: An Application to Public Procurement", brings together four essays in the field of public procurement. Each essay corresponds to one chapter. The links between those different chapters and the underlying logic of the whole dissertation is explained in the General Introduction in which we also provide a review of the related literature and we define the questions of research we address. Nevertheless, since each chapter corresponds to an independent essay, chapters can be read separately. This implies the presence of redundant information across chapters.

Abstract

This Ph.D. dissertation proposes four empirical contributions to explore two fundamental issues in public procurement: contract enforcement and public buyers' discretionary power.

The traditional economic literature has long supported the strict regulation of public procurement, which relied on the selection of the lowest bid, to reduce the market manipulation. However, this approach needs to be re-evaluated by taking into account its global impact on public procurement efficiency. Indeed, more recent works show that contract enforcement issues as well as contractual incompleteness are frequent. In this situation, the lowest bid can correspond to a strategic offer that anticipates the possibility to extract some rents at the contract execution stage: this strategic behaviour can rely on a reduction of the provided quality and/or a renegotiation of the initial agreement. The first part of this dissertation highlights the difficulties associated with contract enforcement. The second part explores if the performance of public procurement can be enhanced when public buyers are granted more discretionary power.

We first consider a baseline institutional environment that corresponds to European public buyers' most frequent situation: the contract has to be awarded

using an open call for tenders. Consequently, contract enforcement is the only way to align parties' interests at the execution stage. In spite of the presence of penalty clauses in public contracts, we show that quality issues are pervasive. We attribute them to the non-verifiability of firms' efforts in chapter 1 and to contractual incompleteness in chapter 2. In this latter case, we shed some light on a solution the buyer can implement. However, this remedy is only appropriated in specific situations.

We then deviate from the baseline institutional environment in order to study a situation in which the public buyer's discretionary margin increases: the open call for tender is no more required. In chapters 3 and 4, we successively analyse the potential benefits of negotiated procedures and restricted auctions. Both tools increase the public buyer's discretion at the awarding stage. We find that they improve procurement efficiency.

Keywords: Public procurement, Auctions, Negotiation, Enforcement, Quality, Renegotiation, Discretion, Efficiency.

Résumé

Cette thèse apporte une contribution empirique à deux problèmes auxquels est confrontée la commande publique: l'insuffisante mise en oeuvre des contrats et le choix d'augmenter ou non les marges discrétionnaires des autorités publiques dans les procédures d'attribution.

L'approche économique traditionnelle et la régulation se sont employées à définir des modes d'attribution des marchés au 'moins-disant', dans lesquels les risques de manipulation sont supposés limités. Cette approche doit cependant être questionnée à l'aune de son impact global sur l'efficacité de la commande publique. En effet, plusieurs travaux récents montrent que, fréquemment, les contrats ne sont pas rigoureusement mis en oeuvre ou sont incomplets. Dans une telle situation, l'offre moins-disante, *ex ante*, peut constituer une réponse stratégique qui intègre la possibilité d'extraire des rentes *ex post*, *via* une qualité inférieure à celle promise et/ou une renégociation de l'accord initial. Une première partie de cette thèse met en lumière les difficultés liées à la mise en oeuvre des contrats, alors qu'une deuxième partie s'intéresse aux solutions que peut apporter un pouvoir discrétionnaire accru.

Ainsi, nous nous plaçons d'abord dans le cadre réglementaire de référence, *i.e.*

tel qu'il se présente le plus souvent aux acheteurs publics européens : l'appel d'offres ouvert est obligatoire et seule une mise en oeuvre rigoureuse du contrat peut aligner *ex post* les intérêts des parties. Malgré l'existence de clauses incitatives, nous montrons que les problèmes de qualité sont persistants. Nous avançons plusieurs raisons à cette persistance: la non-vérifiabilité des efforts (chapitre 1) et l'incomplétude contractuelle (chapitre 2). Dans ce deuxième cas, nous montrons que des solutions peuvent être élaborées. Néanmoins, elles ne sont adaptées qu'à des cas spécifiques.

Nous nous écartons ensuite du cadre de référence pour étudier une situation où les marges de manoeuvre de la partie publique augmentent: elle n'est plus soumise à l'obligation d'utiliser un appel d'offres ouvert. Les chapitres 3 et 4 analysent successivement l'intérêt des procédures négociées et des enchères restreintes qui, toutes deux, augmentent le pouvoir discrétionnaire de l'acheteur. Nous interprétons la capacité de l'une et de l'autre à améliorer l'efficience de la passation comme le signe qu'une plus grande liberté dans l'attribution des contrats peut constituer un outil pertinent d'optimisation de l'achat public.

Mots clés: Marchés publics, Enchères, Négociation, Enforcement, Qualité, Renégociation, Discrétion, Efficacité.

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General Introduction

Public procurement refers to the public authorities' activity of purchasing goods, works and services. As it accounts for 10% to 25% of countries' GDP[1], this activity determines a significant part of public funds use and influences a substantial share of world trade flows. To limit the risk of market manipulation from public buyers (through corruption) and firms (through collusion) and thus to guarantee an efficient allocation of public spending, public purchasing is required to comply with some regulatory rules. In Europe, for instance, public procurement regulation is defined by the 2004/18/EC Directive [European Commission, 2004].

Although theoretical research papers and regulation are full of recommendations, the organization of such markets still seems to remain an open question and, foremost, an empirical one: looking at the differences of public purchasing organization across countries and periods of time leads to puzzling observations. First, there are huge gaps between American rules and European rules. For instance, favouring small and medium firms or taking into account firms' reputation when awarding contracts which is allowed in the United States. It is however against European principles [European Commission, 2004] that first aim at strictly ensuring the equal treatment of candidates [Spagnolo, 2012]. Second, the evolution of

[1]See page: http://ec.europa.eu/trade/policy/accessing-markets/public-procurement/.

European rules and discussions regarding their foundations are frequent. It can reflect the fact that regulators do not have a stable view on the best way to organize such markets [European Commission, 2011b]. For instance, the possibility to negotiate offers was limited in the 2004/18/EC Directive whereas the current reform proposal suggests to widen their use. Finally, even when considering a restricted geographical area at a given period of time, we see disparities. Indeed, the transposition of European directives into national levels brings into light that close public authorities have diverging beliefs on how to organize public purchasing (OECD [2010], Dimitri et al. [2011]): some auctioneers are prone to use open competitive procedures, while others favour negotiated procedures or restricted auctions.

The above variations constitute a rich material to analyse. But they also point out how paradoxical are the issues that regulators, practitioners and, last but not least, researchers have to address when studying public procurement. In particular, it appears that there is no consensual solution to optimize the governance of public contracts.

We can still distinguish two main approaches in the economic literature. A 'traditional' approach which focuses on the design of procurement rules that enable to obtain the lowest price, and to reduce the risk of market manipulation [McCubbins et al., 1987]. However, some criticisms of the 'lowest price paradigm' have progressively emerged. Indeed, some recent works underline the importance of *ex post* dimensions (*i.e.*, the delivered quality or the costs of renegotiation) to achieve an efficient contract governance [Bajari and Tadelis, 2001; Spagnolo, 2012]. In this respect, we can distinguish a second approach. It highlights that improving contract enforcement or even allocating some discretionary power to the buyer at the awarding stage would be highly beneficial. While the former solution is always possible but hard to make operational, the latter is suspected to increase the risk of market manipulation and thus, is drastically limited by the European regulation.

In this dissertation, we aim at discussing from an empirical perspective the relevance of the solutions suggested by the second approach. When using an open competitive procedure, what are the determinants and the magnitude of contract enforcement issues? To what extend can they be addressed by the public authority? Should the regulation finally allow the public buyers to adapt the procedure to the transaction they manage? What is the effect of the resulting increase in discretionary margins? Before presenting our contributions on these subjects, we introduce below the main debates surrounding both approaches.

The traditional approach

For a long time, regulators and economists seemed to agree on the necessity to emphasize two dimensions of the purchasing process: competition and transparency. After the seminal article of Demsetz [1968] demonstrating the benefits of competition for the field to supply public services, most of the economic propositions related to procurement comes from the auction theory literature [Chong et al., 2013b]. The central question is then about remedies to deal with asymmetric information among strategic agents. In this regard, open auction is identified as the best method to award contracts [Bulow and Klemperer, 1996]. On the one side, competitive incentives incite firms to post their best offers so as to increase their winning probability. On the other side, the auctioneers' leeways are limited to the needs definition and the winner's selection. Consequently, the transaction may not be significantly affected by their personal ability, expertise and/or interest.[2] In the end, open auctions appear as a transparent procedure that enables to elicit information about bidders' private information. Since the open auction is the most frequently used awarding tool at the European level, theoretical recommendations from economists seem to be in line with regulators' and practitioners' view. Indeed, around 73% of European public procurement contracts were awarded though

[2]At least, the transaction is less affected by the auctioneer's identity when using an open auction rather than a restricted auction. In the latter situation, the auctioneer decides who are the firms that are invited to post an offer. This choice may highly rely on the auctioneer's personal beliefs and expertise.

an open call for tender between 2006 and 2010 [European Commission, 2011a].

Up to now, numerous quantitative studies have examined whether awarding public contracts through competitive mechanisms allows to achieve cost reductions. Most of these studies rely on a cross-sectional approach in order to compare costs of in-house public management on the one hand and costs of private management when contracts are awarded through a competitive tendering on the other hand. In their overwhelming majority, those studies conclude that the competitive process achieves reduction in government expenditures.[3]

Nevertheless, studies which underline the cost savings associated with competition for the market have been subject to criticisms. In line with the auction theory literature, those works point out the benefits of open auctions by focusing on the *ex ante* phase of the awarding process. Consequently, open competition is demonstrated as being desirable in situations where contracts are assumed to be complete and automatically enforced at zero costs. However, as Spagnolo [2012] stated, "*for a number of different reasons, from poor/costly contract enforcement to the complexity of many goods and services, court enforced contracts are often not sufficient to achieve an effective governance of the exchange*". Thus, focusing efforts on the provision of *ex ante* incentives to award public contracts may not guaranty their proper execution. First, if contracts are not enforced because of corruption issues or because enforcement costs are prohibitively high, firms are likely to anticipate this difficulty: they can post aggressive bids and then shirk on quality or renegotiate their promises [Guasch, 2004; Guasch and Straub, 2006; Iimi, 2013]. Second, in the case of complex transactions, the formal contract does not necessarily contain the entire set of relevant dimensions: some qualitative aspects of the exchange can be hardly contractible and consequently, impossible to enforce through formal mechanisms [Goldberg, 1976; Williamson, 1976]. This may also lead to strategic anticipations from the bidders [Bajari et al., 2013]. In the

[3]See, for instance, a meta-analysis conducted by the Australian Industry Commission [1996] on 203 different international studies.

end, there is growing evidence that *ex ante* asymmetries of information would be a smaller concern than enforcement and contractual incompleteness issues. With regard to such information, more recent approaches emphasize the necessity to reduce enforcement costs or even to allocate more discretionary power to the public buyers.

'Recent' approaches: A focus on contract enforcement and discretion

When not only taking into acount contract price but also quality of the provision or renegotiation costs, competitive incentives may be insufficient (or inappropriate) to achieve an effective contract governance. Depending on the type of awarded contract, the literature suggests two different types of solutions. First, if contract performance is measurable, the public buyers should have interest in enhancing the provision of formal/contractual incentives. Second, if performance measures are difficult/impossible to elaborate, increasing the discretionary margins of the public buyer at the awarding stage may improve contract governance. On the one side, the former solution is always legally possible but would be challenging to make operational. On the other side, to keep public buyers accountable, the regulation of public procurement deliberately restricts their discretionary margins and therefore, their ability to implement the latter solution. We develop below the main debates surrounding both strategies.

Contract enforcement issues

The provision of contractual incentives relies on a classical result from the agency theory [Jensen and Meckling, 1976]. When a public authority (principal) delegates a task or a service to a private operator (agent), the latter has some informational advantages he can use to maximize his own interest (through opportunistic behaviours) at the expense of the former. The public authority is thus exposed to classical risks of adverse selection and moral hazard: the private op-

erator can pretend to have low costs and/or provide low level of service quality. To address this opportunism, the public authority can rely on behaviour-based contracts or on outcome-based contracts, *i.e.* to control the agent's behaviour or to align the agent's remuneration with its performances. In line with such propositions, most of the public contracts include penalty clauses. However, available information indicate that they are not often used, even when important damages occur [Spagnolo, 2012]. This paradox would be related to the costs associated with contract enforcement. In particular, there is evidence that the quality of judicial institutions [Coviello et al., 2013b] as well as the administrative burden of the sanctioning process [Girth, 2012] determine public buyers' propensity to apply penalty clauses. Such actions are also suspected to be likely to damage the relationships between partners [Macaulay, 1963], explaining why public managers can be reluctant to harshly punish their service providers. However,due to a lack of appropriate data on the determinants of quality provision in procurement, there is no clear understanding on how public buyers can properly incentivize firms in a highly regulatory environment.

Discretion in public procurement

As an additional difficulty, providing contractual incentives is possible only if the transaction is highly contractible. When dealing with 'complex' transactions, many dimensions of the exchange may be hard to describe or to anticipate [Goldberg, 1976; Williamson, 1976]. Writing a complete contract may then be impossible or would require to engage prohibitively high transaction costs. Consequently, if the auctioneers do not achieve to properly describe their expectations, the formal agreement is incomplete and do not allow to perfectly align parties' interests through formal mechanisms. The risk is to select the bidder who is most aware of the contractual blanks [Bajari et al., 2013] and will then shirk on quality or renegotiate the agreement.

There are some theoretical approaches that deal with contractual incom-

pleteness in a procurement setting. They can be summed up as emphasizing the benefits of alternative procurement tools. On the one side, negotiated procedures would allow to discuss the technical but also the financial aspects of the offers in order to make sure that the offers cover the needs and that the needs are correctly defined: the negotiation phase is likely to reduce contractual incompleteness [Bajari and Tadelis, 2001; Bajari et al., 2013]. On the other side, restricted auctions, that consist in inviting a limited number of bidders can, in theory, address the issue of non-contractible dimensions thanks to reputational incentives [Kim, 1998; Doni, 2006; Calzolari and Spagnolo, 2009]. During the execution of the contract, the public manager can indeed collect some hard to measure/verify information on the supplier's ability, efforts or performance. This information can be called the reputation of the firm. When using a restricted auction, the public manager can use the reputation of the firm as a mechanism to discriminate between candidates at the invitation stage. In this way, the threat of not being invited to bid in future tendering processes incites suppliers to preserve a good reputation and thus, not to shirk on quality. This may be especially beneficial to repeated interactions when the quality is hard to contractualize.

However, these alternative procurement tools increase the public buyers' discretionary power, and therefore facilitate corruption. Indeed, as soon as the exchange relies on unverifiable dimensions (the 'quality' of the negotiation, the 'reputation' of the firm), the auctioneers' decisions can no more be verified by a third party: they have some discretionary power. They may be tempted to use it to divert public purchasing from its initial purpose by promoting their own interests: discretion allows room for abuses such as corruption or favouritism. Some works have emphasized the threat of corruption in public contracts when the managers have some discretionary power at the awarding stage [Burguet and Che, 2004; Ohashi, 2009]. Nevertheless, such type of illegal behaviours are suspected to be less frequent if discretion is compensated by an increase in transparency [Amaral et al., 2009]. Moreover, rigid procedures do not necessarily prevent from abuses in

discretion [Bandiera et al., 2009]. Finally, the potential benefits of restricted auctions and negotiations still have to be assessed: whether public buyers are prone to use their additional leeways to improve procurement efficiency or to serve their personal interests remains an unanswered question.

Research gaps

In the end, the traditional economic recommendations and the European regulation encourage the use of open auctions to award public contracts. Numerous quantitative studies have demonstrated that this strategy allows to achieve cost savings. However, when taking into account the execution of the contract (*i.e.* the quality of the provided goods/ services or the costs of renegotiations) some recent works tend to indicate that open auctions would frequently result in sub-optimal outcomes. Indeed, poorly enforced and/or incomplete contracts leave to firms some leeways to extract rents and reduce procurement efficiency. Because empirical evidence is still very sparse, the magnitude of such side effects as well as their determinants are not fully understood. In addition, whether the regulation of public procurement should encourage public buyers to use some discretionary margins in the procurement process does not give rise to consensual answers.

Aim of the dissertation

The aim of this dissertation is to give some empirical insights about contract enforcement issues and discretion in a public procurement setting. Thanks to data about the procurement practices of an important French public buyer, we tried to contribute to fill research gaps in two directions. In the first part of this dissertation, we consider quality issues in a highly regulated environment that constrains the public buyer to use an open call for tenders. Since the European directives widely encourage the use of such procedure, this can be considered as a baseline institutional framework. We analyse the determinants of quality issues and the

extent to which public managers can deal with them. In this first part, the difficulties associated with contract enforcement are pervasive: the formal incentives do not always permit to align parties' interests. Therefore, in line with previous theoretical propositions, we aim at testing whether limiting the discretionary margins of the public buyer at the awarding stage is an obstacle to reach procurement efficiency. Thus, in a second part of this dissertation, we go one step further by considering a less regulated environment, in which public buyers are no more required to use an open call for tenders. We successively analyse the determinants and the consequences of alternative strategies: the use of a negotiation phase after an open call for tender and the use of restricted auctions. Both tend to increase the discretionary of the public buyer and our results indicate that this may be beneficial regarding procurement efficiency.

Data

All the chapters of this dissertation have a strong empirical component. The procurement data comes from Paris Habitat-OPH, a French local public buyer that operates in the construction and management of social housing in Paris. It is the first social landlord in Europe and it awards close to 500 contracts per year. These contracts are related to work, service and furniture transactions. During the realization of this dissertation, we had access to internal data that had never been used. We automatically have used the possibility to complete this information using documents from the archives of Paris Habitat-OPH.

More precisely, the efforts of Paris Habitat-OPH to build and collect quality indicators in two different sectors offer the unique opportunity to look at the dynamic of quality provision in a public procurement setting. It is a cornerstone aspect of the first part of this dissertation.

In addition, Paris Habitat-OPH has an internal database on the awarding phases, the contract prices and the renegotiated amounts. This systematic data

collection coupled with its decision to experiment the use of negotiated procedures in one sector and restricted auctions in another, allows to assess the benefits of such procurement tools in a second part of this dissertation .

Finally, the data employed in this dissertation has some considerable benefits. First, it allows a pioneer assessment of procurement efficiency in France. Second, it deals with four different sectors. Third, it covers several years of procurement activities. Fourth, it does not only include information about contract prices, but also about the quality of the offers, the amount renegotiated and/or the delivered quality. Thus, the data permits an over year analysis of different procurement activities through the lens of their financial but also qualitative aspects.

Presentation of the chapters

The first part of this dissertation is divided in two chapters. Both analyze quality issues in a highly regulated procurement environment: the contract has to be awarded using an open call for tenders and public buyers can only incentivize firms by applying penalties.

The first chapter considers a situation in which the public buyer is not only required to comply with strict procurement rules, but also to implement a national safety regulation. Contracts are complete to the extend that performances can be objectively measured. Additionally, they are associated with penalty schemes. Quality issues still persist and even dramatically increased after the implementation of the national safety regulation. Since this safety regulation not only cost 7 billions euros for French landlords but also aimed at improving one dimension of the service quality (here, the safety of 'old' French elevators), the deterioration of two other indicators of service quality (the number of breakdowns and the downtime) is seemingly puzzling. The aim of this chapter is to make propositions on the potential drivers of such degradation. As a result of the law, we show that firms' optimizing behaviours generated direct side effects on the service quality of

elevators that were targeted by the law, but also indirect side effects on those that were not intended to be affected. This can be related to a large literature started with the seminal paper of Peltzman [1975] that shows how behavioural responses of agents to regulation can generate unintended consequences. We also discuss the extent to which public procurement rules may have contributed to prevent the quality deterioration. Here, a non-verifiability issue can explain the public buyer's reluctance to strictly enforce penalty clauses: since the relationship between firms' efforts and performances is especially unclear, the legitimacy of penalties may be hard to prove in court. To sum up, we study a situation in which a public buyer is required to comply with two strict regulations, while coping with difficulties to use contractual incentives.

The second chapter analyses whether and how a public buyer can improve contractual incentives. In the sector we study (the cleaning activity), contracts include performance measures and penalty schemes. Once again, quality issues are still pervasive. To address it, the public buyer introduced some contractual innovations: the awarded contracts are more detailed. We interpret it as an increase of contractual completeness. This chapter aims at studying the relationship between contractual completeness and quality enforcement. This approach is line with a theoretical literature that examines situations in which quality enforcement is endogenously determined by the *ex ante* contracting process [Kvaloy and Olsen, 2009]. Our findings support the idea that bearing the cost of improving contractual completeness is a beneficial strategy. Since the threat of punishment becomes more credible, the need to monitor contracts on a regular basis decreases. Moreover, the resulting quality improvements are durable.

In the end, the first part of this dissertation underlines the difficulties associated with the provision of contractual incentives. We derive some solutions to address those difficulties in the second chapter. However, suggestions are limited to specific cases. Indeed, contrary to the elevators maintenance or the cleaning activity, each building construction, for instance, entails single-use contracts.

Since improving contractual completeness might be highly costly, the public buyer may have no interest in repeatedly bearing such investment. Consequently, other quality enforcement tools seem to be needed. In line with propositions from the literature, the second part of the dissertation analyses whether allocating more discretionary power to the public buyer can help in achieving a more efficient contract governance. Both chapters analyse situations in which the public buyer has some leeways to award unique goods or services, *i.e.* goods or services that are custom made to fit specific needs.

The third chapter aims at assessing the impact of some negotiated procedures on procurement efficiency. The transposition of the 2004/18/EC Directive at the national level allowed French public buyers to award work contracts either through an open call for tenders or through an open call for tenders completed by a negotiation phase. If the reform proposal of the 2004/18/EC Directive is adopted, this possibility should be explicitly offered to all the European public buyers. While, according to the European Commission, this procedure should allow public buyers to get a 'better match between their desired procurement outcome and solutions offered by the market' as well as a decreased probability of collusive practices between bidders, some drawbacks are still highlighted [European Commission, 2011c]. In particular, this procedure may increase the risk of favoritism and corruption and is thought of being 'less efficient in generating savings than the open and restricted procedures' [European Commission, 2011c]. These pro-auction and pro-negotiation arguments from the European Commission reflect the still open debate in the economic literature concerning their relative efficiency. We compare the impact of open auctions and negotiated procedures on some criteria of procurement efficiency: the amounts of the received bids, the amount of the winning bid, the total costs of the contract and the probability of renegotiating the contract. After addressing some endogeneity issue, we are able to give strong evidence that negotiated procedures would be an efficient modernizing tool of public purchasing. Some drivers of the positive effects we observe are

highlighted, enabling us to derive practical implications of these results for public policies.

Finally, the fourth chapter focuses on a situation in which competitive incentives are deliberately reduced by the public buyer when tendering small simple contracts: they are awarded through restricted auctions. Although the literature on public procurement shows that less competitive awarding procedures can be efficient when tendering complex contracts, no argument can be found to explain why a buyer would restrict competition for small contracts. We still find evidence that such a strategy is not anecdotal: according to an OECD report [OECD, 2010], restricted auctions are frequently used to award 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 degree of competition. In particular, we empirically study what determines the probability that a given firm is invited in a given call for tenders and we assess the impact of the invitation process on the final bids received by the buyer. We first find that 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. These unobservable are typically related to the discretionary margins of the auctioneer. As a second result, we find that the selection on unobservables permits to increase the competitiveness of the received bids. In general, we find that discretion in restricted auctions is used to preserve a high level of competition between the 'happy few' firms selected to post bids.

Table 1: Summary of part I (Research questions, methodology and main results)

Chapter	Methodology and Data	Main results
• **Chapter 1.** The Direct and Indirect Effect of Safety Regulation on Quality: a Cautionary Tale from the French "Robien Law". • **Research Questions.** How to explain the side effects of a safety regulation on service quality?	• Data on the monthly number of downwards and downtime experienced by each elevator of Paris Habitat-OPH from 2004 to 2013. • Distinction between 'old' elevators that were intended to be affected by the regulation and 'new' elevators that were not intended to be affected by the regulation. • Econometric analysis: difference-in-difference, spatial econometrics.	• The safety regulation reduces the service quality of 'old' elevators. • A spillover effect also deteriorates the service quality of 'new' elevators. • Behavioral responses of agents to regulation can generate unintended side effects. • Upgrading an infrastructure can generate side effects on its maintenance. • The non-verifiability of firms' efforts do not allow a strict contract enforcement.
• **Chapter 2.** *Ex Ante* Contracting and *Ex Post* Enforcement: An Empirical Analysis of Public Procurement Contracts. • **Research Question.** To what extent does the *ex ante* contracting process determine the *ex post* quality enforcement?	• Database of 102 cleaning contracts. • Contracts are on-going between July 2008 and June 2012. • Information on the monthly level of quality reached on each lot. • The contracts that are awarded after April 2010 are more complete. • Information on buyer's effort toward contract enforcement (penalties, controls). • Econometric analysis: Before/after, fixed-effect regressions, Heckman models.	• The decision to reduce contractual incompleteness has been triggered by a decision of the administrative court of Paris. • Reducing contractual incompleteness significantly improves quality enforcement. • After the reduction of contractual incompleteness, less resources have to be dedicated to monitor the transaction during its execution. • The quality increase is not associated with a price increase.

Table 2: Summary of part II (Research questions, methodology and main results)

Chapter	Methodology (and Data)	Main results
• **Chapter 3.** Discretion and Efficiency in Public Procurement: Evidence from France. • **Research Questions.** Is it beneficial to complete the open call for tender with a negotiation phase?	• Database using information on 427 public-work contracts tendered by Paris Habitat-OPH. • 65% of the contracts are procured using a negotiation phase • Information on contract prices and the value of renegotiation • Econometric analysis: instrumental variables	• The use of a negotiation phase significantly decreases the amounts of the received bids by close to 26%. • It also reduces the probability of renegotiating the contract. • If anything, similar decreases in price are found when analyzing the total cost of the contract
• **Chapter 4.** The Law of Small Numbers: Investigating the Benefits of Restricted Auctions for Public Procurement. • **Research Question.** Why do public authorities restrict competition when tendering small contracts?	• Data set containing 180 service contracts, awarded via restricted auction between 2006 and 2009. • Information on the characteristics on pre-qualified firms. • We know the identity of invited bidders and the value of their offer. • Econometric analysis: Heckman model.	• Restricted auctions may enable savings to be made on *ex ante* transaction costs while maintaining a high degree of competition. • The public buyer uses restricted auctions to share its contracts among firms of good repute. • The unobservable characteristics of invited bidders are associated with more competitive bids.

Part I

Contract enforcement issues

Chapter 1

The Direct and Indirect Effect of Safety Regulation on Service Quality: a Cautionary Tale from the French "Robien Law"*

1 Introduction

The 'Robien law', enacted in July 2003, aimed at reducing fatal and serious accidents in the French elevators sector by imposing safety standards on elevators built before 2001 (the 'old' elevators, thereafter). As a consequence, for an estimated amount of 7.3 billion euros a large part of French elevators had to be modernized in order to meet the specified technical and safety standards.[4] Although an actual evaluation of the law effects on elevator related injuries was never conducted, there are some indications confirming that the law indeed fulfilled its intended purpose and reduced serious accidents.

*This chapter is based on a joint work with Michael Klien. The authors are grateful to Giancarlo Spagnolo for helpful comments.

[4]The first step of modernization was supposed to be completed before July 2008, but it was finally postponed to December 2010 because of delays in the implementation of the law. According the a report made by the municipality of Paris, the law started to be seriously implemented around 2008 [Marie de Paris, 2010].

However, a seemingly paradoxical side-effect occurred since the adoption of the law: the number of elevator breakdowns as well as the downtime of broken elevators, two important indicators of service quality, increased considerably. Ripple effects of this development can be seen in deteriorating tenant satisfaction surveys, press articles about elevators being out-of-service more often than not and even a public inquiry into the experienced 'difficulties' in the elevator sector.[5] This side-effect of the law on service quality is the central topic of this paper.

We argue that the modernization triggered a technological shock because elevators had to become more sensitive for safety reasons, eventually resulting in more frequent breakdowns. Coupled with an inelastic supply of labour in the short run, the higher sensitivity led to an steep hike in breakdowns and downtime. This adverse side-effect of the law is, however, not limited to the service quality of old elevators. As can be seen in the raw data, also the failure rate of elevators constructed from 2001 ('new' elevators, thereafter), therefore *a priori* not affected by the law, surged to unprecedented levels in the wake of the law. The key to understand this secondary effect lies in the firms reaction to the technological shock. With non-linear penalty schemes in place, firms had an incentive to shift maintenance capacity to achieve a balanced failure rate between old and new elevators. Since only old elevators were the designated aim of the law, we interpret this indirect effect as a spillover or general equilibrium effect *a la* Harberger [1962].

To examine the effect of the Robien law on elevator service quality empirically we use an original database from a public housing agency in Paris, which delegates the construction and the maintenance of its elevators to private operators. For each of the more than 3500 elevators, we know the monthly number of breakdowns and downtime between January 2004 and May 2013. Moreover, our data provides information about the construction year of the elevator, allowing us to distinguish old elevators from new elevators and, to use the latter as a control group. The results from a Difference-In-Difference (DID, thereafter) strategy

[5]See, e.g., Marie de Paris [2010],Press Conference [2008].

suggest that the modernization significantly increased both the number of breakdowns and the downtime of old elevators. However, since we suspect that firms re-allocated maintenance capacity in favour of old elevators, our control group might also have been affected by the modernization, leading to an underestimation of the impact of the law. We provide evidence for spillovers from old to new elevators by exploiting the geographical organization of lift maintenance.

Our results show that modernizing existing infrastructures can have important and non-negligible side effects on service quality. This relates to a large literature in the tradition of the seminal paper of Peltzman [1975] that shows how behavioural responses of agents to regulation can generate unintended side effects (see, *e.g.*, Viscusi [1985]; Adda and Cornaglia [2006]). The insights from this literature are highly relevant also for current policy discussions as it helps to anticipate agents' reactions to changes in regulation (see, *e.g.*, Anderson and Matsa [2011]). In addition to focusing on the regulated perimeter, we show that service quality is affected also for elevators not targeted by the law. This spillover is in accordance with the general equilibrium effects in Harberger [1962], showing that behavioural reactions by agents make the final outcome of a regulation very hard to predict in practice. The case featured in this paper indeed shows that firms can react to regulation by reallocating their inputs between activities that are affected differently by the law. The spillover is therefore a natural consequence of the agent taking into account not only one but several, if not all activities, for an optimizing strategy.

On top of that, our paper contributes to the literature stressing the importance of maintenance in relation to investments in infrastructure. The fact that complementarities between infrastructure and maintenance are crucial has been addressed both in macro- as well in microeconomic research. Regarding the former, which is closely related to literature on the optimal mix of public spending, there is some reliable evidence that maintenance is a key factor for growth and development [Rioja, 2003; Kalaitzidakis and Kalyvitis, 2004, 2005; Devarajan et al.,

1996]. Kalaitzidakis and Kalyvitis [2005] even suggests that shifting public expenditure from capital outlays – classical infrastructure spending – to maintenance may have positive effects on growth.

In the microeconomic literature, Hart [2003] shows that coordinating the construction phase of an infrastructure project with the ensuing operation/maintenance phase is critical for the success of a project. In the same vein, this study represents one of the few micro studies on the subject, highlighting that the relationship between 're-investment' and maintenance is characterized by an important complementarity. From this perspective, the Robien law was insufficiently designed as it emphasized the modernization of the infrastructure and did not deal adequately with the additional needs for maintenance.

The paper is organized as follows. In section 2, we present the French elevator sector and the specifics of the Robien law. Section 3 is dedicated to the presentation of our data set and our empirical strategy to evaluate the direct impact of the law. In section 4, we investigate the existence of a spillover between modernized and non-modernized sectors. Our findings are discuss in section 5. Conclusions follow.

2 The French elevator sector

Not only in France but also at the European and international level, the market for elevators is dominated by four large multinational enterprises. The market shares of Kone, Otis, Schindler and ThyssenKrupp in Europe amounted to approximately 77% (by volume) in 2003 [European Commission, 2007]. In addition to the high market concentration, in 2007 these companies were fined a total of 992 million euros, a record figure at the time, by the European Commission for collusive practices in several countries between 1995 and 2005. While the firms have not been prosecuted for such practices in France, the market is still under the scrutiny from public authorities.

The four big firms are active in both construction and maintenance of elevators, while a larger number of small firms are active only on the maintenance market. The construction works are non-recurring events and involve either the installation of new elevators or the modernization of existing ones. In contrast, maintenance describes all obligations a supplier has to meet to ensure the continued functioning of an elevator. It involves not only corrective measures in the case of breakdowns but also preventive actions to ensure a smooth operation of the elevators.

Despite the potential for competition in the maintenance market, in reality it is limited because Kone, Otis, Schindler and ThyssenKrupp can source spare parts from their own production at lower prices that non-producing firms. Given that elevator servicing contracts typically demand replacement of materials, this represents an important competitive advantage. As a consequence, even if 'independent' smaller firms are active in the maintenance sector, they typically work as subcontractors for the four big enterprises.

Based on information from the public housing agency in Paris, the following observations regarding the contractual relationships can be made: elevators are bundled in geographical lots and these lots are awarded through auctions. The contracts typically bundle construction/modernization and maintenance, hence further favouring firms that have the capacity to both construct and maintain elevators. In most cases the contracts are long term (more than 5 years) and describe in a detailed way the technical standards that have to be met along with the permanent servicing requirements.

In order to incentivize firms to avoid breakdowns and deal with failures in a timely manner, the contracts include penalty clauses that are triggered if the monthly level of failures per elevator exceeds a contractually specified threshold. Although the occurrence of failures can be readily measured through an automated monitoring system, penalties do not appear to be applied systematically.

2.1 The Robien law

In the early 2000s, French elevators differed in two main respects from the rest of Europe. First, France had one of the oldest elevator structures in Europe, with a significant portion dating back to before World War II. Second, it had an particularly high rate of mortal/serious elevator related accidents [Marie de Paris, 2010].

In July 2003, after a renewed wave of serious and even fatal accidents, the federal government enacted the law *'urbanisme et habitat'*, also called the 'Robien law'.[6] It's main purpose was to reduce the number of elevator related accidents and it represents a crucial turning point for the elevator sector in France.

The law focused on upgrading the existing infrastructure through a modernization of all elevators built before 2001 and therefore did not live up to the requirements of the European Union directives guiding safety standards.[7] Most importantly, mechanisms had to be put in place to improve stopping accuracy of elevators in order to ensure that doors remain blocked unless the elevator arrives neatly at the floor. Inaccurate stopping that exceeds a threshold of 2cm or any forced opening or closing of the doors would henceforth lead to an emergency stop of the elevator, requiring service personnel to put the elevator back into operation. Business insiders report that these changes increased the sensitivity of elevators and led to more frequent emergency shut-downs.

The whole modernization process was intended to be implemented in three phases of five years each. Within each phase, a detailed list of measured had to be put in place by landlords, the most critical ones being required during the first phase. Regarding the first modernization phase, which we will focus on in the

[6]The former minister Gilles de Robien is considered as being the instigator of this law.

[7]For their implementation in the French law see: Décret numéro 2000-180 du 24 août 2000 relatif à la mise sur le marché des ascenseurs.

empirical analysis, it was initially provisioned to be completed until July 2008. As landlords were unable to implement the laws requirements until that date, however, it was finally deferred to December 2010.

With respect to the success of the law in terms of elevator safety, the European lift federation pronounced that the number of serious/mortal accidents dropped from around seven per year before the law to 3 in 2008, 0 in 2009 and 1 in 2010 [European Lift Association, 2013a]. Despite these improvements, France still had one of the highest number of overall accidents in Europe between 2008 and 2011 [European Lift Association, 2013b]. Therefore, the modernization, although apparently a success, did not solved all the problems of the *'French exception'*.

2.2 Side effects of the Robien law

Apart from the positive and expected effects of the law regarding serious accidents, at least two distinct types of adverse side-effects occurred with respect to service quality.[8] The first one is an effect of the law on the service quality for old elevators, *i.e.* those elevators targeted by the law. The second one refers to a spillover effect on the service quality for new elevators as firms reallocate maintenance capacity from new elevators to deal with the increased breakdowns by old elevators. Although the law was originally designed to affect old elevators only, the optimizing behaviour of the firms in response to the law leads to a change in the service quality of new elevators too.

The direct effect of the Robien law on maintenance quality

The law is poised to have affected the service quality of old elevators through two potential channels. First, modernization makes old elevators more sensitive,

[8] We define service quality as the availability of a functioning elevator. It can be proxied by the number of breakdowns and the downtime.

generating *ceteris paribus* an increase in the number of failures. We interpret the modernization as a technological shock that decreased the output per maintenance employee compared to before the implementation of the law.

Second, it was estimated that an additional 1500 workers would be needed to implement the law as expected. While aggregate statistics show that indeed firm hiring along with turnover increased during the implementation phase (see Figure 1.4 in the appendix), business insiders report that firms did not meet this target and shifted labour resources from maintenance to the more lucrative modernization works [Press Conference, 2008]. This shift occurred both in a qualitative and a quantitative way. On the one hand, firms had more workers on modernization. On the other hand, particularly high skilled workers were used for modernization works, leaving the less experienced ones on the maintenance part. In the end, the labour resources dedicated to maintenance became insufficient as a result of the law, decreasing the service quality.

The indirect effect of the Robien law on maintenance quality

In addition to the effect that the Robien law has had on the service quality for old elevators, this paper tries to make the point that the effects were reaching even further. Taking into account not only the elevators intended to be affected by the law, an additional effect materializes. The main driver of this effect lies in the optimizing behaviour of the firms, which have the possibility to shift staff between new and old elevators. Hence, instead of assuming that firms do not react, we postulate that as a result of the technological shock firms change the allocation of workers from new elevators to old elevators.

As mentioned previously, contracts include penalty clauses that are triggered if the number of breakdowns (or the downtime) exceeds a specified thresholds. Moreover, the penalties are progressive, which means that the marginal penalty is increasing with the number of failures. As a results of this non-linear penalty

scheme, situations with a very unbalanced failure distribution among elevators are likely suboptimal.

In the particular case of the Robien law which led to a surge in failures of old elevators, firms reacted by shifting maintenance capacity from new elevators to old elevators. The law, through the optimizing behavior of the firms, therefore generated a spillover effect from old to new elevators. Hence, the new elevators, not subject to the law, were nevertheless affected through the allocation of maintenance resources within the firms.

Given the regional nature of the maintenance activity, part of the shift may also be an automatic response from employees. They indeed have to address failures in a geographical perimeter, including both old and new elevators. Consequently, a maintenance employee simply deals with elevators failures according to chronological order of occurrence. For this reason, an increase in downtime of new elevators as a result of the law may be a mix of deliberate re-allocation of maintenance staff and also the organization of failure management.[9]

To sum up, we argue that the Robien law has generated two types of side effects with respect to maintenance quality. On the one hand, the law had a direct impact on the maintenance of old elevators by making them more sensitive and decreasing the maintenance output per employee. On the other hand, because of the re-allocation of the maintenance staff, the law has indirectly affected the service quality of new elevators. The decrease of quality for old elevators constitutes a direct effect in the sense that the very elevators specified by the law were adversely affected. In contrast, the suspected indirect effect implies that the law influenced the servicing of elevators that were not targeted by the law: the new elevators.

[9]That the whole effect is a mechanical result of the chronological organization of failure management is, however, unlikely because this should affect only downtime but not the number of breakdowns. In addition, as the empirical results show new elevators followed the failure increase of old elevators with a lag, suggesting more than a mechanical relationship that would have synchronized the trends immediately.

3 Empirical Analysis

3.1 Data and Descriptive statistics

We have access to an original database from a public local agency, Paris Habitat-OPH, which is in charge of social housing in Paris. It owns around 5 082 elevators[10] and delegates their modernization and maintenance to private firms. The elevators in our dataset are managed by three firms, which are among the four major firms of the sector.

From January 2004 to May 2013, we know the monthly number of breakdowns and the downtime for a sub-sample of 3607 out of 5082 elevators in total.[11] To avoid our results to be driven by extreme values, we use the logarithm of maintenance quality variables. Moreover, we limit the maximal monthly number of breakdowns to 50.[12] Descriptive statistics are displayed in Table 1.1.

Table 1.1: Descriptive statistics

Variable	Mean	Std. dev.	Min	Max	N
$\log(NbBreakdowns_{it})$	0.45	0.86	0	3.93	404 771
$\log(Downtime_{it})$	1.41	2.93	0	10.71	404 771

	$\log(NbBreakdowns_{it})$		$\log(Downtime_{it})$	
	$AFTER_t$=0	$AFTER_t$=1	$AFTER_t$=0	$AFTER_t$=1
OLD_i=1 (3 413 elevators)	0.28	0.64	0.71	2.19
	N=204 780	N=180 889	N=204 780	N=180 889
OLD_i=0 (194 elevators)	0.38	0.57	1.01	1.94
	N=8 844	N=10 258	N=8 844	N=10 258

In our database there are 3413 elevators constructed before 2001 (the 'old'

[10] There are around 420 000 elevators in France [Marie de Paris, 2010].

[11] The elevators not comprised by our data are elevators that are connected to another monitoring system. The monitoring system for an elevator depends on the district and the monitored elevators do not change during our sample period.

[12] Un-plausibly high breakdown figures can arise as a result of the automated monitoring system. The results are, however, hardly affected either by dropping or by using the original values.

elevators) and 194 elevators constructed from 2001 (the 'new' elevators). The dummy variable OLD_i is equal to one if the construction year of the lift i was before 2001, zero otherwise. Regarding the year of implementation, we distinguish the period before and after 2009.[13] The variable $AFTER_t$ is equal to one if the year of observation t is equal or greater than 2009, and zero otherwise.

Figure 1.1: Average downtime

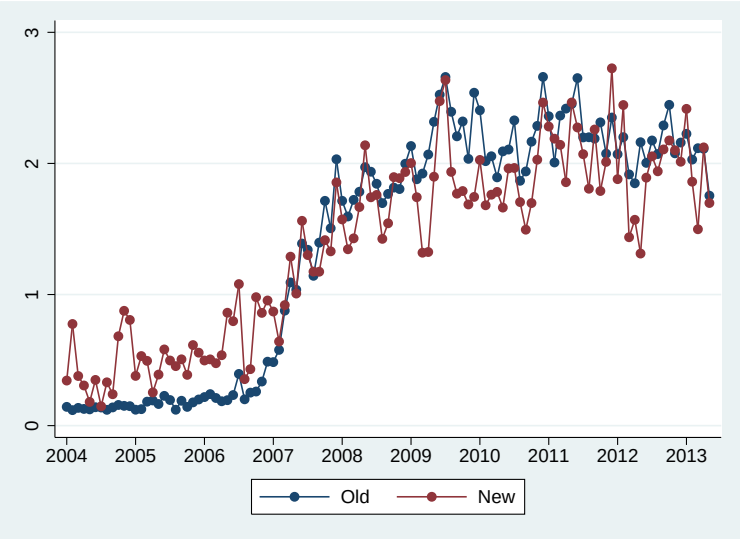
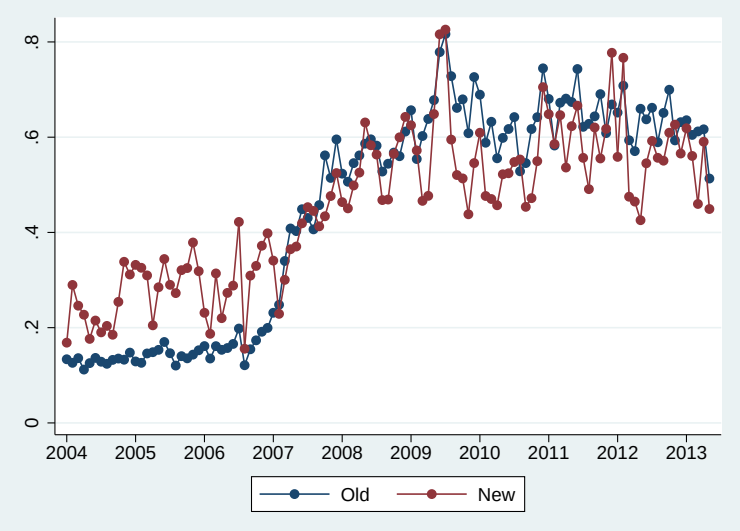


Figure 1.2: Average number of breakdowns



The raw data for breakdowns and downtime before and after the law's implementation are given in Table 1.1. Figures 1.1 and 1.2 distinguish the evolution

[13] According to Paris Habitat, the law started to be seriously put into practice around 2008.

of the average downtime and number of breakdowns for treated an non-treated elevators. First, in each figure, the curves tend to have similar sense of seasonal variations. Second, although these variations seem to be larger for new elevators (especially before 2008), their curves look indifferently flat before 2007. The graphs indicate no violation of the common trend assumption that may confound our empirical strategy. Third, there is a kind of transition period between 2007 and 2009: while both curves increase, the failures of old elevators start to exceed the failures of new elevators. And fourth, this tendency persists from 2010 to 2013: on each figure, the curves related to old elevators tend to be above those related to new elevators. Finally, these simple graphs appear to suggest that the law had severe consequences on the service quality of elevators, both old and new elevators.

3.2 Methodology

The empirical strategy employed in this paper follows a simple Difference-in-Difference approach. To evaluate if the law had an effect on service quality we will compare the over time change for elevators targeted by the law (old) and those not targeted by the law (new). The simple estimating equation is therefore:

$$Y_{it} = \beta_0 + \beta_1 OLD_i + \beta_2 AFTER_t + \beta_3 OLD_i * AFTER_t + u_{it} \qquad (1.1)$$

where Y_{it} is the proxy for service quality, OLD_i and $AFTER_t$ are the dummy variables indicating whether an elevator is built before 2001 (targeted by the law) and whether the observation is before or after the implementation of the law. Most importantly, β_3, the coefficient on $OLD_i * AFTER_t$, represents the treatment effect, *i.e.* the estimated effect of the law on service quality for old elevators. To control for seasonal effects, we also include a set of month fixed effects. We calculate cluster robust standard errors at the elevator level to account serial correlation across time.

As the underlying dataset represents elevator-level panel data, we can estimate a generalized version of the above model by adding an elevator fixed effect. This yields the following model:

$$Y_{it} = \eta_0 + \eta_1 AFTER_t + \eta_2 OLD_i * AFTER_t + c_i + u_{it} \tag{1.2}$$

where the treatment status indicator (OLD_i) is absorbed by the fixed effect c_i. Similar to before, η_2 represents the quantity of interest, the effect of the law on service quality. The main advantage of equation 1.2 over equation 1.1 is that it controls for time-invariant confounding factors related to elevator characteristics but also the location/neighbourhood of the elevator.

Another concern may be related to the indicators of service quality, the number of failures and the duration of immobilization, which are strictly positive. As the above linear models may be a bad representation of the non-linear relationship – because the range of the dependent variable is limited – we also estimate a Tobit model with left truncation at 0.[14]

Finally, as reported in the previous subsection, the implementation of the law did not occur in a single year but was rather effected sequentially until 2009. To analyse the dynamics of the implementation, we therefore re-estimate the models in equation 1.1 and 1.2 with a full interaction of time year effects instead of a single dummy indicator:

$$Y_{it} = \beta_0 + \beta_1 OLD_i + \lambda_t + OLD_i * \lambda_t \gamma + u_{it} \tag{1.3}$$

$$Y_{it} = \eta_0 + \lambda_t + OLD_i * \lambda_t \delta + c_i + u_{it} \tag{1.4}$$

[14]Given the large number of fixed effects and the absence of a standard procedures to implement a fixed effect Tobit model, equation 1.1 will be used for the Tobit model.

where λ_t represents the time year effects that replace $AFTER_t$. Consequently, instead of a single treatment effect we obtain an estimate for the difference between old and new elevators for every year. This allows us to look at the evolution of the difference between the treated and non-treated elevators over time. We would expect to find a significant increase in the difference between old and new elevators during the year where the law is implemented: around or after the year 2008.

3.3 Results

Table 1.2: Baseline DID Estimations

	$\log(NbBreakdowns_{it})$			$\log(Downtime_{it})$		
	(1) DID	(2) FE	(3) Tobit	(4) DID	(5) FE	(6) Tobit
OLD_i	-0.092***		-0.384***	-0.288***		-1.962***
	(0.023)		(0.083)	(0.060)		(0.339)
$AFTER_t$	0.195***	0.227***	0.495***	0.945***	1.030***	4.087***
	(0.026)	(0.028)	(0.076)	(0.086)	(0.090)	(0.337)
OLD_i*$AFTER_t$	0.166***	0.134***	0.598***	0.535***	0.450***	2.869***
	(0.027)	(0.029)	(0.078)	(0.088)	(0.092)	(0.345)
N	404771	404771	404771	404771	404771	404771
Month FE	Yes	Yes	Yes	Yes	Yes	Yes

Cluster robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1.2 exhibits the first DID results for the effect of the Robien law on the number of breakdowns and elevator downtime. The coefficient on $OLD_i * AFTER_t$ in column (1) suggests that the law increased the number of breakdowns by roughly 17%. The FE specification in column (2) yields a similar but slightly smaller effect and the Tobit model in column (3) also supports the conclusion that the law had a significant and positive effect on the number of breakdowns.[15] Looking at elevator downtime, it appears that the effect of the law was even more

[15]The raw coefficients of the Tobit model cannot be directly interpreted in terms of magnitude but confirm that the conclusions from the other models are still valid when taking the bounded nature of the dependent variable into account.

pronounced than for the number of breakdowns. The models in column (4) and (5) suggest that downtime increased by 54% and 45%, respectively. Although again the FE estimate is somewhat smaller, the overall impact of the law on downtime is significant not only in a statistical sense but also in magnitude. The Tobit model in column (6) supports these findings.

An important observation relates to the 'main' coefficients, OLD_i and $AFTER_t$, in Table 1.2. It is interesting to note that old elevators appear to have had a lower failure rate and less downtime before the implementation of the law. Hence, in contrast to the safety issues, old elevators seem to have been less prone to failures than new ones in the past. Turning to the coefficient $AFTER_t$, the results show that not only the service quality of old elevators changed strongly but that also the control group (new) experienced a substantial increase in the number of breakdowns and downtime. Columns (1) and (4) suggest that the number of breakdowns and downtime increased by 20% and 95% respectively, even for elevators not subject to the law.

A simple before-after (law) comparison would find that breakdowns for old elevators have increased by 17%+20%=37% and downtime by 54%+95%=149%. Although we deliberately partial out the 'overall changes' by having the new elevators that are not subject to the law as a control group, at the outset it is not clear why there is such a pronounced change for new elevators. In any case, the 17% and 54% increases in breakdowns and downtime should be considered as lower bound estimates. We will further investigate this surprising finding in the following section, after looking at the dynamics of the law's effect.

Table 1.3 presents the results from models 1.3 and 1.4 where the $AFTER_t$ dummy variable is replaced by time year effects. Focusing on the interaction effects in Table 1.3 – which are contrasted to the base year 2004 – the results show that there is a strong increase in breakdowns and downtime of old elevators (relative to new elevators) starting in 2007 and peaking in 2009. After 2009 the difference

Table 1.3: Dynamics

	$\log(NbBreakdowns_{it})$		$\log(Downtime_{it})$	
	(1)	(2)	(3)	(4)
	DID	FE	DID	FE
OLD_i	-0.103***		-0.314***	
	(0.026)		(0.065)	
2005.year	0.075***	0.086***	0.019	0.041
	(0.026)	(0.028)	(0.073)	(0.081)
2006.year	0.058*	0.097***	0.243***	0.373***
	(0.032)	(0.034)	(0.093)	(0.102)
2007.year	0.164***	0.237***	0.760***	0.991***
	(0.036)	(0.037)	(0.122)	(0.139)
2008.year	0.304***	0.397***	1.244***	1.531***
	(0.045)	(0.047)	(0.158)	(0.181)
2009.year	0.353***	0.446***	1.409***	1.693***
	(0.043)	(0.045)	(0.141)	(0.162)
2010.year	0.295***	0.385***	1.402***	1.680***
	(0.043)	(0.050)	(0.146)	(0.175)
2011.year	0.376***	0.467***	1.705***	1.984***
	(0.047)	(0.050)	(0.157)	(0.172)
2012.year	0.328***	0.418***	1.459***	1.738***
	(0.039)	(0.044)	(0.139)	(0.161)
2013.year	0.322***	0.413***	1.561***	1.840***
	(0.044)	(0.048)	(0.159)	(0.178)
OLD_i*2005.year	-0.063**	-0.075***	0.014	-0.008
	(0.026)	(0.028)	(0.074)	(0.081)
OLD_i*2006.year	-0.024	-0.063*	-0.112	-0.242**
	(0.032)	(0.034)	(0.093)	(0.102)
OLD_i*2007.year	0.126***	0.053	0.318**	0.088
	(0.037)	(0.038)	(0.124)	(0.141)
OLD_i*2008.year	0.124***	0.031	0.423***	0.136
	(0.046)	(0.048)	(0.161)	(0.183)
OLD_i*2009.year	0.193***	0.101**	0.704***	0.420**
	(0.044)	(0.046)	(0.144)	(0.165)
OLD_i*2010.year	0.191***	0.101**	0.613***	0.334*
	(0.044)	(0.050)	(0.149)	(0.177)
OLD_i*2011.year	0.151***	0.060	0.457***	0.178
	(0.048)	(0.051)	(0.160)	(0.175)
OLD_i*2012.year	0.179***	0.088*	0.522***	0.243
	(0.041)	(0.045)	(0.143)	(0.164)
OLD_i*2013.year	0.164***	0.073	0.443***	0.164
	(0.045)	(0.049)	(0.163)	(0.182)
N	404771	404771	404771	404771
Month FE	Yes	Yes	Yes	Yes

Cluster robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

in service quality between old and new elevators decreases to some extent, more strongly for downtime than for the number of breakdowns. The coefficients on the interaction terms are consistently smaller for the FE models in columns (2) and (4) compared to the standard DID models but the dynamics and the qualitative interpretation are the same.

It is interesting to note that the main performance shortfall arises at the same time as firms' business activity peaks (see Figures 1.3 and 1.4 in the appendix) around 2009. Therefore, this period appears to correspond to the most intense phase of the law implementation during which the lack of labour resources was especially significant. This lack of workforce should have been transitory, decreasing after the modernizations were finished. However, the technological shock is expected to be persistent since the new safety requirements remain in place well beyond the modernization phase. The differential effect over time we see in Table 1.3 supports the idea that the law affected service quality through both channels and that the technological change generated long run consequences on service quality.

Another feature that carries over from the results in Table 1.2 is the fact that also the new elevators as control group experienced a substantial increase in breakdowns and downtime from 2007 to 2009 but a little less strong. It seems that service quality for new elevators followed those of old elevators with a lag, catching up in 2011. This apparent connection of failure patterns between new and old elevators is analysed in more detail in the ensuing section.

To summarize, the results from the empirical analysis in this section show that the Robien law has had a negative effect on elevator service quality. Using elevators not subject to the law as a control group, the law is estimated to have increased the number of breakdowns between 14% and 17% and downtime between 45% and 54%.

4 The indirect impact of modernization: a general equilibrium perspective

A critical question in every DID strategy is the appropriateness of the control group. Several assumptions relate to the link between the control and treatment group. The exogeneity assumption for instance rules out selection into either of the two groups and is rather innocuous here because the treatment group was decided after the realization of the construction year. More relevant to the present paper is the 'Stable Unit Treatment Value' assumption (SUTVA) that rules out interactions between the units in the population.

In the previous section we saw that after the implementation of the law not only the service quality of the old elevators was adversely affected but that breakdowns and downtime increased also strongly for new elevators, not subject to the law. There are actually two readings for this finding: First, the similar movements in failure rates may increase our confidence in the common trend assumption that in the absence of treatment both groups would have had the same time trends. The second interpretation is that in the current case SUTVA simply does not hold. As outlines in the previous chapters, if the allocation of workers – and therefore also failure rates – between new and old elevators is subject to optimizing behaviour by the operating firm, we may expect that the law has triggered a reaction that will affect not only the old but also the new elevators.

Unfortunately controlling for such general equilibrium effects to calculate an unbiased treatment effect is not possible with the available data. As suggested by Miguel and Kremer [2004] or Blundell et al. [2004] a potential solution would lie in the use of conducting experiments with group randomization or at least the existence of a firm or group that was not affected by the law. This is not possible in the present paper as all elevators are managed by the same three firms that operate both new and old elevators. We will return, however, to the possibility

of getting a less biased estimate by differentiating firms with more or less shifting potential at the end of this section.

Before that we will try to make the case that the law actually had significant spillover effects from old to new elevators. To this end, we will show that there is a strong and robust relationship between the failure rates of new elevators and old elevators. If the portrayed channel through the constraints on labour are indeed present, we would expect that more breakdowns by old elevators also increase the breakdowns by new elevators because the maintenance staff has to deal with more failures by old elevators increasing the response time to service new elevators.

Given that maintenance is typically organized in spatially separate areas, these failure spillovers should be regional or local in nature and we estimate the following spatial autoregressive model:

$$Y_{it}^{new} = \eta_0 + \rho W_{ij} Y_{jt}^{old} + c_i + u_{it} \tag{1.5}$$

where W_{ij} is the spatial weight matrix that defines the neighbourhood relationship between elevators. We use two different concepts of neighbourhood and therefore two different weight matrices. On the one hand, we define all elevators in the same district as neighbours and weight them equally regardless of their distance. On the other hand, we use a weight matrix that considers all elevators within 1 km as neighbours and weigh the elevators within this radius depending on the distance. The closer an elevator the higher the weight.[16] The overall term $W_{ij}Y_{jt}^{old}$ is simply a weighted average of the breakdowns or downtime of neighbouring elevators. As we are interested in the spillover from old elevators to new elevators, the weighted average is calculated on the basis of old neighbouring elevators only (Y_{jt}^{old}). Naturally, only elevators from the same firm are considered

[16]Both matrices are row normalized so that the sum of each row in W adds up to one.

relevant for spillovers.[17]

As spillover patterns may arise for a variety of reasons, a number of different specifications are estimated to ensure that the spillover is not simply the result of common shocks. These specifications will contain different subsets of elevator FE, elevator-year FE, month fixed effects and month-year fixed effects. Finally, we will estimate a specification where we control for overall spillovers by adding another spatial term:

$$Y_{it}^{new} = \eta_0 + \rho_1 W_{ij} Y_{jt}^{old} + \rho_2 W_{ij} Y_{jt}^{all} + c_i + u_{it} \tag{1.6}$$

This last specification includes the weighted average of all neighbouring elevators $W_{ij}Y_{jt}^{all}$. If the coefficient on ρ_1 remains statistically significant, it can be considered as a very strong confirmation of spillover effects between old and new elevators.

After establishing the existence of the spillover effects, we will return once more to the baseline DID framework to test if the general equilibrium effects vary between firms. Depending on the initial allocation of labour forces among old and new elevators the firms may have different degrees of leeway when shifting between the two groups. If really general equilibrium effects are the reason for the increase in breakdowns for new elevators, we would expect this increase to be smaller if less shifting is possible. The share of new elevators may therefore be pivotal. We will analyse this separating the three firms and estimating a DID for each of them separately.

[17]We estimate a model by OLS, knowing that the spillover creates a potential endogeneity between neighbouring elevators. Estimations using the failure rates of all neighbouring elevators managed by other firms as an instrument for Y_{jt}^{old} yields similar results.

4.1 Testing the idea of spillover as the main mechanism for general equilibrium effects

Table 1.4: Spillover effects on new elevators: within district

	$\log(NbBreakdowns_{it})$			
	(1)	(2)	(3)	(4)
$W.Y^{old}$	0.766***	0.487***	0.378***	0.081
	(0.077)	(0.081)	(0.081)	(0.078)
$W.Y^{all}$				0.758***
				(0.103)
	$\log(Downtime_{it})$			
	(1)	(2)	(3)	(4)
$W.Y^{old}$	0.862***	0.656***	0.378***	0.212***
	(0.065)	(0.083)	(0.070)	(0.078)
$W.Y^{all}$				0.697***
				(0.095)
N	18595	18595	18595	18595
Elevator FE	Yes	Yes	No	Yes
Elevator-Year FE	No	No	Yes	No
Month FE	Yes	No	Yes	Yes
Month-Year FE	No	Yes	No	No

Cluster robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1.4 shows the results from estimating the spatial model in equation 1.5 when considering all elevators within a district as neighbours. In columns (1), (2), and (3) the specifications with different sets of FE are exhibited. Not surprisingly, moving from the baseline model with elevator and month FE to a specification with elevator and month-year FE (column (2)) or a specification with elevator-year and month FE (column (3)) captures more and more variation and consequently reduces the size of the spatial spillover. The coefficient on the spatial lag remains, however, statistically significant and of considerable size. Even when allowing the elevator FE to vary each year the estimated ρ_1 suggests a breakdown or

downtime spillover of 38%. This means that increasing the number of breakdowns of neighbouring old elevators by 1% is expected to increase the breakdown by a new elevator by 0.37%.

Table 1.5: Spillover effects on new elevators: within 1 km radius

	$\log(NbBreakdowns_{it})$			
	(1)	(2)	(3)	(4)
$W.Y^{old}$	0.379***	0.268***	0.230***	0.093*
	(0.036)	(0.043)	(0.041)	(0.047)
$W.Y^{all}$				0.265***
				(0.034)
	$\log(Downtime_{it})$			
	(1)	(2)	(3)	(4)
$W.Y^{old}$	0.301***	0.124***	0.080***	0.173***
	(0.025)	(0.026)	(0.021)	(0.030)
$W.Y^{all}$				0.167***
				(0.031)
N	19102	19102	19102	19102
Elevator FE	Yes	Yes	No	Yes
Elevator-Year FE	No	No	Yes	No
Month FE	Yes	No	Yes	Yes
Month-Year FE	No	Yes	No	No

Cluster robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As shown in column (4), adding the second spatial lag to control for overall spillovers further decreases the size of the effect and the ρ_1 becomes insignificant for the number of breakdowns, but not for downtime. Very similar results are obtained when using the second weight matrix, that considers elevators as neighbours if they are within a one km radius.[18] The results in Table 1.5 basically confirm the previous findings. Moreover, the ρ_1 remains weakly significant in column

[18]Here the elevators j are also weighted according to their distance to elevator i. Using a linear decay function gives an elevator that is 50m away twice the weight of an elevator with a distance of 100m.

(4), suggesting that some smaller spillovers are also present in the number of breakdowns. On the other hand, the much larger effect for downtime, both in Tables 1.4 and 1.5, can be interpreted as evidence that the spillover works more strongly through delays in repair than through the mere occurrence of a breakdown.

To conclude, there is consistent evidence of failure spillovers, meaning that an increase in the failures of old elevators increase breakdowns and downtime for new elevators. Although these cross-sectoral spillovers are not direct evidence of the general equilibrium effects that are expected to have been caused by the Robien law, these findings strongly suggest the channel through which the law on old elevators may have affected new elevators. If the failure rate of old elevators doubles as a result of the law, the observed spillovers would unquestionably lead to a decrease of service quality for new elevators.

4.2 Enterprise specific DID: the shifting potential

Since labour resources in general and maintenance and repair capacity in particular appear to be the key to the observed spillovers, this final part of the empirical section repeats the initial DID for each firm separately. The three firms in the sample are expected to react differently to the law, depending on their initial allocation of resources between old and new elevators. Despite that we don't observe the actual number of employees servicing old and new elevators, we know the number of old and new elevators that a firm is servicing.[19]

The results in Table 1.6 show a widely varying treatment effect of the law. Firm 1 exhibits a very strong effect of more than 20% and roughly 100% in breakdowns and downtime, respectively. In stark contrast, the coefficients on the interaction effects is much smaller and typically not statistically significant from zero in

[19]Our data, however, comprises only those elevators that are services by a firm on the basis of a contract with the housing agency. Contracts outside public housing are not covered by the data.

Table 1.6: DID per firm

	$\log(NbBreakdowns_{it})$					
	Firm 1		Firm 2		Firm 3	
	(1) DID	(2) FE	(3) DID	(4) FE	(5) DID	(6) FE
OLD_i	-0.251***		0.066*		-0.031	
	(0.068)		(0.037)		(0.025)	
$AFTER_t$	0.079	0.065	0.251***	0.187***	0.158***	0.169***
	(0.054)	(0.052)	(0.044)	(0.063)	(0.034)	(0.036)
OLD_i*$AFTER_t$	0.232***	0.204***	-0.012	0.067	0.090**	0.052
	(0.054)	(0.053)	(0.049)	(0.076)	(0.036)	(0.038)
	$\log(Downtime_{it})$					
	Firm 1		Firm 2		Firm 3	
	(1) DID	(2) FE	(3) DID	(4) FE	(5) DID	(6) FE
OLD_i	-1.171***		0.214		-0.086	
	(0.253)		(0.162)		(0.064)	
$AFTER_t$	0.244	0.137	0.784***	0.487*	0.923***	0.837***
	(0.195)	(0.181)	(0.185)	(0.259)	(0.111)	(0.114)
OLD_i*$AFTER_t$	1.106***	0.986***	-0.140	0.214	0.337***	0.184
	(0.196)	(0.183)	(0.202)	(0.297)	(0.118)	(0.121)
N	234319	234319	22739	22739	107342	107342
share of new lifts	0.022		0.108		0.107	

Cluster robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

the case of Firm 2 and 3. The main reason for the difference between the firms can be found when looking at the estimates for $AFTER_t$: the control group (the new elevators) experienced no statistically significant increase after the implementation of the law for Firm 1, whereas Firms 2 and 3 show a large and significant increase in the failure rate for new elevators.

Given that these two firms have a much larger share of new elevators in the total number of elevators that they service – both roughly 10% compared to only 2% for Firm 1 – the results seem to suggest that the shifting potential for Firm 1 was already limited and therefore it was not possible to reduce the servicing for

new elevators significantly. Conversely, the shifting effects appear to have been strongest for Firms 2 and 3, which exhibit a much more balanced increase of breakdowns and downtimes – the difference between the increase in old and new elevators not being statistically significant – as a result of the law.

Given that the control group of the DID strategy is contaminated through spatial spillovers, our baseline results from section 3 may underestimate the true effect of the law. If we use firm 1 as a case where the contamination is limited due to smaller shifting potential, the actual effect of the modernization is closer to 20% for breakdowns and 100% for downtime instead of 13% and 45% as indicated in the baseline DID (see Table 1.2).

5 Discussion

This paper highlights the side effects of a safety regulation on the provision of service quality. In Figure 1.7 in the appendix, we can see that contract prices for elevator maintenance did not increase in the wake of the modernization. However, it is not obvious why the laws effects materialized only in quality and not in price. In this final section, we discuss potential structural characteristics of the underlying case that may explain the observed phenomenon.

One explanation lies in the characteristics of the landlord we study, which is not a 'classic' landlord. As a public buyer, Paris Habitat-OPH has not only to comply with the safety regulation, but also with public procurement rules [European Commission, 2004]. As previously stated by Chong et al. [2013b], for instance, these rules encourage the use of open competition that are expected to provide strong incentives for competitive bids in terms of low prices while generating quality enforcement issues (See, *e.g.*, Bajari and Tadelis [2001] or Calzolari and Spagnolo [2009] for theoretical discussions on this issue and Iimi [2013] for empirical evidence).

To deal with quality problems, most of the public contracts include penalty clauses that can be used to punish suppliers if performance shortfall arises. Nevertheless, not only in the current case but more as a general tendency there is evidence that penalty clauses are not rigorously enforced [Spagnolo, 2012]. One of the main reasons given in the literature are the costs associated with the use of courts and juridical instruments [Coviello et al., 2013b]. Firms are likely to anticipate this phenomena by posting aggressive bids (to increase their winning probability) and then shirking on quality (to not damage their profits), explaining why public procurement rules may be prone to generate low price/low quality equilibria.

In our case, enforcement costs may especially arise from the non-verifiability of service quality.[20] In the elevator sector, disentangling who or what is responsible for a performance shortfall is made difficult because it can have several causes, like elevator misuse, bad maintenance, bad infrastructure or difficulty to find replacement material. In particular the extent to which suppliers' effort is responsible for the shortfall in service quality gives rise to intense debates.[21]

Consequently, as long as firms' effort is not related through a stable/transparent relationship to service quality, which is the only measurable dimension of the production process, shirking by the private firm is hard to prove. The non-verifiability therefore explains buyers' reluctance to apply penalty clauses as firms may challenge penalties in court. Empirical evidence of such reluctance is provided by Girth [2012] who studies survey data and interviews with public managers. She derives the conclusion that despite public managers having powerful sanctioning tools at their disposal, the burdensome and the discretionary nature of the sanctioning process lead agents to refrain from applying penalties.

[20] According to Laffont and Martimort [2002],*It is often the case that, when two parties engage in a relationship, they are uncertain about the values of some parameter which will affect their future gains from trade*' (chapter 6, page 240). These situations refer to a non-verifiability problem.

[21] In the report from the Marie de Paris [2010], many different reasons are given by stakeholders to explain the bad performances in the elevator sector.

Specifically for the Robien law, as the higher sensitivity of elevators became a new source of failures, it has contributed to the overall uncertainty. The additional difficulties to identify the source of the failures makes enforcing penalties even more delicate, thus potentially reinforcing the side effects of the law.

Because of the costs associated with contract enforcement, one solution suggested by the procurement literature is to allocate more discretionary power to the public buyer at the awarding stage. The public buyer may indeed have some (unverifiable) information about firms' efforts and/or expertise. If the public buyer was allowed to use this information to select the contract provider, the latter would have incentive to not shirk on quality so as to avoid an exclusion from the future tendering processes (Kim [1998]; Doni [2006]; Calzolari and Spagnolo [2009]). However, due to the fear of abuses in discretion and the need to preserve public buyers' accountability, the current European regulation drastically limit the possibility to exclude firms from an auction based on past performance [European Commission, 2004].

6 Conclusion

This paper deals with the question of safety regulation and its impact on service quality. We analyse a particular law in the French elevator sector, that led to a substantial modernization of the existing infrastructure to decrease fatal injuries. The focus of this paper is on the unintended side effects of the law on the quality of the provided service. The theoretical channels through which the modernization can affect service quality, are shown to be empirically relevant. The Robien law analysed in this paper has both short and long term effects on service quality through additional modernization works and the technological shock due to the higher sensitivity. Not only old elevators, which are targeted by the law, are affected but also the quality for new elevators decreases significantly. The latter constitutes a spillover effect that results from firms adapting to quality problems

associated with the modernization. We also show that the spillover effect is particularly relevant for firms which have a larger shifting potential as measured by the share of new elevators.

Modernizing infrastructures to make them adapted to technological or safety standards is likely to become a growing concern, especially in developed countries. Our paper highlights that such type of change should be accompanied by a reflection on recurring events like maintenance, that might determine to a large extent the proper functioning of infrastructure. If it is known that quality issues are a relevant feature, designing policies that affect the service provision is such a substantive sense should consider more profoundly the complementarity between investment and maintenance.

7 Appendix

Figure 1.3: Firms' turnover

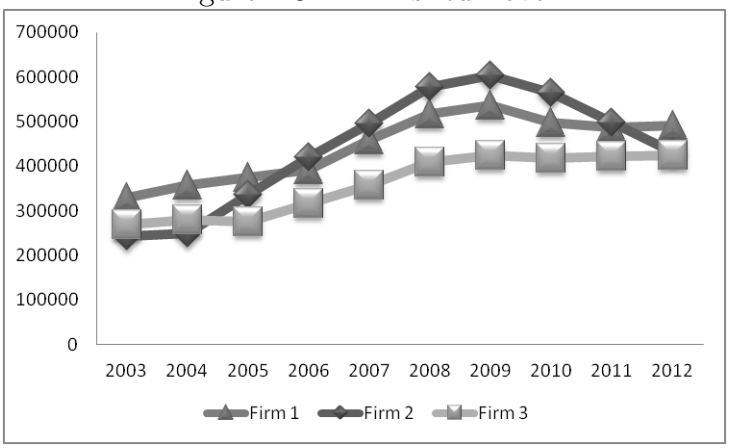


Figure 1.4: Firms' number of employees

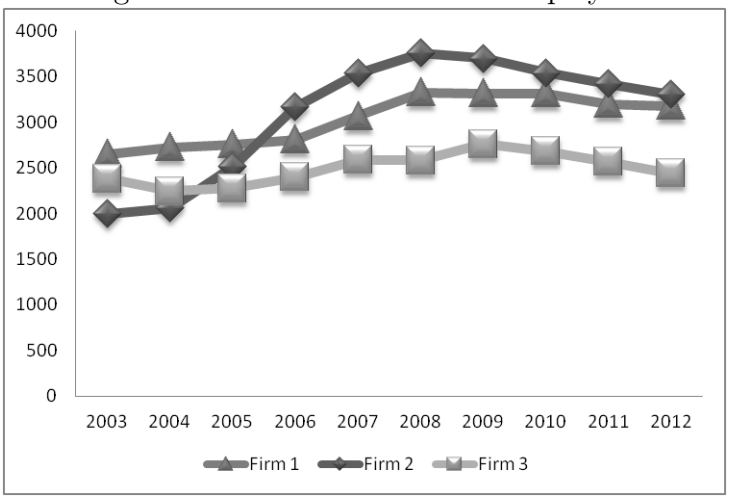


Table 1.7: Maintenance price

Awarding year	2005	2006	2007	2010	2011
Annual price per elevator (in €)	1 897	1 647	1 406	1 540	1 323

Chapter 2

Ex Ante Contracting and Ex Post Enforcement: An Empirical Analysis of Public Procurement Contracts*

1 Introduction

In 2009, a public buyer operating in the field of social housing was sanctioned by the administrative court of Paris for disqualifying a candidate during an open call for tenders : arguing that this candidate was guilty for providing low level of service quality in past cleaning contracts, the public buyer decided to reject its candidacy at the pre-qualification stage of the procurement procedure. The court, seized by the dismissed private operator, has considered that the argument used to disqualify the claimant was unlawful. As a consequence, the public buyer was condemned to re-organize the call for tenders and to evaluate the candidacy of each operator, including the claimant. This judicial decision triggered an important or-

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ganizational change on the public buyer's side. Confronted with a statutory ban to eliminate firms' candidacy on the basis of bad past performances,[22] the public authority decided to deal with firms' opportunism in another way, *i.e.* by improving the completeness of its contracts. However, since the transaction costs incurred to reduce contractual incompleteness can be substantial [Bajari and Tadelis, 2001], the extent to which this strategy is relevant is not immediately obvious. As it will be analysed, it highly relies on the ability of better *ex ante* contracting to improve quality enforcement and on the magnitude of such relationship.

Up to now, the literature has mainly focused on the disciplinary power of competition for the field to deter firms' opportunism in public procurement. In Europe, for instance, the public sector buyer is usually forced by regulation to use an open call for tender [European Commission, 2004]. This mechanism is most often considered as efficient, notably because the overwhelming majority of empirical works on this issue indicates that this procedure allows to reduce costs.[23] Nevertheless, its impact on quality is much more puzzling, suggesting that those costs savings might be achieved at the expense of quality.

As a first explanation, the complexity of the transaction can give rise to incomplete contracts that do not allow to perfectly align parties' interests and thus to deter firms' opportunism (see, e.g., Grossman and Hart [1986]). However, cleaning contracts refer to a rather simple activity in which performance measure is supposed to be easy and thus, allow the design of incentive schemes [Brown and Potosky, 2005]. A second explanation lies on poor contract enforcement. Evidence indicates that public buyers do not apply penalty clauses, even when important damages occur [Spagnolo, 2012]. Previous empirical literature on this subject focuses on the enforcement costs to explain their limited use (see, *e.g.*,

[22] See Spagnolo [2012] for an extensive discussion on this issue.

[23] For instance, a meta-analysis conducted by the Australian Industry Commission [1996] on 203 different international studies on the effect of contracting on cost in public procurement reveals that the most frequently reported magnitudes of cost savings lies in the ranges of 10-30 percent.

Girth [2012]; Coviello et al. [2013b]). However, in our case, the public buyer tends to apply penalty clauses: low level of service still persists, suggesting that those clauses have a low incentive effect.

We complete previous empirical analyses on quality enforcement issues by investigating the role played by the *ex ante* contracting process in the deterrence of *ex post* opportunism. This approach is line with a theoretical literature that examines situations in which *'the verifiability of the agent's actions is endogenously determined by the principal's investments in drafting an explicit contract pertaining to the quality of the agent's output'* [Kvaloy and Olsen, 2009]. In this literature, investing in the *ex ante* contracting process can reduce contractual incompleteness and thus increase the court's ability to verify that the agent's actions are line with the intend of the contract. This may be especially efficient in moral hazard settings [Kvaloy and Olsen, 2010], where the supplier has some private information and needs some incentives to provide efforts.

To investigate the role of contractual specification on the deterrence of moral hazard, we use an original database coming from Paris Habitat-OPH, the local public buyer sanctioned by the administrative court in 2009. We have access to monthly information related to 102 allotted contracts signed with a set of private operators in the sector of house-cleaning over a four year period. Two significant dates need to be pointed out. First, in order to facilitate performances comparisons and to implement a penalty system, the public authority decided in 2004 to build a tool so as to systematically assess the level of service quality.[24] Second, in April 2010 (and in reaction to the court decision previously mentioned), the public buyer decided to implement two major changes : all the contracts launched after this date include (1) more detailed specifications (in particular, about the way to reach a satisfying quality of service) and (2) a reinforced enforcement regime both for controls and penalties. We interpret these changes as an increase of

[24]This tool take the form of an evaluation grid, based on multiple and objective criteria, which should be monthly completed for each contract.

contractual completeness. As a result, we have panel data which allows us to observe the evolution of quality before and after an exogenous shock on the level of contractual completeness, leaving us with a quasi-natural experiment. Moreover, our information about the value of the penalties paid and the frequency of controls enables to disentangle the direct impact of the formal contract from its indirect impact. We indeed capture this indirect impact by investigating whether controls and penalties provide stronger incentives after the change in contract design.

Our findings suggest that bearing the costs of reducing contractual incompleteness significantly improves the delivered quality: more complete contracts not only reduce the average level of moral hazard (direct impact) but also optimize the monitoring of the contract (indirect impact). Regarding the latter aspect, we indeed find that controls and penalties have the ability to deter firms' opportunism only when contracts are well-specified. In addition, we give evidence that quality improvements are made possible without prices raising. As a consequence, our analysis illustrates how an exogenous 'bad' event (the court decision) finally leads to an unexpected and profitable organizational change. On the one side, for standard goods or services like cleaning activities, the transaction costs that enable to reduce contractual incompleteness are incurred only once. On the other side, the resulting long term reduction of firms' opportunism is not associated with a price increase while allowing to spare on the costs that have to be engaged to monitor the suppliers' performances.

We believe our results contribute to the emerging empirical literature on the issue of public contract enforcement [Girth, 2012; Coviello et al., 2013b]. While previous studies investigate the impact 'exogenous' factors on public contract enforceability, we shed light on a strategy which is not only at the discretion of public managers but also in line with the theoretical literature on endogenous verifiability (see,of *e.g.*, Kvaloy and Olsen [2009, 2010]).

The rest of the paper stands as follow. Section 2 presents the conceptual

framework and puts forward the hypothesis we aim to test. Section 3 then gives some details about the institutional context, the data and our empirical strategy. The results from our estimations are provided in Section 4. Finally, we discuss those results and potential recommendations for outsourcing of public services in Section 5.

2 Conceptual framework

Numerous quantitative studies have compared costs of in-house public management and costs of private management when contracts are awarded through a competitive tendering. In their overwhelming majority, those studies conclude that outsourcing achieves reduction in government expenditures in a great variety of sectors such as refuse collection industry [Domberger et al., 1986; Dijkgraaf and Gradus, 2004], road maintenance [Blom-Hansen, 2003], vehicle and warehousing maintenance [Domberger et al., 2002], cleaning and housekeeping [Domberger et al., 2004] and [Milne and Wright, 2004] and even prisons [Cabral and Saussier, 2013]. Competition for the field thus effectively prevents rent extraction by encouraging operators to bid competitively.

Nevertheless, abandoned rent on costs can be recovered on the quality of the service (*quality-shading hypothesis*). Nowadays, although the effect of outsourcing on quality is of fundamental importance for the efficient organization of public services, empirical studies which examine quality issues exist in far fewer numbers than those on costs savings. Moreover, the few number of existing studies provides mixed evidences. While some of them suggest that service quality had been stagnant or risen when contracting out [Domberger et al., 1995, 2004; Savas, 1977], others reach the opposite conclusion of reduced quality following contracting out [Evatt Research Centre, 1990; Hartley and Huby, 1986; Ascher, 1987]. An interpretation of those mixed results relies on contract specification and monitoring: as put forward by the Australian Industry Commission [1996], quality issues are

primarily a result of poor application of the process of outsourcing rather than outsourcing *per se*.

From a theoretical perspective, we can distinguish two main explanations about why the outsourcing process can entail quality issues. On the one side, a first strand of the literature focuses on the role of contractual incompleteness (see, *e.g*, Grossman and Hart [1986]): when dealing with some transactions, writing complete agreements might be prohibitively costly. The resulting contractual blanks prevent parties from safeguarding their respective interests. On the other side, even in the case of complete contracts (*i.e* contracts for which performances are measurable), *ex post* opportunistic behaviours can be due to asymmetries of information between parties [Jensen and Meckling, 1976]: because operators may not share the buyer's goals and be more familiar with the details of the task, they may have both motive and opportunity to behave in ways that maximize their own interest at the expense of the public authority. In other words, they are able to 'shirk' by delivering a lower service quality. Solutions lie on the provision of outcome- or behaviour-based contracts.

In the specific case of cleaning activity, contracting on quality is supposed to be rather simple.[25] Consequently, contractual incompleteness should not be an issue. Moreover, those contracts include incentive schemes that should align parties' interests and limit informational rents. Despite of that, quality issues

[25]As an illustration, Brown and Potosky [2005] sent a survey to public managers about the transaction cost dimension of a variety of basic local government services in order to build a typology of "ease of measurement" for service performances. More precisely, they ask manager to determine this measurement easiness in a five point scale, giving that "*a service is easy to measure if it is relatively straightforward to monitor the activities required to deliver the service and to identify performance measures that accurately represent the quantity and the quality of the service*". They also precise that for easy-to-measure services, "*government officials can easily write a contract and clearly specify the activities and outcomes for the vendor to perform and achieve*". This way, they identify very easy-to-measure outsourced activities, such as payroll, commercial solid waste collection and street and house cleaning (score < 2) and very difficult-to-measure ones, such as child welfare programs, drug and alcohol treatment and operation of mental health program (score > 4). According to such a typology, contracts established to outsource cleaning services might be rather complete and quality-shading might be rather scarce on this sector.

often raised: in the data we explore about cleaning activities, the persistence of quality issues are illustrated by frequently imposed penalties, users complaints, breach and early termination of contracts.

Explanations of such paradox can be found in the literature on endogenous verifiability. Indeed, the seminal papers of Townsend [1979] and Dye [1985] highlight that costly contracting and imperfect enforcement are important vehicles to understand the nature of transactional relationships. While the classic moral hazard approach assumes perfect enforcement (see, *e.g.*, Holmström [1979]) and models of incomplete contracting consider that contracting is prohibitively costly so that legal enforcement is impossible (see, *e.g.*, Grossman and Hart [1986]), more recent contributions overstep those assumptions by dealing with costly contracting and endogenous verifiability [Kvaloy and Olsen, 2009, 2010]: the time and efforts spent on the contracting process determine the level of verifiability.

Contracting on quality is indeed challenging. Even if service quality may be identified in terms of performance characteristics, their assessment may require subjective judgement rather than mere accumulation of data [Jensen and Stonecash, 2005]. For instance, in the specific case of cleaning services, the only way quality can be measured is through personal observation and what constitutes a high standard of cleanliness may vary from one observer to another [Domberger and Jensen, 1997]. In such a situation, improving contract details can help in reducing ambiguities between parties about the intends of the contract and thus, increase its enforceability. This threat might then help to overcome the service providers' temptation to reduce efforts.

The data currently available to us in this study are closed to the framework of Kvaloy and Olsen [2010] where contracting is costly and enforcement is probabilistic (the probability that the incentive contract will be enforced by a court of law is determined by the costs spent on contracting). In their paper, better contract specification leads to higher-powered incentives. Nevertheless, as far as

we know, there is no hard empirical proofs of such statements. This is precisely how this paper contributes to the literature by filling this gap.

3 Data and empirical strategy

3.1 Institutional framework

Over the last decades, outsourcing activities to external providers has become a fairly common practice for governments. As a consequence, the way it influences the costs of public services is the focus of academics' and practitioners' interests. The outsourcing of public activities is regulated by European directives, which are then transposed into national law through the 'French Public Procurement Code'. As soon as service contracts reach the EU-thresholds (around 200 k€), both regulations constrain the public buyers to use the traditional open call for tenders.[26] This procurement process is made of different steps. First, the buyer defines its needs and it launches a publicity. Second, firms send documents related to their candidacy (their references, their number of employees, their competences, etc.) and their offer. Third, the buyer analyses the different bids. If they are satisfying, the associated offers are also analysed. Finally, the winner is the "most economically advantageous offer". This selection process is deliberately rigid so as to respect the principles of the directive: equal treatment, non-discrimination, mutual recognition, proportionality and transparency (European Commission [2004]). In theory, this rigidity is supposed to ensure the efficiency of competitive mechanisms because any firm can submit a bid which is evaluated according objective and transparent criteria; moreover, ignoring the number and the offers of rivals incite bidders to reveal their private information. Nevertheless, this statement is true only if, in particular, it is possible to contract on and monitor the quality of

[26] While a derogation is possible in specific cases, it is still the most used mechanism: according to a EU-report, 68% of service contracts awarded between 2006 and 2010 followed an open procedure (see the 'Impact of the Effectiveness of EU Public Procurement Legislation', p.12, Part 1, European Commission (2011)).

the service. Otherwise, the *ex ante* competition does not prevent opportunistic behaviors and firms can decrease the delivered quality.

3.2 Cleaning contracts

In our set of house-cleaning contracts, contract specification entails a precise description of quality standards, in terms of direct service provision (detailed description of the tasks, the resources to be used and the calendar of interventions) as well as in terms of relational aspects (compliance with deadlines when answering to the buyer's requirements and when providing contractual documents such as service manuals and periodical activities' reports). Concerning the monitoring, the contract specifies how the quality will be evaluated and by whom.

As previously mentioned, the public buyer we study implemented a detailed evaluation grid in order to minimize the issue of subjective judgement and to allow comparisons based upon an objective quality-scoring identically constructed across all cleaning contracts. Evaluation are made during 'contradictory controls', *i.e.* controls in the presence of the representative of the public buyer and the responsible for technical and administrative matters of the cleaning company, organized once per month. The contract holder is notified 48 hours in advance.[27]

The completion of the evaluation grid (called *quality control sheet*) leads to a final mark out of 100. This scoring then allows to contractually defined incentives mechanisms. Indeed, if the obtained mark is less than 80, a second contradictory control is planned 48 hours later and penalties are imposed to the contract holder. Those penalties increase if the mark obtained during the second control is still less than 80. The goal of such penalties is to provide coercive means

[27]It is important to note that such a delay does not enable the private operator to react by 'falsifying' the quality evaluation through a short-term effort just before the control. Indeed, a lot is composed by between 544 and 3.066 accommodations and controls are ran for random buildings. Furthermore, cleanliness is mainly derived from the length of effort over time and a short and intense burst of activity might be not sufficient to obtain a good evaluation.

at the disposal of the public buyer to enforce contractual specifications and, in case, to punish any breach of contractual obligations. Moreover, the public buyer is contractually authorized to impose penalties when the cleaning companies fail to fulfil their obligations in terms of mandatory documents supply. Finally, contracts also contain a cancellation clause that can be applied in the event of repeated failures and/or when accumulated penalties exceed a contractually predetermined threshold.

Regarding such contractual arrangements, one could imagine that the public buyer we study is well protected against opportunism. This is not what we observe in the data. As previously said, frequently imposed penalties, users' complaints, breach and early termination of contracts persist despite the use of open auctions, the definition of quality standards and the monitoring of the contract.

To tackle those problems, the public buyer has decided to modify its formal contracts in three directions. From the specification point of view, the new versions of the '*General Conditions*' and of the '*Guide of Special Techniques Specifications*' are more precise regarding the obligations of the operator. For instance, the contract describes more technically the way cleaning must be performed and includes a glossary of cleaning operations. From the monitoring point of view, the new contractual arrangement increases the level of details provided to the cleaner about how the evaluation is made and adds the possibility of unplanned and not contradictory controls by public agents. Finally, concerning incentives, the new contract adds new categories of penalty clauses and increases their amounts. Aside this formal transformation, the public buyer also decided to be more rigorous in the application of penalties. Table 2.5 (in the appendix) highlights all the differences between old (launched before April 2010) and new contracts (launched after April 2010).

Table 2.1: Descriptive statistics

Variable	Description	Mean	Std. dev.	Min	Max	N
$Quality_{ijt}$	Level of quality supplied by firm$i$ on lot$j$ at time$t$(from 0 to 100)	88.91	6.86	42.5	100	1382
$Observe_{ijt}$	Takes the value 1 if the $Quality_{ijt}$ was measured, 0 otherwise	0.61	0.49	0	1	2248
$NewDesign_{jt}$	Takes the value 1 if the contract for lot j is awarded after April 2010, 0 otherwise	0.56	0.50	0	1	2248
$Decision_t$	Takes the value 1 after the decision of the administrative court of Paris, *i.e.* after May 2009, 0 otherwise	0.78	0.42	0	1	2248
$Penalties_{ijt-1}$*	Overall value of penalties paid by firm i for lot$j$ at time *t-1* (in euros)	563.73	1 531.12	0	13 790	2195
$ControlFreq_{ijt-1}$*	Number of times the buyer controlled the quality supplied by firm$i$ on lot j at time *t-1* / Maximal number of times it could have done it	0.54	0.28	0	1	2195
$Price_{ijt}$	Winning bid of firm i at time$t$ for the fixed part of lot j, divided by the number of accommodations and by the number of months (in euros). This a unit price per month, per accommodation	13.48	3.57	8.94	31.91	102
$NbOffers_{jt}$	Number of offers for lot j at time t	6.23	2.90	1	14	102
$NbAccommodations_{jt}$	Number of accommodations for lot j at time t	1 846.167	593.76	544	3 066	102

* Variables built thanks to information related to periods from January 2008 through June 2008

3.3 Data

The public buyer we study organizes its cleaning activity by establishing a geographic allotment. Indeed, the buildings located in a same area correspond to a given lot j whose characteristics remain rather constant over time. It allows us to follow a lot over time and to assess whether different types of contract are associated with different quality levels. Over the period of 48 months we study (between July 2008 and June 2012), our unbalanced panel database[28] of 49 lots experimented a total of 102 contracts. More precisely, 45 lots have been renewed one time,[29] whereas 4 have been renewed two times. We know that these contracts are shared out among 13 firms and are managed by 6 different departments on the buyer's side (each department is in charge of a geographical area). We also have information regarding the monthly level of implemented quality, the controls fre-

[28]The panel database is unbalanced because some quality indicators are missing. Additional details are given when presenting the data. Additional econometric specifications are also run to deal with the biases this issue might generate.

[29]It means that we observe a lot through two different contracts and sometimes through two different suppliers

quency, the applied penalties, the tendering phase and the price of the contract. Summary statistics of our variables are presented in Table 2.1, whereas Table 2.6 (in the appendix) provides descriptive statistics when distinguishing variables before and after the change. We call panel A the 50 contracts launched before April 2010 and Panel B the 52 launched after this date.

3.3.1 Dependent variable

We are mainly interested in explaining the variable $Quality_{ijt}$. It measures the level of quality delivered by firm i on lot j at time t. As previously said, quality indicators are based on a scale of 0 to 100.[30] The average level of quality is 88.91, which is around 9 points beyond the threshold implying penalties. Quality scores of panel B are significantly higher of two points than panel A ($p < 0.01$).

Figure 2.1: Quality evolution over time

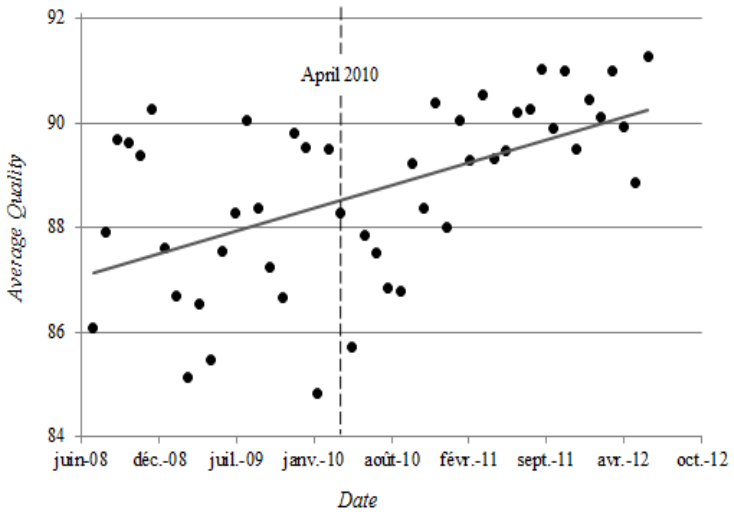


Figure 2.1 reports the average value of quality at each period and shows that $Quality_{ijt}$ significantly increased after April 2010. Since most of the on-going contracts belong to panel B after April 2010, this observation strongly corroborates

[30]This mark is communicated to the supplier, but is not a public information.

our intuition that the level of service quality increased after the modifications of the contract design.

3.3.2 Main independent variable

We want to assess the impact of contractual completeness on moral hazard. The precise information we have enables to disentangle a direct impact due to the new contract design from an indirect impact due to more efficient controls and penalties.

Contract design

We first constructed the variable $NewDesign_{jt}$, which is a binary variable taking the value 1 if the contract running on lot j at time t belongs to Panel B, 0 otherwise. This variable captures the exogenous shock affecting all the contracts launched from April 2010. As previously said, it resulted in specifying the contracts in more detail, in reinforcing the penalties clauses and in including a new procedure of control. We interpret those changes as an increase of contractual completeness. According to the literature on the endogenous verifiability, such change may increase contract enforceability. We may then expect a positive impact of the variable $NewDesign_{jt}$ on the level of service.

Controls

The variable $ControlFreq_{ijt-1}$ corresponds to the number of times the quality delivered by firm i on lot j at time t has been controlled, divided by the maximal number of times it could have been controlled. On average, it is equals to 0.54. It is higher in Panel A than in Panel B. It reflects that our buyer decreased controls frequency while reinforcing contractual requirements and imposing higher penalties. One interpretation would be a substitution effect between the greater amounts of penalties and the necessity to carry out assiduous controls. In other words, if the expanded threat of punishment disciplines firms, then regular controls are

less useful. We expect that a firm managing a frequently monitored contract (*i.e.* having a larger $ControlFreq_{ijt-1}$) feels more intensely under the scrutiny of the buyer, leading us to anticipate a positive impact of the variable $ControlFreq_{ijt-1}$ on our dependent variable.

Incentives

$Penalties_{ijt-1}$ is the second variable that accounts for contract monitoring. It corresponds to the full amount of penalties paid by firm i on lot j at time t. Around 731 additional euros per contract have been paid. When considering the contracts' size,[31] this amount is rather low and reflects that penalties are a least resort. Nevertheless, a significant difference of 150 euros of penalties distinguishes Panel A from Panel B, which sheds some light on our buyer's decision to reinforce the sanction mechanisms. This evolution appears even more clearly in Table 2.2 that summarizes the value of penalties paid each year by the cleaning contracts' suppliers. Since penalties account for small amounts and since reaching a fixed amount of penalties lead to a breach of the contract, we claim that it is the accumulated value of paid penalties that may have an incentive effect on the suppliers' decision to improve their current performances. We thus expect a positive impact of the variable $Penalties_{ijt-1}$ on $Quality_{ijt}$.

Table 2.2: Penalties per year

Year	2008	2009	2010	2011	2012**
Penalties*	21646,5	12347,4	37297,2	60641,5	20800,0

* in Euros ; ** until June

The variables $ControlFreq_{ijt-1}$ and $Penalties_{ijt-1}$ capture some heterogeneity regarding the contract monitoring. However, when the contract enforceability increases, we expect that monitoring firms' outcomes provides stronger incentive to deliver high quality. Therefore, $ControlFreq_{ijt-1}$ and $Penalties_{ijt-1}$ may have

[31] The final price of the contracts we study are made of two parts: a fixed part and a variable part; this last part depends on some buyer's needs which are unknown at the awarding stage. We only have precise information about the winning bid for the fixed part. It accounts for at least 70% of the final price and equals around 395 642 k€.

a larger impact after the change in contract design.

3.3.3 Control variables

We use additional controls to capture heterogeneity across contracts. Indeed, some dimensions like the degree of competition, the price or the scope of the contract can affect the level of delivered quality. The variables associated with these dimensions and their expected impacts on quality are described below.

Geographical allotment

Our variable $NbAccomodations_{jt}$ captures the number of accommodations which are included in lot j at time t. We indeed aim at exploiting the panel nature of our data by following a same lot over time. To correctly perform it, the lots have to remain stable. Nevertheless, we cannot rule out that our buyer will build, buy or sell buildings, therefore affecting the characteristics of the lots. The variable $NbAccomodations_{jt}$ enables to account those types of changes. Since our buyer allots its cleaning activity because he expects larger lots to be more difficult to manage, we suspect that the number of accommodations negatively impacts on the level of delivered quality.

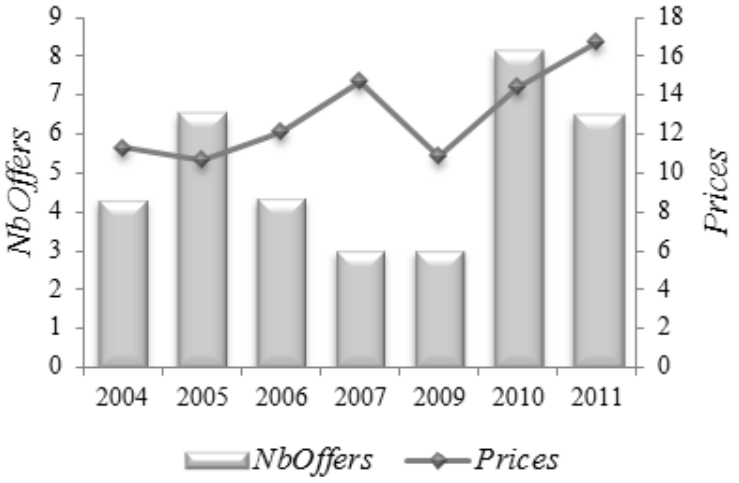
Competition

The variable $NbOffers_{jt}$ stands for the number of offers received by the buyer for lot j at time t. An increase in competition is supposed to be beneficial: it incites firms to reveal their private information and to lower their rents. However, more competition might also encourage aggressive bids at the expense of quality. Indeed, as previously underlined, asymmetries of information might allow firms to shirk on quality during the execution of the contract. Therefore, the impact of competition on quality in not consensual and hard to make out.

An additional difficulty is that the degree of competition is often considered

as an endogenous variable, *i.e.* a variable varying for unobserved reasons that also affect outcome variables (like quality).[32] So as to clarify the nature of the variable $NbOffers_{jt}$, Figure 2.2 describes the relationship between the number of offers and the year the contract is awarded. All the contracts starting from 2010 include the new design. We can see that the number of offers tends to increase in 2010 and 2011. Although it seems surprising that strengthening the contract design generates a boom in the number of potential suppliers, practitioners argue that this change sent to firms the signal that the buyer was unsatisfied with its current main suppliers and aimed at finding new performing firms. This signal may have renewed the set of interested firms, creating a chock on the degree of competition. If this increase in competition actually enabled to renew the set of suppliers (19% of the contracts launched in 2010 are awarded to new firms) by attracting performing firms, adverse selection might have been reduced. However, if more competition ended up in encouraging aggressive bids, it may have resulted in damaging quality. Finally, the variable $NbOffers_{jt}$ is problematic for two reasons: its impact on quality is hard to anticipate and we don't know whether we should consider it as an independent variable.

Figure 2.2: Number of offers and prices evolution over time



[32]See, e.g., Coviello and Mario Mariniello [2012] or Amaral et al. [2013]

Prices

We finally built the variable $Price_{ijt}$ which corresponds to the bid of the winning firm i for lot j at time t divided by the number of accommodations. This variable imperfectly captures the competitiveness of the winning offers.[33] Although bids competitiveness might signal firms' efficiency, low prices might also reflect a strategic or a naive behaviour of candidates.[34]

In addition, for the same grounds as those put forward when presenting the variable $NbOffers_{jt}$, the variable $Price_{ijt}$ is likely to be endogenous. Once again, we try to clarify it by analysing its evolution over time (see Figure 2.2). We can see that winning bids tend to increase from 2010. Thus, it seems that the new contract design is associated with less competitive bids: firms would compensate the costs they incur to fulfil the increasing expectations of the buyer by posting higher prices. Even though the potential trade-off between price and quality is a matter of concern in this paper, considering $Price_{ijt}$ as an independent variable that impacts on the delivered quality may be an issue.

Outcome variables

We have to decide about whether introducing $NbOffers_{jt}$ and $Price_{ijt}$ as control variables. On the subject of 'bad controls', Angrist and Pischke [2008] (p.64, chap. 3) give the following reasoning:

"*Some variables are bad controls and should not be included in a regression model even when their inclusion might be expected to change the short regression coefficients. Bad controls can be defined as variables that are themselves outcome variables in the notional experiment at hand. Consequently, bad controls might just as well be dependent variables too. On the other hand, good controls are variables that we can think of as having been fixed at the time the regressor of interest was*

[33] As previously mentioned, the final price of the contract are made of a fixed part and a variable part. The variable $Price_{ijt}$ is built thanks to information we have about the winning bid for the fixed part, which accounts for at least 70% of the final price.

[34] 'Naive behaviour' refers to the winner's curse issue (see, *e.g.*, Hong and Shum [2002a]).

determined".

On the one hand, the price and the degree of competition may have been affected by the change in contract design. They could be considered as outcome variables. On the other hand, $NbOffers_{jt}$ and $Price_{ijt}$ are fixed before the quality delivering. We could thus decide to use them as control variables. However, we can reasonably assume that prices and (at least, part of) the quality are simultaneously determined by the agent at the awarding stage. We do not have this problem with the number of offers: it is fixed before the delivering of quality and it results from rival's decisions. As a consequence, we decide to use $NbOffers_{jt}$ as a control variable and $Price_{ijt}$ as an outcome variable; we separately explore the determinants of the latter variable in a second step of our analysis.

3.4 Models specifications

We are interested in assessing whether better specified contracts enable to improve the level od quality. We can investigate this question because the buyer we study built the quality indicator $Quality_{ijt}$. Therefore, we first estimate the following model (1):

$$Quality_{ijt}=\beta_1+\beta_2.NewDesign_{jt}+\beta_3.Y_{jt}+W_j+\epsilon_{ijt} \quad (1)$$

where $NewDesign_{jt}$ is our first main variable of interest capturing the change in the formal contract, Y_{jt} is a vector of variables capturing the characteristics of the lot j at time t. We abstract unobservable biases due to the nature of the lots by adding lot fixed effects (W_j). This first model is a simple "before-after" estimation: it assesses the impact of the switching from panel A to panel B. Since our main goal is to investigate the impact of new contracts on moral hazard issues, we second run a model with firm fixed effects, Z_i:

$$Quality_{ijt}=\beta_1+\beta_2.NewDesign_{jt}+\beta_3.Y_{jt}+W_j+Z_i+\epsilon_{ijt} \quad (2)$$

Equation (2) enables to have a more conservative estimation regarding the impact of the new contract design on moral hazard issues. Indeed, if the coefficient associated to the variable $NewDesign_{jt}$ decreases when switching from equation (1) to equation (2), it means that part of the increase in quality comes from the selection of more efficient firms. In equation (2), the variable $NewDesign_{jt}$ only captures some changes in the level of quality that are related to moral hazard issues. Then, we can disentangle the impact of the formal contract itself from the frequency of the controls and the penalties by running a third model with the vector X_{ijt}=($ControlFreq_{ijt-1}$, $Penalties_{ijt-1}$):

$$Quality_{ijt}=\beta_1+\beta_2.NewDesign_{jt}+\beta_3.Y_{jt}+\beta_4.X_{ijt-1}+W_j+Z_i+\epsilon_{ijt} \quad (3)$$

Finally, we also run a fourth model to test whether the formal contract determines the efficiency of the controls and the applied penalties. To do so, we add an interaction term between the variable $NewDesign_{jt}$ and the demeaned value of the variables related to contract enforcement ($\widehat{X}_{ijt} = X_{ijt}$-$\bar{X}_{ijt}$).[35] We obtain the last following equation:

$$Quality_{ijt}=\beta_1+\beta_2.NewDesign_{jt}+\beta_3.Y_{jt}+\beta_4.X_{ijt-1} + \beta_5.(NewDesign_{jt}*\widehat{X}_{ijt-1})+W_j+Z_i+\epsilon_{ijt} \quad (4)$$

In this model, while the vector of coefficients β_4 captures the influence of controls and penalties before the changes in contract design, β_5 captures their

[35]See pages 68-69 of chapter 4 in Wooldridge [2001] for the explanation regarding the construction of the interaction term.

influence after the change. Moreover, demeaning the variables X_{ijt} in the interaction term enables to assess the marginal impact of penalties and controls after the change in contract design.

4 Results

4.1 The determinants of quality

Table 2.3 exhibits our baseline results for the effect of the contractual completeness on quality enforcement. In Model 1, which is a simple before-after, we find that the change in contract design has a significant and positive impact on quality. When switching from Model 1 to Model 2, we add firms fixed effects. The coefficient associated to the variable $NewDesign_{jt}$ slightly decreases. We interpret it to be a sign that the reduction of moral hazard issue is the main driver of the quality improvement.

Table 2.3: How to implement quality?

	Model 1 $Quality_{ijt}$	Model 2 $Quality_{ijt}$	Model 3 $Quality_{ijt}$	Model 4 $Quality_{ijt}$
$NewDesign_{jt}$	2.526***	2.006***	2.104***	1.433*
	(0.605)	(0.721)	(0.709)	(0.738)
$ControlFreq_{ijt-1}$			1.529+	-4.283***
			(0.959)	(1.494)
$NewDesign_{jt} * \hat{ControlFreq}_{ijt-1}$				8.601***
				(1.813)
$Penalties_{ijt-1}$			0.000	-0.000+
			(0.000)	(0.000)
$NewDesign_{jt} * \hat{Penalties}_{ijt-1}$				0.001***
				(0.000)
$NbOffers_{jt}$	0.063	0.018	0.088	0.062
	(0.159)	(0.196)	(0.199)	(0.196)
$NbAccommodations_{jt}$	-0.002***	-0.001	-0.001	-0.002+
	(0.001)	(0.001)	(0.001)	(0.001)
$Constant_{ijt}$	91.332***	85.040***	83.855***	88.308***
	(1.505)	(2.288)	(2.474)	(2.696)
Lot	Yes	Yes	Yes	Yes
Firm		Yes	Yes	Yes
N	1359	1359	1359	1359
$Adj - R2$	0.21	0.24	0.24	0.25

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

We then add the variables $ControlFreq_{ijt-1}$ and $Penalties_{ijt-1}$ in Model 3.

The coefficient associated with the variable $NewDesign_{jt}$ remains positive and significant. It corroborates the central idea of the paper: improving the contract details reduces the suppliers' temptation to shirk on quality. In other words, the formal contract itself acts as a discriminating devise.

However, in Model 3, we do not find that the variables related to the *ex post* monitoring influence the level of quality. By distinguishing their respective impact before and after the change in contract design, model 4 allows to further investigate this result. In model 4, we indeed see that the formal contract itself has a sizeable influence on the efficiency of the *ex post* monitoring : our specification exhibits a negative effect of $ControlFreq_{ijt-1}$ and $Penalties_{ijt-1}$ before the change in contract design, whereas their effect becomes positive and significant after the change in contract design.

In addition, although the degree of competition does not influence the delivered quality, we unsurprisingly find that smaller lots are associated to higher performances.

4.2 Robustness checks

4.2.1 Testing selection bias

Quality control should be done on a monthly basis but the examination of the data reveals that controls are not always performed. As a consequence, our dataset suffers from missing information corresponding to situations in which controls were not made. Since the decision to make a control is highly decentralized, left to the caretaker's discretion, whose motives are hard to make out, the reasons we may invoke to justify this sample selection are multiple. Therefore, the way this sample selection affects our estimates is difficult to anticipate.

The variable $Observe_{ijt}$ is a dummy variable: it takes the value one if the quality is controlled, 0 otherwise. It indicates that $Quality_{ijt}$ was not measured in 39% of all cases. This sample selection is important and could therefore bias our estimates. In order to tackle this issue, we can use a two-step heckman method [Heckman, 1979]. Provided that we achieve to explain why quality is observed or not, it enables to extrapolate the missing quality indicators as if they would have been observed. Thereafter, the model indicates whether the bias due to sample selection is severe and it accounts for the bias effect both on the dependent and on the independent variables.

The first step of the procedure corresponds to the selection equation which models the probability of being observed. The second steps corresponds to the corrected outcome equation: it explains the level of quality, given it is observed. However, to be over-identified, the model requires at least one instrument to be included in the first step but not in the second step. This variable must be correlated with the variable $Observe_{ijt}$ (instrument relevance condition), but not with any unobservable that could influence the variable $Quality_{ijt}$ (exclusion restriction condition).

We suspect $ControlFreqOthers_{ijt-1}$ to be a valid instrument. It measures the rate of control at (t-1) on a sub-sample of observations. This sub-sample is made of all the observations related to the period (t-1) with the exception of both the observations related to the firm i and the observations related to the department managing lot j.[36] Regarding the relevance condition, we assume that people having both the same job and the same employer may observe and influence each others, through a spillover effect. This way, we overcome the lack of clarity regarding caretaker's motives to perform controls by considering that, on average, they may share the same motives on the short term: one caretaker's diligence to

[36]To calculate the value of the variable $ControlFreqOthers_{ijt-1}$, we look at the total number of control performed at *t-1* (in the other departments and with the other firms) and we divide this number by the total number of controls that could have been performed at *t-1* (in the other departments and with the other firms).

carry out a control depends on the observation of the others caretaker's diligence, which is captured through their control rate at (*t-1*). So as to respect the exclusion restriction, we build our instrument on a sub-sample of observations: we exclude those which are likely to be correlated with the unexplained performances of firm i on lot j at time t. Thus, the sub-sample excludes the observations related to firm i and those related to the department managing lot j. Indeed, a firm is likely to observe the past controls frequency of its territorial department and/or the past controls frequency of its other ongoing contracts: this information may influence its behaviour. [37] On the contrary, this firms should not be aware, at least in the short term, of the caretakers' propensity to perform controls in the other departments regarding the other firms: this is true assuming that firms do not communicate among each other on a highly regular basis. As a consequence, this private information of the caretaker should not influence a firm's incentives toward quality. Moreover, this private information should also not influence the firms' rating which is based on objective criteria.

Results of the two-step Heckman estimates are presented in Table 2.8 in the appendix. Whatever the specification, we can see that our instrument is significant ($p < 0.01$), satisfying the relevance condition. The variable *Lambda* captures the impact of the first stage on the second stage. Given that *Lambda* is negative and sometimes significant, we conclude that the probability of being observed is higher when the quality is lower, validating the existence of a sample selection bias. However, our main findings remain extremely stables. There is one notable change in model 8: the coefficient associated with the variable $NewDesign$ slightly decreases. Since this model does not seem to be significantly affected by the sample selection (*Lambda* is no more significant), model 4 might be more relevant than model 8 to estimate equation (4).

[37] For instance, a firm may be more prone to increase the quality of service if it observes that the caretakers tend to increase their controls.

4.2.2 Testing shock exogeneity

As previously mentioned, the modification of the contract design by the public buyer is not an *ex nihilo* decision. On the contrary, it is a reaction to a judicial decision of the administrative court of Paris in June 2009 (see Figure 2.3 that reports the timing of the events).

If ever this court' s decision impacted on the buyer's and/or firms' behaviors, we may fear of not having a quasi-natural experiment. To check that, we replicate our estimates by including the variable $Decision_t$ which is a dummy variable taking the value 1 after May 2009. Results are presented in Table 2.9 in the appendix. Whatever the specification, we can see that the decision has no impact neither on the buyer's propensity to observe the quality, nor on the level of delivered quality: parties did not adapt their behavior to this decision. Moreover our results still remain perfectly stable and confirm that the average level of quality clearly depends on the change in contract design and its enforcement, not on the decision of the court. It corroborates what we observe on Figure 2.1.

4.3 Prices and rent-seeking

To complement our analysis, we explore the determinants of prices. In particular, we want to assess whether the new contract design had a significant impact on prices, *i.e.* whether the public buyer has to arbitrate between price and quality. Therefore, we estimate the following equation:

$$Price_{ijt}=\beta_1+\beta_2.NewDesign_{jt}+\beta_3.PriceIndex_t+\beta_4.Y_{jt}+W_j+Z_i+\epsilon_{ijt}$$

This estimation allows to assess the impact of the change in contract design, given the nature of the lot (we add the lot fixed effects, W_j) and the degree of competition. We also aim at disentangling the impact of the identity of the supplier i from the impact of the change in contract design. However, since we run our estimations on a (rather small) sample of 102 contracts, we cannot simultaneously add lot and firm fixed effects. We address this issue by testing various specifications: each one includes a specific category of fixed effects. This strategy still allows to test whether results are stable across specifications.

Since the contracts we study have been awarded between 2004 and 2011, we are likely to observe a price increase, not because of the new contract design, but because of a general price increase in the sector (which is partially collinear to the variable $NewDesign_{jt}$). To address it, we also include a price index of cleaning services: we collected it on the website of the French National Institute of Statistics (the "INSEE") and call it $PriceIndex_t$.

Table 2.4: Prices (bids) and change in contract design

	Model 13 $Price_{ijt}$	Model 14 $Price_{ijt}$	Model 15 $Price_{ijt}$
$NewDesign_{jt}$	2.203	5.579	0.253
	(2.898)	(3.898)	(3.459)
$NbOffers_{jt}$	-0.706***	-0.469**	-0.733***
	(0.181)	(0.198)	(0.190)
$NbAccommodations_{jt}$	-0.001	-0.001	-0.001
	(0.001)	(0.002)	(0.001)
$PriceIndex_t$	0.155	-0.098	0.226
	(0.128)	(0.169)	(0.178)
$Constant_{ijt}$	1.196	26.947	-5.142
	(13.587)	(20.161)	(18.138)
Lot		Yes	
Firm			Yes
N	102	102	102
$Adj-R2$	0.34	0.49	0.38

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

Results of estimates are presented in Table 2.4. The number of offers has the expected impact and is line with previous results from the literature that more competition attracts lower bids. Moreover, we find that the new design has no significant impact on the received prices, whatever the specification we consider. It highlights the previous existence of rent-seeking behaviors from cleaning operators

which actually have sufficient leeway to increase quality without raising bids.

5 Conclusions

The results we obtain in this study show that reducing contractual incompleteness enables to significantly reduce moral hazard issues, through direct and indirect effects. Indeed, while more complete contracts are associated with lower moral hazard, they also enable to increase the incentive power of controls and penalties processes.

In addition, we find that this improvement does not necessarily result in a significant increase in prices. It validates the idea that asymmetries of information result in rent-seeking behaviours that can be diminished by providing the good incentives.

The solution we provide is appropriated for standard transactions. However, for single-use contracts, bearing the costs of reducing contractual incompleteness might be irrelevant. Consequently, this paper also has important message concerning the way outsourcing public services is organized in the European Union. As illustrated by the previously mentioned decision of the administrative court of Paris, European rules in public procurement do not allow to take past experiences and reputation into account. While this obligation increases transparency and thus, limits abuses in discretion with public funds, it still appears as being insufficient to systematically obtain the best value for money. Drawbacks come from the fact that those rules only put the emphasis on the awarding process, which ensures, under rarely gathered conditions, an efficient contract execution. In the end, when awarding custom made contracts, public managers still have to find a way to address the issue of contractual incompleteness and contract enforcement.

6 Appendix

Table 2.5: Old *versus* new contract design

	Panel A Old contract	Panel B New contract
Tasks descriptions and contractual requirements	62 tasks and 3 levels of frequency (daily, weekly, monthly)	118 tasks and 6 levels of frequency (daily, weekly, monthly, quarterly, semi-annual, annual)
Evaluation for quality	Unchanged	
Performance obligations	Unchanged	
Mandatory documents	Unchanged	
Controls	Contradictory controls (once per month / at the discretion of the public buyer)	Contradictory controls (once per month / at the discretion of the public buyer) + **Unplanned and not contradictory controls** (at the discretion of the public buyer)
Penalties	60 euros if quality score < 80 / 300 euros if the 2nd following quality score is still < 80	**3 %** of the price (fixed part) if quality score < 80 / **6 %** of the price (fixed part) if the 2nd following quality score is still < 80 + **new penalties** for late delivery of mandatory documents

Table 2.6: Sample comparisons

Variable	Panel A	Panel B	t-test*
$Quality_{ijt}$	87.75	89.90	0.0000
$Observe_{ijt}$	0.64	0.60	0.0526
$Penalties_{ijt-1}$	495.64	620.59	0.0569
$ControlFreq_{ijt-1}$	0.64	0.45	0.0000
$Price_{ijt}$	12.31	14.61	0.0009
$NbOffers_{jt}$	4.36	8.02	0.0000
$NbAccommodations_{jt}$	1 839.82	1 852.269	0.9163

* P-value of the difference between means

Table 2.7: Matrix of correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) $Quality_{ijt}$	1								
(2) $Observe_{ijt}$	0	1							
(3) $NewDesign_{jt}$	0.157	-0.0409	1						
(4) $Decision_t$	0.0902	-0.0201	0.601	1					
(5) $Penalties_{ijt-1}$	0.0211	-0.0430	0.0407	0.0934	1				
(6) $ControlFreq_{ijt-1}$	0.0328	0.376	-0.334	-0.188	-0.00336	1			
(7) $Price_{ijt}$ t	0.154	-0.0301	0.299	0.173	0.0809	-0.125	1		
(8) $NbOffers_{jt}$	0.0993	-0.0512	0.629	0.378	-0.0856	-0.272	-0.152	1	
(9) $NbAccommodations_{jt}$	-0.0420	0.0131	0.0222	-0.0202	0.0267	0.000128	-0.0999	-0.0450	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 2.3: Timing of the events

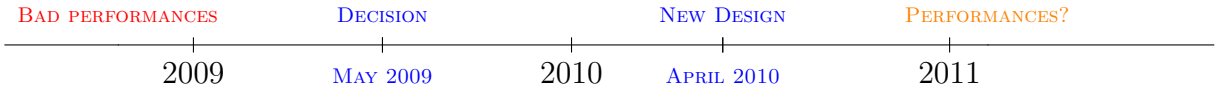


Table 2.8: Dealing with sample selection

	Model 5 $Quality_{ijt}$	Model 6 $Quality_{ijt}$	Model 7 $Quality_{ijt}$	Model 8 $Quality_{ijt}$
$NewDesign_{jt}$	2.187***	1.655**	1.685**	1.184+
	(0.611)	(0.688)	(0.713)	(0.734)
$ControlFreq_{ijt-1}$			0.540	-5.192***
			(1.061)	(1.643)
$NewDesign_{jt} * \hat{ControlFreq}_{ijt-1}$				9.238***
				(1.818)
$Penalties_{ijt-1}$			0.000	-0.000
			(0.000)	(0.000)
$NewDesign_{jt} * \hat{Penalties}_{ijt-1}$				0.001***
				(0.000)
$NbOffers_{jt}$	0.128	0.074	0.116	0.076
	(0.133)	(0.161)	(0.164)	(0.163)
$Nb\_Accommodations_{jt}$	-0.002***	-0.001	-0.001	-0.002+
	(0.001)	(0.001)	(0.001)	(0.001)
$Constant_{ijt}$	88.576***	87.731***	86.836***	91.324***
	(1.387)	(2.333)	(2.603)	(2.802)
	$Observe_{ijt}$	$Observe_{ijt}$	$Observe_{ijt}$	$Observe_{ijt}$
$ControlOthers_{ijt-1}$	2.616***	2.681***	2.481***	2.768***
	(0.162)	(0.165)	(0.174)	(0.180)
$NewDesign_{jt}$	0.374***	0.460***	0.526***	0.651***
	(0.110)	(0.124)	(0.127)	(0.130)
$ControlFreq_{ijt-1}$			0.656***	2.303***
			(0.170)	(0.277)
$NewDesign_{jt} * \hat{ControlFreq}_{ijt-1}$				-2.550***
				(0.335)
$Penalties_{ijt-1}$			-0.000	-0.000
			(0.000)	(0.000)
$NewDesign_{jt} * \hat{Penalties}_{ijt-1}$				-0.000
				(0.000)
$NbOffers_{jt}$	-0.088***	-0.093***	-0.085***	-0.107***
	(0.023)	(0.029)	(0.030)	(0.031)
$Nb\_Accommodations_{jt}$	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
$Constant_{ijt}$	-0.439	-0.506	-0.895*	-2.049***
	(0.312)	(0.488)	(0.501)	(0.537)
Lambda	-1.923**	-1.873**	-1.726**	-0.861
	(0.775)	(0.746)	(0.815)	(0.753)
Lot	Yes	Yes	Yes	Yes
Firm		Yes	Yes	Yes
N	1359	1359	1359	1359

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

Table 2.9: Testing for the exogeneity of the change in contract design

	Model 9	Model 10	Model 11	Model 12
	$Quality_{ijt}$	$Quality_{ijt}$	$Quality_{ijt}$	$Quality_{ijt}$
$Decision_t$	0.310	0.297	0.233	0.591
	(0.499)	(0.497)	(0.500)	(0.499)
$NewDesign_{jt}$	2.014***	1.497**	1.562**	0.877
	(0.670)	(0.738)	(0.759)	(0.777)
$ControlFreq_{ijt-1}$			0.529	-5.319***
			(1.062)	(1.645)
$NewDesign_{jt} * \hat{ControlFreq}_{ijt-1}$				9.341***
				(1.820)
$Penalties_{ijt-1}$			0.000	-0.000+
			(0.000)	(0.000)
$NewDesign_{jt} * \hat{Penalties}_{ijt-1}$				0.001***
				(0.000)
$NbOffers_{jt}$	0.129	0.075	0.115	0.070
	(0.133)	(0.161)	(0.164)	(0.163)
$NbAccommodations_{jt}$	-0.002***	-0.001	-0.001	-0.002+
	(0.001)	(0.001)	(0.001)	(0.001)
$Constant_{ijt}$	88.272***	87.457***	86.655***	90.936***
	$Observe_{ijt}$	$Observe_{ijt}$	$Observe_{ijt}$	$Observe_{ijt}$
$Decision_t$	0.007	-0.011	0.006	0.019
	(0.091)	(0.091)	(0.093)	(0.097)
$ControlOthers_{ijt-1}$	2.616***	2.681***	2.481***	2.769***
	(0.162)	(0.165)	(0.174)	(0.180)
$NewDesign_{jt}$	0.371***	0.466***	0.523***	0.641***
	(0.120)	(0.134)	(0.136)	(0.139)
$ControlFreq_{ijt-1}$			0.656***	2.305***
			(0.170)	(0.277)
$NewDesign_{jt} * \hat{ControlFreq}_{ijt-1}$				-2.552***
				(0.335)
$Penalties_{ijt-1}$			-0.000	-0.000
			(0.000)	(0.000)
$NewDesign_{jt} * \hat{Penalties}_{ijt-1}$				-0.000
				(0.000)
$NbOffers_{jt}$	-0.088***	-0.093***	-0.085***	-0.107***
	(0.023)	(0.029)	(0.030)	(0.031)
$NbAccommodations_{jt}$	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
$Constant_{ijt}$	-0.446	-0.494	-0.901*	-2.067***
	(0.326)	(0.497)	(0.510)	(0.545)
Lambda	-1.928**	-1.874**	-1.741**	-0.906
	(0.775)	(0.746)	(0.816)	(0.753)
Lot	Yes	Yes	Yes	Yes
Firm		Yes	Yes	Yes
N	1359	1359	1359	1359

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

Part II

Discretion in public procurement

Chapter 3

Discretion and Efficiency in Public Procurement: Evidence from France*

1 Introduction

Public procurement is an important part of a developed country's economy [European Commission, 2008]. Improving procurement efficiency should therefore be high on a legislator's agenda. In this respect, the European Commission adopted its new proposals aiming at modernising public procurement legislation at the end of 2011. These proposals include the revision of the 2004/18/EC Directive. In particular, they suggest improving "the flexibility of procurement to better respond to purchasing needs of authorities" by allowing public buyers broader use of negotiated procedures with publication [European Commission, 2011c].

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In 2004, a reform of the French Public Procurement Code (the Code, hereinafter) introduced and widened the possibility for public buyers to use negotiated procedures with publication up to around 5,000,000€.[38] These procedures consist of an open auction followed by a multilateral negotiation phase. However, their impact on procurement efficiency is still to be assessed. While, according to the European Commission, this procedure should allow public buyers to get a "better match between their desired procurement outcome and solutions offered by the market" as well as a decreased probability of collusive practices between bidders, some drawbacks are still highlighted [European Commission, 2011c]. In particular, this procedure may increase the risk of favouritism and corruption and is thought of being "less efficient in generating savings than the open and restricted procedures" [European Commission, 2011c]. These pro-auction and pro-negotiation arguments from the European Commission reflect the still open debate in the economic literature concerning their relative efficiency.[39]

In this paper, we aim at empirically assessing the potential benefits of these negotiated procedures with publication on efficiency. We study the impact of using such procedures on the amounts of the received bids as well as on the amount of the winning bid and on the total costs of the contract (*i.e.* including the amounts renegotiated). The effect of using negotiated procedures on the probability of renegotiating the contract is also assessed. Their impact is compared with that of the open auction, the most frequently used procedure at the European level [European Commission, 2009]. The implications will be twofold. First, we intend to contribute to the ongoing debates in the economic literature surrounding the efficiency of alternative tendering procedures. Second, we aim at finding out whether this new proposed reform of the European Commission is going in the right direction and therefore provide strong public policy recommendations.

In order to do so, we have constructed an original database using information

[38] See Table in Section 3 for the successive thresholds between 2001 and 2010.
[39] See Section 2 for details on the "auction vs. negotiation" debate.

on 427 public-work contracts tendered by Paris Habitat-OPH, the largest social housing constructor in Europe, between January 2004 and December 2009. We have gathered data on every construction contract available and fulfilled at the time of coding. Available information includes, for each contract, the type of awarding procedure used, the estimated contract costs and duration, the number of candidates and bidders, the amounts of received bids as well as their technical grades and the total amounts renegotiated.

Following recommendations of the European Commission, all studied contracts are awarded to the best offerer (*i.e.* according to both price and quality of technique criteria). Our primary interest is on the effect of negotiated procedures on prices. To compare the prices of offers while keeping the level of technical valuation constant, some of our estimations include two indicators designed by our public buyer and capturing the technical quality associated with each offer. We also deal with a classical challenge of endogeneity, due to a potential omitted variable bias. Indeed, we suspect not being able to isolate some dimensions related to the complexity of the transaction. This complexity might influence both the decision to use a negotiated procedure and the competitiveness of the received offers. We use some exogenous changes in the environment of the public buyer to build instruments.

After dealing with the endogeneity issue, we show that the use of negotiated procedures has a significant negative impact on the amounts of the received bids as well as on the the total cost of the contract, though the latter result is less significant. We also find evidence that negotiated procedures decrease the probability of renegotiating the contracts. We argue that negotiated procedures enable public buyers to benefit from both the competitive effect of open procedures and the dissipation of uncertainty that occurs during the negotiation phase. In addition, we suspect that collusive behaviours, in particular those making use of complementary bids, may be more difficult to sustain when negotiated procedures are used as bidders may be asked to justify any part of their offers during the negotia-

tion phase. This argument is supported by simple statistical tests using Benford's Law. Finally, in accordance with Amaral et al. [2009], we believe that part of the positive effects we observe was made possible by the transparency-enhancing reforms that took place simultaneously with the introduction of these negotiated procedures and that may have played a great role in limiting abnormal behaviours of public buyers.[40] Practical implications of these results for public policies are then discussed.

This paper is organised as follows. Section 2 presents the debates of the economic literature on the potential advantages and drawbacks of negotiated procedures. The ongoing debates prevent us from making clear-cut predictions regarding the outcomes of this study. A discussion of the institutional framework as well as its recent changes is available in Section 3. In Sections 4 and 5, we respectively present our buyer's practices and the data we have gathered. Our empirical methodology and results are exposed in Section 6. Section 7 discusses the results. A final section concludes with practical implications for public policies.

2 The Auction vs. Negotiation Debate

A common view in the economic literature is that more competition is always desirable as it gives strong incentives to firms to be efficient and to reveal their private costs [Bulow and Klemperer, 1996]. Moreover, open auctions are considered to be the most transparent procedure and thus less sensitive to corruption or favouritism. These beliefs widely explain why they are often the only available mechanism to award large contracts in public procurement.[41] However, some recent contributions pin down their limits: competitive incentives may not always be sufficient to reach procurement efficiency and the rigidities of open auctions would sometimes generate more costs than benefits. When dealing with complex

[40] Examples of these transparency-enhancing reforms are available in Section 3.
[41] In particular, this is the case in French Public Procurement (as discussed in Section 3).

transactions, buyers may indeed have difficulties in precisely specifying their needs: this leads to incomplete contracts which may give rise to costly *ex post* adaptations [Bajari and Tadelis, 2001]. In these cases, more flexible procedures such as negotiated procedures should therefore be preferred to open auctions. Moreover, *ex post* adaptations also impact the *ex ante* stage. Indeed, using procurement data from Caltrans, Bajari et al. [2013] show that bidders anticipate when adaptations will be required at the execution stage. In order to compensate for this uncertainty, candidates extract a higher rent at the bidding stage. With these results in mind, negotiated procedures are also suspected to be more suitable, as the negotiation phase would reduce the degree of uncertainty regarding the execution of the contract.

Benefiting from the positive aspects of negotiated procedures still requires some conditions to be fulfilled. These conditions highly rely on the behaviour of the organisers of public procurement when tendering contracts. There are at least two main conditions to be fulfilled. First, in theory, public buyers should align the procurement mode on the characteristics of the transaction: negotiations should be used when contracts are complex. This alignment is observed for private buyers [Bajari et al., 2009]. However, politicians and bureaucrats - the two main actors in the organisation of public procurement - may either voluntarily or involuntarily fail to choose the right procedure for a given project. Chong et al. [2013b] actually show that French mayors do not properly align the awarding procedure on the transaction's characteristics (they tend to favour open auctions even for complex contracts). The authors attribute this misalignment to the fear of being suspected of favouring some firms [Spiller and Moszoro, 2012]. Thus, to avoid being discredited by a third-party, French public authorities would tend to routinely favour more traditional and consensual procedures - like open auctions - instead of using procedures inspired by the private sector. In addition, the tendency of the public sector to use rigid rules [Bozeman, 1993; Pandey and Scott, 2002], may explain bureaucrat's misalignment of the procedure with the characteristics of the

transaction. This functioning, which is supposed to prevent abuse of public funds, should lead to a greater tendency of bureaucrats towards conservatism and hence a lower probability of adopting new procurement tools such as negotiated procedures. Second, high transparency and accountability of public buyers should be enforced so as to prevent corruption. Indeed, politicians and bureaucrats may be corrupted (or may favour some firms) and try to influence the selection of the supplier so as to obtain personal benefits [Coviello and Gagliarducci, 2010; Hyytinen et al., 2009]. Since negotiations increase *ex ante* communication between parties and generate some opacity, they may help to sustain these types of strategies. If the use of negotiated procedures leads to a higher level of favouritism or corruption, then the benefits associated with such procedures may be much lower than expected.

Notwithstanding these obstacles, the empirical literature provides several studies on the efficiency of alternative procedures. Using data from the railway industry in Germany and after controlling for the endogeneity of the choice of procurement mode, Lalive and Schmutzler [2011] show that the use of open auctions is more efficient than direct negotiations with the former supplier. Open auctions increase, on average, the frequency of the service by 16% and decrease the procurement price by 25%. Closer to our subject, Thomas and Wilson [2002] experimentally find multilateral negotiations to be more efficient than auctions with four sellers (*i.e.* four firms in the case of public procurement) and equivalent to auctions with only two sellers. This study is corroborated by Vellez [2011] who also finds that multilateral negotiations decrease prices by close to 25% compared to open auctions and that these benefits increase with the number of bidders.

With respect to the aforementioned studies, our paper distinguishes itself for several reasons. In contrast to Lalive and Schmutzler [2011] who analyse direct negotiations with the former supplier, we study the effect of multilateral negotiations. With the widening of the possibility of using negotiated procedures included in the forthcoming procurement Directive of the European Commission, multilat-

eral negotiations are likely to become a more and more frequently used tool in public procurement. Moreover, our study also differs from that of Vellez [2011] since we deal with the endogeneity issue associated with the choice of using multilateral negotiations. In particular, we use a two stage least squares technique with instruments based on exogenous sources of variation in the environment of public procurement organisers. We also consider the impact of negotiated procedures on *ex post* renegotiations using two outcome variables (the total cost of the contract and the probability of renegotiations). Finally, to the best of our knowledge, our study is the first to include indicators of the technical quality associated with each offer. These indicators, created by our public buyer, enable us to appreciate the price of each bid holding quality constant.

3 Institutional Framework

French public buyers have to follow the Code. Its constitutional principles are invariant and written in the first article of the Code since 2001.[42] Yet, major changes to the Code have occurred during the last decade, encouraged by European legislation (Directive 2004/18/EC). They notably concern the allowed awarding procedures and they globally bring more and more freedom to public buyers in the organisation of their purchases, particularly regarding work contracts. The evolutions regarding the possibility of using the various types of procedures and the dates of the threshold changes are reported in Table 3.1.[43]

A first major change is the tendency to reduce formalism. The allowed awarding procedures can indeed be divided into two groups, the formalised procedures and the non-formalised procedures; the area of the non-formalised procedures having clearly been enlarged, especially for work contracts. These non-formalised

[42]These constitutional principles are: freedom of access to public contracts, equal treatment of the candidates and transparency of the procedure.

[43]Note that open auctions are still available below the thresholds presented in Table 3.1. However, they are mandatory above these reported values.

Table 3.1: Successive thresholds between 2001 and 2010

Date of change	Possibility of using non-formalised procedures	Possibility of using formalised procedures with a negotiation phase	Open auctions (formalised procedure)
Before March 2001	$< 38\ 200$€	-	$> 38\ 200$€
March 2001	$< 90\ 000$€	-	$> 90\ 000$€
January 2004	$< 230\ 000$€	$> 230\ 000$€ and $< 5\ 900\ 000$€	$> 5\ 900\ 000$€
January 2005	$< 210\ 000$€	$> 210\ 000$€ and $< 5\ 270\ 000$€	$> 5\ 270\ 000$€
January 2008	$< 206\ 000$€	$> 206\ 000$€ and $< 5\ 150\ 000$€	$> 5\ 150\ 000$€
December 2008	$< 5\ 150\ 000$€	$< 5\ 150\ 000$€	$> 5\ 150\ 000$€
January 2010	$< 4\ 845\ 000$€	$< 4\ 845\ 000$€	$> 4\ 845\ 000$€

procedures enable the public buyer to adapt some key-dimensions of the procedure to its needs but also to add a negotiation phase. Conversely, formalised procedures are strictly defined and no adaptation is possible. Before 2001, formalised procedures were mandatory as soon as the estimated value of the contract reached 38 200€. For work contracts, this threshold reached 90 000€ after the 2001 reform, 230 000€ after the 2004 reform and 5 150 000€ at the end of 2008.[44] Therefore, before 2004, only formalised procedures were available over 38 200€, whereas they are now mandatory only over approximatively 5,000,000€ since the end of 2008 for work contracts.

A second major change for work contracts is on available formalised procedures. The 2004 reform of the Code introduced the possibility of using a formalised procedure (without any particular dispensation) which allows a multilateral negotiation phase after the open call for tender. Nevertheless, this possibility is forbidden for contracts exceeding around 5 000 000€ (the threshold has been changed three times; see Table 3.1); in these cases, a simple open call for tender is mandatory.

Beside these evolutions, the 2004 reform aimed at increasing transparency in public procurement. It appears to be the new paradigm of the Code: the

[44]Only major changes are described here; see Table 3.1 for more details about the successive thresholds.

simultaneous increase of discretion and transparency. For instance, public buyers now have more obligations concerning the information they have to communicate to the losing candidates and the increasing obligation to publicly announce the weightings of the selection criteria of the supplier.

To sum up, the 2004 reform introduced the possibility of adding a negotiation after an open call for tender, even for quite large work contracts. This possibility is allowed either through a non-formalised or through a formalised procedure, depending on the size of the contract and the time it is awarded. This greater freedom results from the transposition of the 2004/18 EU-Directive at the French level. However, the transposition of the Directive may vary from one country to another, which means that negotiated procedures are not uniformly available in all European countries.

4 Procurement modes in Paris Habitat-OPH

We have comprehensive data on the 427 work contracts tendered by Paris Habitat-OPH between January 2004 and December 2009.[45] Paris Habitat-OPH is an independent local public buyer and the main constructor of social housing in Paris. It is organised as fourteen "departments", all located in the same offices. Each of these departments is in charge of some specific activity (construction of new buildings, rehabilitation, etc.). Overall, Paris Habitat-OPH procures around 500 contracts every year.

4.1 Characteristics of the awarding procedures used

Between January 2004 and December 2009, three different types of procedure are used by Paris Habitat-OPH. The main phases of these procedures are reported in

[45] Only purely fixed-price contracts are taken into account.

Table 3.2.

Table 3.2: Characteristics of the three awarding procedures used

Open auction (formalised procedure)	Publication	Reception of the candidatures AND the offers	Selection of the candidates		Analysis of the offers			Selection of the winner
Formalised procedure with a negotiation phase	Publication	Reception of the candidatures	Selection of the candidates	Reception of the offers	Analysis of the offers	Negotiation phase	Second offer analysis	Selection of the winner
Non-formalised procedures	Publication	Reception of the candidatures AND the offers	Selection of the candidates		Analysis of the offers	Negotiation phase or not	Second offer analysis	Selection of the winner

The first procedure is the traditional open call for tender. The buyer publicly publishes its need to procure goods in order to inform potential suppliers. Then, he receives firms' candidatures, which are made up of various administrative documents, past references and a list of the firms' competencies, along with their offers. First, the buyer analyses the candidatures. Then, if a candidature is satisfactory, the buyer analyses the associated offer. Finally, he chooses the winner according to price and technical quality criteria.

As it is used by Paris Habitat-OPH to tender work contracts, the non-formalised procedure (with or without a negotiation phase) is rather close to the traditional open call for tender. The first main difference is the possibility to complete competition with a negotiation phase. However, this negotiation phase has to be previously announced in the publication. The second main difference is its "smoothness": the buyer has, for example, more liberty about the delays in the organisation of the procedure.

The last procedure used by Paris Habitat-OPH to procure work contracts is the formalised procedure with a negotiation phase. There are similarities with the two previously described procedures. Like the open call for tender, this procedure is strictly defined (no "smoothness") whereas the possibility of using a negotiation phase is similar to non-formalised procedures. Nevertheless, the formalised procedure with a negotiation phase has its specificity: the buyer must separate the reception of candidatures and the reception of offers in two phases. During the

first phase, the buyer receives the candidatures and analyses them. Project specifications are communicated to firms who submitted a satisfactory candidature. During the second phase, the buyer receives the offers and analyses them.

Our buyer negotiated all received offers when a negotiation phase was used. In accordance with the Code, this negotiation phase cannot result in re-defining the buyer's needs. It aims at verifying that the buyer's needs are properly understood by the bidders – in case of imprecise specifications, for instance – and, conversely, it enables the buyer to request clarification of the received offers. These precisions might be about the duration and the organization of the works, the quality of the material used, the price of some tasks, etc. In other words, discussions are about the technical but also the financial aspects of the offers, so as to make sure that the offers cover the needs. After this negotiation phase, firms are free to adapt the price and the quality of their proposal. Any negotiation, whatever its form (email, letter or meeting), is traceable since it gives rise to a detailed report. These reports may contribute to the transparency of negotiated procedures.

4.2 Buyer's practices

We have information on our public buyer's decision to negotiate the contracts and about the awarding procedures used to select the providers. This information is illustrated in Table 3.3 (regarding the buyer's choice to use a negotiation phase or not) and Table 3.4 (regarding the buyer's choice to use an awarding procedure or another).

To negotiate or not to negotiate ?

Contracts launched before 2004 are naturally procured through an open auction, that is without any negotiation phase, which reflects French public buyers' legal

obligations at the time.[46] Subsequently, contracts are increasingly awarded after a negotiation phase: this is the result of a progressive implementation of the 2004 reform of the Code and a change in terms of our buyer's routines.

Table 3.3: Number of contracts, use of a negotiation phase and year of publication

	2003	2004	2005	2006	2007	2008	2009	Total
No negotiation phase	27 100%	47 58.75%	31 31.31%	18 22.78%	15 24.59%	6 10.00%	5 23.81%	149 34.89%
Negotiation phase	0 0%	33 41.25%	68 68.69%	61 77.22%	46 75.41%	54 90.00%	16 76.19%	278 65.11%
Total	27 100%	80 100%	99 100%	79 100%	61 100%	60 100%	21 100%	427 100%

Disentangling the use of a negotiation phase from other features of the procedures

From 2004 to 2009, negotiations may be used either through a formalised procedure or a non-formalised procedure (respectively around 35% and 38% of the formalised and non-formalised procedures are used without any negotiation phase). As a consequence, we are able to separately assess the impact of a negotiation phase from the impact of other features of the awarding procedures. We indeed argue that studying the specific characteristics of the procedures – rather than awarding procedures themselves – is probably more interesting in determining policy implications: it enables the separation of the key-features to be encouraged.

Table 3.4: The decision to negotiate depending on the awarding procedure

	Open auction (formalized)	Formalized procedure with negotiation	Non-formalized procedures	Total
No negotiation phase	99	4	50	153
Negotiation phase	0	192	82	274

[46]Note that in contrast with the rest of the paper which uses the date of the attribution of the contract, Table 3.3 uses the date of the publication of the contract. This distinction is made to confirm that no contracts whose publication started prior to the 2004 reform of the Code were awarded using a negotiated procedure.

5 Data

The descriptive statistics of the 427 contracts attributed by Paris Habitat-OPH between January 2004 and December 2009 are presented in Table 3.5.

5.1 Contract characteristics and bidder characteristics

For each project, before choosing the procurement mode, Paris Habitat-OPH calculates its own estimation of the value and the duration of the contract. On average, the contracts studied are estimated at 1 220 696€ with an expected duration of slightly more than 8 months. The projects studied appear to be quite heterogenous in size considering that the estimated values of the projects range from 15 000€ to 22 600 000€, with a standard deviation which is twice the mean. To deal with this issue, we normalise all dependent variables (received bids, winning bids and total costs of the contract) by the variable *Estimate* as it is commonly the case in previous works [De Silva et al., 2008; Ohashi, 2009].

Our buyer received 1578 bids for the 427 contracts we study. The mean bid is 6% above the estimation of the contract while the average winning bid and the total cost of the contract are, respectively, 9 and 5% lower than this value. Individual bids from firms may depend on the number of contracts the firm is currently handling (*i.e.* a less occupied firm is likely to bid more aggressively than an overloaded one). To account for this issue, we have constructed the variable *Utilization Rate* to control for differences in terms of available capacities across bidders [Bajari and Ye, 2003a]. We also have information on the volume of contract delegated to subcontractors. According to practitioners, a more subcontracted contract is likely to be more complex. Finally, we add the variable *Index* to capture the evolution of prices in the construction sector; this variable is meant to account for changes in economical conditions over time.

Table 3.5: Descriptive statistics

Variable	Description	Mean	Std. dev.	Min	Max	N
	Across Contracts					
Estimate	Contract's estimated value (in euros)	1 220 969	2 552 604	15 000	22 600 000	427
Duration	Contract's estimated duration (in months)	8.27	6.15	1	38	427
Subcontracted	Volume of work delegated to subcontractors (in euros)	411 126.3	1 372 275	0	22 107 794	427
Nb candidates	Number of candidates for the contract	7.97	5.40	1	28	427
Nb bidders	Number of bidders for the contract	3.70	2.08	1	18	427
Nego	Takes the value 1 if the a negotiation phase is used, 0 otherwise	0.65	0.48	0	1	427
Less formalism	Takes the value 1 if the awarding procedure is a non-formalised one, 0 otherwise	0.31	0.46	0	1	427
Criteria	Takes the value 1 if the weight of technical and price criteria are specified, 0 otherwise	0.64	0.48	0	1	427
Technical Weight	Technical weight to evaluate bidder's offers (in%) - reported if *Criteria*=1	43.34	11.48	20	80	274
Index	Monthly construction price index, created by the National Institute of Statistics (INSEE)	733.75	48.32	646.8	815.5	427
Winning Bid	Amount of the winning bid	1 163 976	2 496 628	9 645.21	23 042 728	427
Norm. Winning Bid	*Winning Bid / Estimate*	0.911	0.267	0.149	2.67	427
Total Costs	Total costs of the contract (including renegotiations)	1 230 303	2 749 450	9645.21	30 494 464	427
Norm. Total Costs	*Total Costs / Estimate*	0.949	0.287	0.149	2.799	427
Renego	Takes the value 1 if the contract was renegotiated, 0 otherwise	0.550	0.498	0	1	427
	Across Bidders					
Bid	Final price submitted by the bidder (in euros)	1 216 931	2 571 441	9645.21	24 037 048	1578
Norm. bid	*Bid / Estimate*	1.06	0.40	0.15	4.68	1578
Utilization Rate[47]	Remaining value of contracts won but not yet completed (in euros) divided by the Maximum value of contracts won but not yet completed experienced by the bidder (in euros)	0.16	0.28	0	1	1578
Rivals Utilization Rate[48]	Average *Utilization Rate* of rivals candidates (in euros)	0.14	0.14	0	1	1578
Ranking[49]	Position of the offer in the technical ranking made by the buyer (if *Criteria*=0)	1.59	1.20	1	9	586
Technical Mark[50]	Technical value of the offer from the buyer's point of view on a scale of 0 to 100 (if *Criteria*=1)	68	21	0	100	992

5.2 Awarding procedure characteristics

65% of the contracts are procured using a negotiation phase; this fraction increases over time (as shown in Table 3.3). 31% of the contracts are procured through non-formalised procedures. This rather low rate reflects the fact that, for more valuable contracts, this possibility only appeared at the end of the period studied. Another change related to awarding procedures and due to legal evolutions is likely to affect the outcomes of public procurement. Before 2004, public buyers had no obligation to specify the weightings of the selection criteria in the publication of the call for tenders. They only had to specify that offers would be evaluated according to price and/or technical criteria. But since 2004, the Code imposes on the buyer to stipulate the weights associated with each of the two dimensions in the publication of the call for tender.[51] In our dataset, all the contracts are tendered without any precisions regarding weights before February 2005 (*i.e.* the variable *Criteria* is equal to 0). After September 2005, the weightings are systematically specified (*i.e.* the variable *Criteria* is equal to 1 and the observed *Technical Weight* is on average 43.34%). During the transition period (from February 2005 to September 2005), the variable *Criteria* takes the value 0 or 1. Given that this change will become systematic, it can be considered exogenous.

When *Criteria* is equal to zero, the buyer still ranks the offers according to their technical valuation. It is reported in the variable *Ranking*, which takes the value 1 if the offer was considered as the best technical offer; the variable *Ranking* takes the value 2 if the offer was considered as the second best offer from a technical point of view, and so on. It happened that the buyer judged that the offers were equally satisfying from a technical point of view. In this situation, the variable *Ranking* equals 1 for all the posted offers. When *Criteria* is equal to one, the buyer gives a technical rating of the offer, on a scale from 0 to 100. It is captured in the variable *Technical Mark*.

[51] See Mateus et al. [2010] for a discussion on the disclosure of selection criteria.

5.3 Level of competition

We have information on the number of candidates (*Nb candidates*) and the number of received offers (*Nb bidders*) for each tendered contract. At first view, both of these variables could be used to appreciate the level of competition. However, there are very strong disparities in the number of candidates between the procedure organised in two phases (the reception of candidatures and then the reception of offers) and the procedures organised in a single phase (candidatures and offers are received simultaneously). In the first case, the ratio *Nb bidders / Nb candidates* is equal to 0.33, whereas in the second case it is equal to 0.80 (See Table 3.6). Indeed, the costs incurred in preparing a candidature are extremely low compared to the costs of preparing an offer. Thus, the buyer received far more candidatures when the procedure was organised in two phases. Whereas we cannot exclude a correlation between the number of received offers and the procurement mode, the disparities are widely lower. Therefore, we choose to use *Nb bidders* to control for the level of competition.

Table 3.6: Number of candidates and number of bidders depending on the awarding procedure

	(1) Open auction (formalized)	(2) Non formalized procedures	(3) Formalized procedure with a negotiation phase	Average (1) and (2)
Nb candidates	5.4	4.7	11.5	5.0
Nb bidders	4.1	3.8	3.4	4.0
Nb bidders/Nb candidates	0.76	0.88	0.33	0.80

Following Bajari et al. [2013], we control for the level of free capacities of the rival candidates. These authors use the utilization rate of the second lowest bidders to tackle it. As the second lowest bidder is not necessarily, in our case, the second "best" bidder according to price and quality criteria, we rather use the variable *Rivals Utilization Rate*, which measures the average utilization rate of all other candidates.

6 Empirical strategy and results

6.1 Econometric method

We aim at exploring the impact of the decision to use a negotiation phase on the received bids submitted by firm i for contract n as well as on the winning bid and total costs of contract n. Thus, we first estimate the following models:

$$\begin{aligned} Norm\ Bid_{ni} = \gamma_0 + Nego_n\gamma_1 + Z_n\Gamma_2 + W_{ni}\Gamma_3 + \\ V_{ni}\Gamma_4 + X_{ni}\Gamma_5 + Index_n\gamma_6 + C\Gamma_7 + \epsilon_{ni} \end{aligned} \tag{3.1}$$

$$\begin{aligned} Norm\ Winning\ Bid_{ni} = \gamma_0 + Nego_n\gamma_1 + Z_n\Gamma_2 + W_{ni}\Gamma_3 + \\ V_{ni}\Gamma_4 + X_{ni}\Gamma_5 + Index_n\gamma_6 + C\Gamma_7 + \epsilon_{ni} \end{aligned} \tag{3.2}$$

$$\begin{aligned} Norm\ Total\ Costs_{ni} = \gamma_0 + Nego_n\gamma_1 + Z_n\Gamma_2 + W_{ni}\Gamma_3 + \\ V_{ni}\Gamma_4 + X_{ni}\Gamma_5 + Index_n\gamma_6 + C\Gamma_7 + \epsilon_{ni} \end{aligned} \tag{3.3}$$

Where γ_1 is the coefficient associated with the variable we are primarily interested in. Z_n is a matrix of control variables related to contract n's characteristics (*Estimate*, *Duration*, *Criteria*, *Technical Weight*, *Less Formalism* and *Subcontracted*) and Γ_2 its associated matrix of coefficients. W_{ni} is a vector of variables containing characteristics related to firm i when bidding for contract n (*Utilization Rate*) and V_{ni} is a matrix controlling for the heterogeneity in the degree of competition firm i faces when bidding for contract n (*Rivals Utilization Rate*, *Nb bidders*) with, respectively, Γ_3 and Γ_4 their associated matrix of coefficients. X_{ni} is a matrix that controls for the quality of the offer submitted by firm i on contract n (*Technical Mark* and *Ranking*) with Γ_5 its matrix of coefficients. γ_6 is the coefficient associated with our price index in the construction industry at the time the contract n was tendered. Finally, C includes several fixed effects to control for unobserved variations in time (by month and by year) with Γ_7 their matrix of coefficients. ϵ_{ni} is the error term.

Concerning our variable of interest, *Nego*, we are likely to face an omitted variable bias. Indeed, the decision to use a negotiated procedure may be driven by our buyer's expectations of the outcomes. For instance, the buyer may rationally use a negotiated procedure because he expects to receive less competitive bids due to a more complex contract. We choose to deal with this endogeneity issue by using a 2SLS regressor. In order to do so, we have constructed three instruments (*Politics*, *Politics2* and *Routines*). To be valid, each of these instruments needs to fulfil two conditions: relevance and exogeneity.

Our first two instruments (*Politics* and *Politics2*) are related to the political cycle. Although Paris Habitat-OPH is officially an independent structure, we cannot root out its strong political links. In particular, several members of the board of direction of our public buyer are serving in elected offices at the municipal level. As we have discussed in Section 2, the choice of a procedure by a politician is likely to be influenced by the fear of being suspected of favouritism or corruption [Chong et al., 2013b]. In particular, we believe that awarding procedures that allow some discretion from public buyers (notably negotiated procedures) are less likely to be used during the time immediately preceding and following municipal elections to avoid being challenged by a political opponent. Indeed, during this period, politicians may be under higher scrutiny than during the rest of their mandate. In this case, buyers may choose to award contracts through an open call for tenders rather than a negotiated procedure, the latter being widely regarded as less transparent [Bajari et al., 2009]. *Politics* measures the time in months that separates the current call for tender from the next Parisian municipal election while *Politics2* is the square of *Politics*. According to our discussion, we believe that *Politics* should have a significant positive impact on the decision to use a negotiated procedure (the closer to the next election, the smaller *Politics* and therefore the less negotiated procedures are used) while *Politics2* should have significant negative impact on the decision to use a negotiated procedure (contracts far from the next election, that is contracts tendered right after an election, will less

likely be awarded through a negotiated procedure). In addition, we rule out any influence of our instruments on unobservable parts of our outcomes: the election dates are exogenous discontinuities and the changes in political pressure they are likely to induce regarding the choice of the awarding procedure would not be related to any expectations regarding the competitiveness of the received bids, satisfying the exogeneity condition.[52]

Our third instrument (*Routines*) is related to our public buyer's internal routines concerning the choice of a procedure. According to the literature on procurement (see, *e.g.*, Chong et al. [2013b] that study the French case), as well as our descriptive statistics, we expect that public buyers are traditionally more prone to use some procedures (the open call for tenders in the case of France) rather than others. We notice that newly available procedures such as negotiated procedures may take time to be 'adopted' by the different departments of our buyer. Moreover, we suspect a spillover effect: the choice of procedure by a given department of our buyer is likely to be influenced by past choices of procedures from other departments of Paris Habitat-OPH either through internal discussions between the different departments or through the observation of other departments' practices. Our third instrument is constructed to capture this spillover effect. *Routines* is defined as the ratio of contracts awarded by other departments using a negotiated procedure during the last quarter divided by the ratio of contracts awarded by other departments using a negotiated procedure before the last quarter. Basically, *Routines* captures how the use of negotiated procedures has evolved in other departments during the last quarter compared to the past. If negotiated procedures were more frequently used by other departments during the last quarter than before that, we would expect a given department to be more likely to use such procedures to tender its current contract. According to our discussion, *Routines* should therefore have a significant positive impact on the choice of using a negotiated procedure. Furthermore, we believe that *past* choices of procedures in

[52]Further evidence of the exogeneity of these instruments are available in Section 6.2.3

other departments will have no impact on the outcomes of the current procedure other than through the choice of the procedure. To calculate the instrument for a given contract, we indeed exclude observations that could be correlated with the outcomes of this contract, satisfying the exogeneity condition.

6.2 Estimation results

In this section, we start by estimating the impact of negotiated procedures on the whole sample of normalised received bids. We then turn to seek the impact of using such procedures on both the normalised winning bids and the total cost of the contracts. For every test reported in this section, we use three alternative specifications. These three models intentionally always include the same covariates from one test to another. The first specification includes our variable of interest, *Nego* and exogenous control variables (*i.e.* variables that neither depend on decisions taken by our buyer nor on strategies from firms). When switching from the first to the second model, we add variables related to the technical valuation of the offers: What weight is attributed to the technical dimensions in the selection criteria ? What technical mark did the firm obtain ? This switching enables us to capture some heterogeneity across projects and offers relative to quality. Adding these variables enables us to isolate the level of requirement of the buyer and how well the offers satisfy these requirements. Finally, when switching from the second to the third model, we add covariates related to the level of competition, the procedure used and the amounts subcontracted. Results from this last specification should be taken with caution as some of the added covariates may potentially be endogenous [Angrist and Pischke, 2008] .

6.2.1 Estimation on the received bids

In this section, we aim at exploring the effect of the negotiation phase on the whole sample of received bids.

Our results are presented in Table 3.7. In Models 1, 2 and 3, the dependent variable is the normalised received bids and we use an OLS regressor. In Models 5, 7 and 9 we show the results of the 2SLS regression of the normalised received bids with the first stage regressions, using our three instruments, respectively shown in Models 4, 6 and 8. All specifications include fixed effects by months and year to respectively account for Paris Habitat-OPH's internal agenda as well as unobservable economic differences over the studied period. All regressions were computed using heteroscedasticity-robust standard errors.

In our OLS regressions (Models 1, 2 and 3), *Nego*, our variable of interest, is associated with a positive yet non-significant coefficient. The use of a negotiation phase therefore seems not to have a significant impact on the amounts of the received bids. Results related to contracts' characteristics may be put in line with previous works. First, more subcontracted contracts are associated with less competitive bids. Indeed, these types of contracts are generally considered as more complex contracts [Bajari et al., 2013]. Second, longer contracts attract lower bids though the coefficient is statistically significant only in Model 3.

However, the sign and significance of the coefficient associated with our variable *Technical Weight* is puzzling as contracts for which public buyers put more weight on technical quality attract significantly lower offers. This result may be due to an inappropriate use of this tool by the buyer or to an over-estimation of the contract value when the contract involves highly technical transactions.

Table 3.7: Negotiation and received bids

	Model 1 OLS *Norm. Bid*	Model 2 OLS *Norm. Bid*	Model 3 OLS *Norm. Bid*	Model 4 1st Stage *Nego*	Model 5 2SLS *Norm. Bid*	Model 6 1st Stage *Nego*	Model 7 2SLS *Norm. Bid*	Model 8 1st Stage *Nego*	Model 9 2SLS *Norm. Bid*
Nego	0.012	0.006	0.005		-0.279***		-0.246***		-0.281***
	(0.032)	(0.033)	(0.035)		(0.096)		(0.094)		(0.098)
Less Formalism			0.040					-0.042	0.021
			(0.034)					(0.031)	(0.035)
Criteria	-0.181***	0.057	0.052	-0.285***	-0.297***	-0.199**	-0.036	-0.188**	-0.055
	(0.057)	(0.096)	(0.096)	(0.052)	(0.066)	(0.091)	(0.102)	(0.092)	(0.104)
Technical Weight		-0.005***	-0.005***			-0.004***	-0.006***	-0.004***	-0.006***
		(0.001)	(0.001)			(0.001)	(0.001)	(0.001)	(0.001)
Technical Mark		0.031	0.033			0.104*	0.057	0.062	0.050
		(0.059)	(0.058)			(0.056)	(0.059)	(0.054)	(0.059)
Ranking		0.016	0.016			-0.035***	0.006	-0.025**	0.007
		(0.012)	(0.013)			(0.013)	(0.014)	(0.012)	(0.014)
Nb Bidders			0.007+					-0.040***	-0.004
			(0.005)					(0.004)	(0.006)
Utilization Rate			0.026					0.040	0.036
			(0.043)					(0.033)	(0.044)
Rivals Utilization Rate			0.057					0.066	0.075
			(0.084)					(0.081)	(0.086)
Duration	-0.002	-0.002	-0.004**	-0.012***	-0.005***	-0.012***	-0.005**	-0.018***	-0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Subcontracted			0.007***					0.006***	0.010***
			(0.002)					(0.002)	(0.003)
Index	0.005***	0.004***	0.005***	0.018***	0.008***	0.018***	0.007***	0.015***	0.007***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Politics				0.065***		0.066***		0.059***	
				(0.007)		(0.006)		(0.006)	
Politics2				-0.001***		-0.001***		-0.001***	
				(0.000)		(0.000)		(0.000)	
Routines				0.067***		0.066***		0.077***	
				(0.017)		(0.018)		(0.016)	
Constant	-2.379**	-1.966**	-2.464**	-12.762***	-5.198***	-12.369***	-4.307***	-10.378***	-4.579***
	(1.005)	(0.994)	(1.083)	(0.813)	(1.422)	(0.809)	(1.391)	(0.861)	(1.412)
Nb. Obs.	1578	1578	1578	1578	1578	1578	1578	1578	1578
Adj. R^2	0.028	0.038	0.043	0.374	-0.054	0.382	-0.024	0.427	-0.030
F-Stat				52.676		54.737		52.738	
Hansen J Stat (Chi-sq(2) P-Value)					0.407		0.385		0.350

Standard errors in parentheses
+ $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
All specifications include month and year fixed effects.

Models 4, 6 and 8 present the first stage regressions of the decision to use a negotiated procedure. All three of our instruments are statistically significant and have the predicted sign. Statistics reported throughout Table 3.7 tell us that we need not worry about a weak instrument issue (F-Stat) and that we cannot reject that our three instruments are exogenous provided that at least one of them is (J-test for overidentifying restrictions). Once we have satisfyingly accounted for this endogeneity issue, we find in Models 5, 7 and 9 that the decision to use a negotiated procedure is associated with significantly lower prices of the received offers. We believe that this difference is due to the fact that negotiated procedures are used for shorter, yet more complex contracts where competition seems to be an issue (see, respectively, the signs and significance of the variables *Duration Subcontracted* and *Nb bidders* in Models 4, 6 and 8) which is rather close to recommendations from the economic literature.[53] Moreover, we can see that negotiated contracts are associated with offers that are more satisfying from a technical point of view (see the variables *Ranking* and *Technical Mark*).

The coefficient associated with *Nego* indicates that, once accounting for the choice of using a negotiated procedure, the normalised received bids are decreased by close to 26% when such a procedure is used. Overall, our other results are very close to those presented in Models 1, 2 and 3.

6.2.2 Estimation on the winning bids

In this section, we aim at exploring the effect of negotiated procedures on the winning bids and total cost of the contract.

Our results are presented in Table 3.8. In Models 11, 14 and 17 the dependent variable is the normalised winning bid while it is the normalised total cost of

[53]The fact that shorter contracts are significantly more frequently procured using negotiated procedures might be the result of the thresholds defined in the Code that prevent the use of these procedures for high-valued contracts (which may be longer to execute).

the contract in Models 12, 15 and 18. Models 10, 13 and 16 present the first stage regressions of the choice of using a negotiated procedure associated with the 2SLS regressions shown throughout the table, using our three instruments. All specifications include fixed effects by month to account for Paris Habitat-OPH's yearly agenda as well as fixed effects by year to control for unobservable economic differences over the period studied. All shown regressions include heteroscedasticity-robust standard errors.

In all of our first stage regressions of the decision to use a negotiated procedure, our three instruments are statistically significant and have the expected sign. Statistics reported throughout Table 3.8 tell us that we need not worry about a weak instrument issue (F-Stats) and that we cannot reject that our three instruments are exogenous given that at least one of them is (J-test for overidentifying restrictions). Concerning *Nego*, our variable of interest, we find that negotiated procedures decrease both the winning bids and the total costs of the contracts. The coefficients associated with *Nego* are comparable in size to those in Table 3.7 and suggest that the use of a negotiated procedure may lead to a decrease in the normalised winning bids and the total cost of the contracts by close to 25%. Yet, in all but one case (Model 18), the results are not statistically significant. That is, if anything, the use of a negotiated procedure is found to have a significant effect on the normalised total costs of the contracts but not on the normalised winning bids. Results from our control variables are generally in line with previous works. As an interesting finding, we can see that our variables that capture the technical valuation of the offers are associated with less competitive winning bids and total costs (see the coefficients of *Technical mark* and *Ranking* in Models 14, 15, 17 and 18): better offers are correlated with less competitive price, which suggests that there is a trade-off between price and quality.

Table 3.8: Negotiation, winning bids and total costs

	Model 10 1st Stage *Nego*	Model 11 2SLS *Norm. Winning Bid*	Model 12 2SLS *Norm. Total Costs*	Model 13 1st Stage *Nego*	Model 14 2SLS *Norm. Winning Bid*	Model 15 2SLS *Norm. Total Costs*	Model 16 1st Stage *Nego*	Model 17 2SLS *Norm. Winning Bid*	Model 18 2SLS *Norm. Total Costs*
Nego		-0.225	-0.240		-0.232	-0.251+		-0.262+	-0.283*
		(0.167)	(0.169)		(0.168)	(0.171)		(0.163)	(0.165)
Less Formalism							-0.108*	-0.052	-0.069+
							(0.060)	(0.041)	(0.045)
Criteria	-0.208**	-0.177**	-0.214**	-0.267	-0.299**	-0.348**	-0.340*	-0.368***	-0.420***
	(0.104)	(0.087)	(0.092)	(0.195)	(0.142)	(0.156)	(0.192)	(0.143)	(0.157)
Technical Weight				-0.003	-0.003*	-0.003*	-0.003	-0.003*	-0.003*
				(0.003)	(0.001)	(0.002)	(0.003)	(0.001)	(0.002)
Technical Mark				0.025	0.119+	0.156*	0.094	0.168**	0.208**
				(0.118)	(0.074)	(0.080)	(0.114)	(0.080)	(0.086)
Ranking				-0.186***	-0.154***	-0.138**	-0.200***	-0.160***	-0.148**
				(0.064)	(0.055)	(0.060)	(0.059)	(0.052)	(0.059)
Nb Bidders							-0.030***	-0.025***	-0.026***
							(0.010)	(0.009)	(0.009)
Utilization Rate							-0.045	-0.046	-0.068
							(0.075)	(0.048)	(0.053)
Rivals Utilization Rate							0.290*	0.277**	0.309**
							(0.150)	(0.138)	(0.148)
Duration	-0.013***	0.002	0.003	-0.013***	0.001	0.002	-0.019***	-0.008**	-0.008*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)
Subcontracted							0.004	0.013***	0.014***
							(0.004)	(0.003)	(0.003)
Index	0.017***	0.007**	0.008***	0.016***	0.007**	0.008***	0.014***	0.007**	0.007**
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Politics	0.053***			0.054***			0.048***		
	(0.013)			(0.013)			(0.013)		
Politics2	-0.001***			-0.001***			-0.001***		
	(0.000)			(0.000)			(0.000)		
Routines	0.065*			0.061*			0.071**		
	(0.035)			(0.035)			(0.034)		
Constant	-11.624***	-4.808**	-4.868**	-11.338***	-4.593**	-4.713**	-9.731***	-3.814**	-3.763*
	(1.497)	(2.203)	(2.203)	(1.481)	(2.146)	(2.160)	(1.572)	(1.930)	(1.964)
Nb. Obs.	427	427	427	427	427	427	427	427	427
Adj. R^2	0.295	-0.173	-0.180	0.299	-0.168	-0.185	0.329	-0.079	-0.092
F-Stat	10.270			10.360			10.102		
Hansen J Stat (Chi-sq(2) P-Value)		0.7155	0.7711		0.6872	0.7809		0.7418	0.7905

Standard errors in parentheses
+ $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
All specifications include month and year fixed effects.

In Table 3.8, the absolute value of the coefficient associated with *Nego* is consistently larger when regressing the normalised total costs than when regressing the winning bids (comparing equivalent specifications only). The total cost of the contract being equal to the winning bid plus the amounts renegotiated, we interpret this result as first evidence that negotiated procedures have an impact on *ex post* renegotiations. To confirm this evidence, we look at the impact of negotiated procedures on the probability of renegotiating the contract.[54] Results are shown in Table 3.9 (in the appendix) where we regress the variable *Renego*, a dummy taking the value 1 when the contract was renegotiated and 0 otherwise, using a 2SLS regressor on *Nego*, our variable of interest, and other covariates. First stage regressions from Models 19, 20 and 21 in Table 3.9 are, respectively, identical to those shown in Models 10, 13 and 16 of Table 3.8. As expected, our variable or interest, *Nego*, is associated with a statistically significant negative coefficient. The use of a negotiated procedure therefore seems to significantly lower the probability of occurrence of renegotiations between the parties at stake. Longer contracts lead to significantly more probable renegotiations and the amounts subcontracted, our indicator of the complexity of the project, also significantly increase the probability of renegotiations. More puzzling is the sign associated with our variable *Nb Bidders*. Indeed, the construction sector is often thought of being close to the independent private values framework: within this framework, we would not expect a significant effect of the number of bidders on the probability to renegotiate. We believe that our finding may be linked to the fact that more complex contracts attract less bidders. Our coefficient is therefore probably additional evidence that more complex contracts lead to a higher probability of renegotiations.

[54] Estache et al. [2009] also use the probability of renegotiating the contract as a dependent variable, though their work is on the impact of multidimensional auctions.

6.2.3 Exogeneity of political instruments

Our political instruments measure the distance to the next election of the mayor of Paris. They respect the exclusion restriction if the unobservable characteristics of the projects do not change with the political cycle. Indeed, we assume that the political cycle affects public procurement only through a change in the preferences of politicians in terms of procedures.

To complement the Hansen J-tests we performed for each specification (which provide some statistical evidence of the validity of the exclusion restriction), we also perform an analysis of the potential link between the political cycle and the observable characteristics of the projects. We want to make sure that some unwanted discontinuities do not occur around the elections:

- If the observable characteristics of the project change around the elections, the unobservable characteristics might change too, violating the exogeneity condition.
- If no unwanted discontinuities occur, this would comfort our approach: observable characteristics of the awarded contracts are exogenous; it does not contradict our hypothesis that the types of projects are not affected by the political agenda.

Figure 3.1 in the appendix displays the relationships between the month of awarding and the number of contracts, the mean contract duration and the log of the mean contract estimated value. Since Chong et al. [2013a] have shown that political manipulation of procurement contracts is also likely to alter the amount of the realised spendings before the election, our lowest graph reports the log of the values of realised investments by month of delivery of the project. The vertical red line corresponds to the March 2008 municipal election (the only one

that occurred during the period we study). We also reported the quadratic fitted values to estimate the approximate time of the discontinuity. These graphs do not exhibit discontinuities around this election, comforting our approach.

7 Discussion

7.1 Why do negotiated procedures decrease the bids?

The discussion of the details of both the project and the offers that occurs during the negotiation phase leads to a decrease in the uncertainty surrounding the transaction for the two parties at stake. As argued in Section 2, when transactions are complex, buyers may have difficulties in correctly specifying their needs in the call for tenders. If buyers' needs are imprecisely specified, then bidders will compensate for the resulting uncertainty by extracting a higher rent at the bidding stage [Bajari et al., 2013]. Discussing the details of the project will lead to a lower level of uncertainty for the firms and therefore a decrease in the rents extracted as well as a decreased probability of renegotiating the contracts. In addition, discussing the details of an offer directly with the firm may lower the asymmetry of information on the buyer's side. The buyer may then be more able to evaluate what specific part of the offer may allow room for negotiations on price, therefore leading to a further reduction in the overall rent extracted by bidders.

Furthermore, our public buyer uses negotiated procedures in appropriate cases. Indeed, negotiated procedures would exhibit better results notably when used for complex projects with a low degree of competition [Bajari et al., 2009]. In our first stage regressions, we have shown that Paris Habitat-OPH used more negotiated procedures when contracts were more complex and when the level of competition was likely to be an issue (a lower number of bidders). Therefore, we cannot rule out that part of the positive effects we observe in this study comes from the fact that our public buyer chooses a negotiated procedure in accordance

with specific recommendations of the economic literature.

The negotiation phase may also stimulate another pro-competitive channel. The buyer indeed has some freedom to decide on the content of the negotiations which prevents bidders from being able to perfectly anticipate the rules of the game. Maintaining some degree of uncertainty might make any *ex ante* coordination between bidders much harder to achieve. As a consequence, the decline in price we observe may also be driven by a decrease in collusive strategies - which are likely to be especially pregnant in the public work sector (see, *e.g.*, Bajari and Ye [2003a]; Ishii [2007]). We run simple statistic tests based on Benford's Law to support this argument.[55] We compare the first two digits of the amount of the winning bids by distinguishing open auctions and negotiated procedures.[56] Results are shown in Figure 3.2 and Table 3.10 in the appendix. Observation and results from the goodness of fit tests tell us that collusion may be more likely to have occurred in open auctions than in negotiated procedures. Since thresholds from the Code regarding the use of negotiated procedures may harm the application of Benford's Law, we perform additional tests on the distance between the winning bid and the estimation, which should allow us to circumvent this problem.[57] Results are shown in Figure 3.3 and Table 3.10 in the appendix. Again, we find that collusion is more likely to have taken place in auctions than in negotiated procedures.

[55]Benford's Law gives us the reference frequency distribution that should be observed in real-life data (if not tampered with) of single digit numbers according to their position in a figure. It is based on the observation that the number 1 occurs more often than the number 2 as a first digit. The number 2 itself occurs more often than the number 3 as a first digit, and so on. Benford's Law has been repeatedly used to detect fraud or collusion in many settings [Abrantes-Metz and Bajari, 2009]. One popular application has been to detect manipulation of the Libor rate [Abrantes-Metz et al., 2011, 2012]. Benford's Law has also previously been used to check for collusion in public procurement [Vellez, 2011].

[56]When looking at negotiated procedures, we use the amounts of the bids received prior to the negotiation phase to avoid the tampering that may come from the negotiation phase.

[57]This distance is simply coded as the absolute value of the difference between the winning bid and the estimated contract value. Contrarily to the values of the bids that are indirectly restricted by the legal thresholds of the Code (*i.e.* negotiated procedures are never available over 5 million €), the aforementioned distance should suffer from no such restrictions in values.

Finally, negotiated procedures increase the level of discretionary power of the public buyer. This increase in discretionary power may in turn lead to an increase in abnormal behaviour of the buyer (*i.e.* favouritism and/or corruption). However, simultaneously to the introduction of the possibility of having recourse to negotiated procedure, the 2004 reform of the Code significantly raised the levels of transparency and accountability of public buyers. Most notably, since the application of the reform, the weightings of the selection criteria have to be specified in the call for tenders. Moreover, public buyers are required to inform evicted firms of the specific reasons motivating the rejection of their offers. Finally, the traceability of the negotiations between parties might also contribute to the accountability of our buyer since the discussions leading to the final offers are verifiable by a third party. We believe that such a raise in the levels of transparency and accountability will put public buyers under more scrutiny from third parties (notably, from evicted firms). Hence, if public buyers are more likely to have their decisions challenged through increased transparency, they may consequently be less prone to exhibit abnormal behaviours [Amaral et al., 2009].

7.2 How realistic is our coefficient?

This study finds that the use of negotiated procedures may lead to a decrease in the normalised received offers by close to 26%. We believe that, although this coefficient may appear high, several arguments point to the fact that this coefficient is actually very likely to be accurate. First, the sole rent extracted by bidders due to the high uncertainty surrounding the project at the bidding stage could represent up to 14.6% of value of the contract [Bajari et al., 2013]. As we have argued, discussing the details of the project during the negotiation phase may lead to a decrease of this rent. Second, based on our previous discussion, we know that these negotiated procedures were used in the best possible setting. That is, Paris Habitat-OPH appropriately chose when to use these procedures and the increase in transparency and accountability prevented public buyers such as

ours from having recourse to abnormal behaviours. In addition, the previously discussed decrease in collusive practices may also lower the received bids. In his analysis, Connor [2010] finds the mean cartel overcharge in public procurement to be slightly above 23%. Finally, Lalive and Schmutzler [2011] as well as Vellez [2011] find figures close to ours when comparing the price paid by a public buyer in two alternative awarding procedures.

7.3 Main limitation of the study

In this paper, we do not account for the increased transaction costs incurred by the public buyer when using negotiated procedures. Indeed, negotiated procedures require parties to dedicate time and resources to the discussions, therefore raising transaction costs. Firms are likely to compensate these additional costs by increasing the level of their offers. However, the unaccounted for supplementary costs incurred by public buyers are clear limitations to any positive result found on such procedures. Further results should try to incorporate estimations of these increased transaction costs on the buyer's side.

8 Conclusion and implications for public policy

In this paper we aim at investigating the impact of using a negotiated procedure on the whole sample of bids as well as on the winning bids received by a major French public buyer. This issue should be at the top of the agenda since a similar procedure may soon be available in all European countries. The current European reform proposal in public procurement indeed explicitly suggests introducing or widening the possibility to negotiate the offers after a competition phase.

First, contrarily to the view expressed in the impact assessment of the new European proposals, our results point to the fact that these procedures may lead to

price decreases when properly used.[58] With this result in mind, specific guidelines informing public buyers when negotiated procedures are appropriate should go hand in hand with the new Directive. Second, we interpret part of this beneficial effect of the discretionary margin as the result of a satisfying level of transparency, which puts public buyers under third party scrutiny. In this regard, a high level of transparency should be maintained with the application of the new Directive. Fortunately, the new reform proposal aims at compensating the greater freedom by an increase in public buyers' accountability.[59] We may therefore hope to observe similar positive effects of negotiated procedures with the application of the new Directive.

Nevertheless, some legitimate fears, which are specific to negotiations, are still to be empirically addressed. In particular, public buyers will have to acquire the appropriate expertise to properly handle negotiations as they are not in the culture of public purchasing.[60] It is likely that this expertise will have to be gained on the job. In this respect, deeper investigations should be led about the dynamic impact of negotiations: do learning-by-doing effects lead to better outcomes or do they progressively encourage abnormal behaviour on the buyer's side?

[58] Indeed, the assessment underlines that negotiated procedures are thought of being "less efficient in generating savings than the open and restricted procedures" [European Commission, 2011c].

[59] According to the EC: new rules "should aim at making life easier for CAEs and firms whilst at the same time continuing to guarantee a high level of transparency and efficient safeguards for equal treatment of bidders." [European Commission, 2011c].

[60] "CAE' staff would have to acquire higher expertise to validly conduct negotiations." [European Commission, 2011c].

9 Appendix

Table 3.9: Negotiation and probability to renegotiate

	Model 19 2SLS *Renego*	Model 20 2SLS *Renego*	Model 21 2SLS *Renego*
Nego	-0.486*	-0.527**	-0.570**
	(0.249)	(0.249)	(0.258)
Less Formalism			-0.154*
			(0.079)
Criteria	-0.219+	-0.496*	-0.590**
	(0.143)	(0.289)	(0.294)
Technical Weight		0.004	0.004
		(0.003)	(0.003)
Technical Mark		0.028	0.117
		(0.151)	(0.163)
Ranking		-0.055	-0.077
		(0.144)	(0.147)
Nb Bidders			-0.033**
			(0.014)
Utilization Rate			-0.204**
			(0.090)
Rivals Utilization Rate			0.314*
			(0.187)
Duration	0.030***	0.030***	0.017**
	(0.005)	(0.005)	(0.007)
Subcontracted			0.017***
			(0.006)
Index	0.008**	0.009**	0.007*
	(0.004)	(0.004)	(0.004)
Constant	-5.780**	-6.410**	-4.401+
	(2.938)	(2.894)	(2.705)
Nb. Obs.	427	427	427
Adj. R^2	-0.054	-0.092	-0.052
Hansen J Stat			
(Chi-sq(2) P-Value)	0.5383	0.5774	0.5027

Standard errors in parentheses. + $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

All specifications include month and year fixed effects.

Figure 3.1: Contract characteristics and municipal election

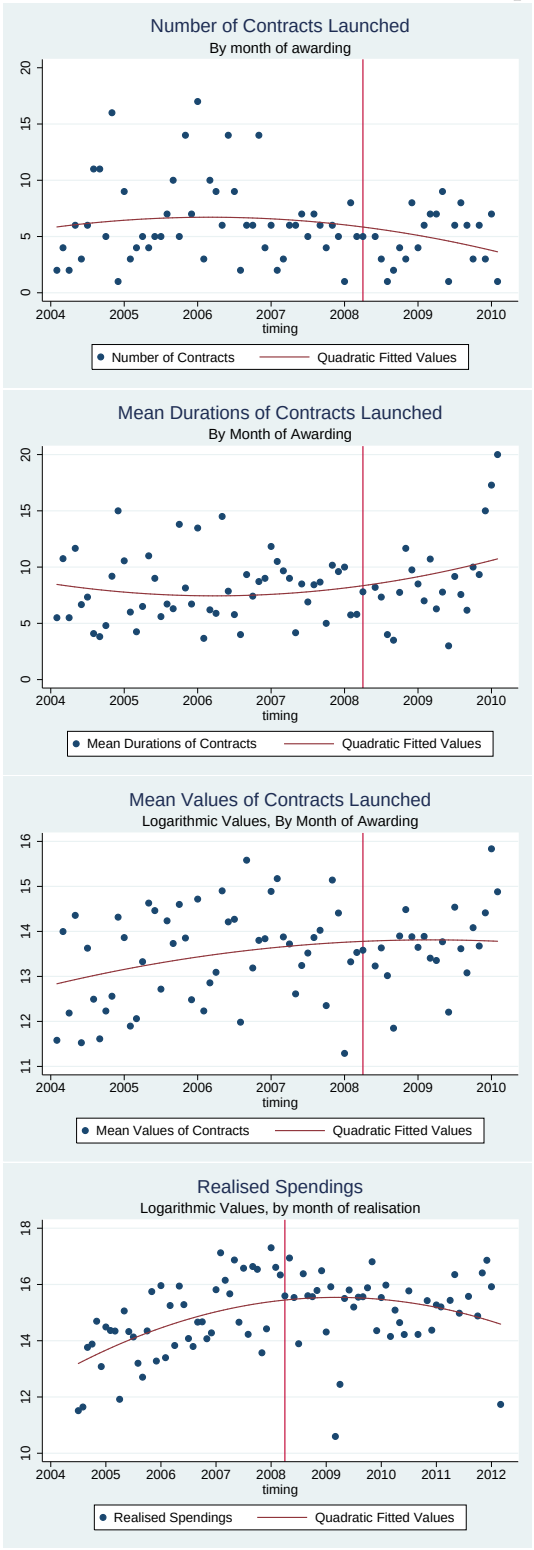


Figure 3.2: Benford's Law and Winning Bids

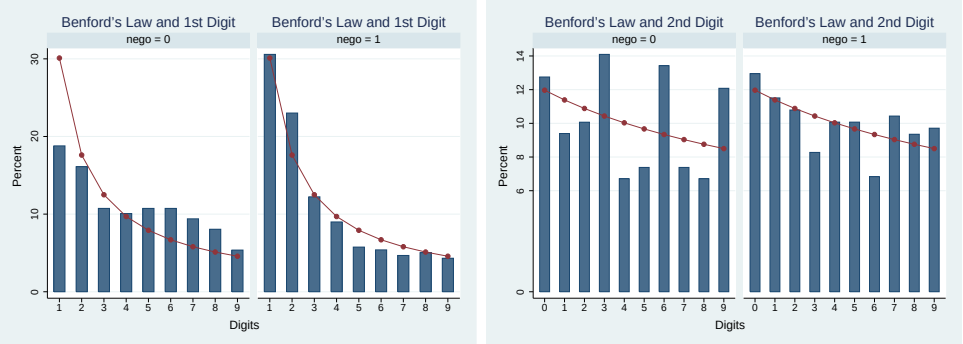


Figure 3.3: Benford's Law and Distance to Estimation

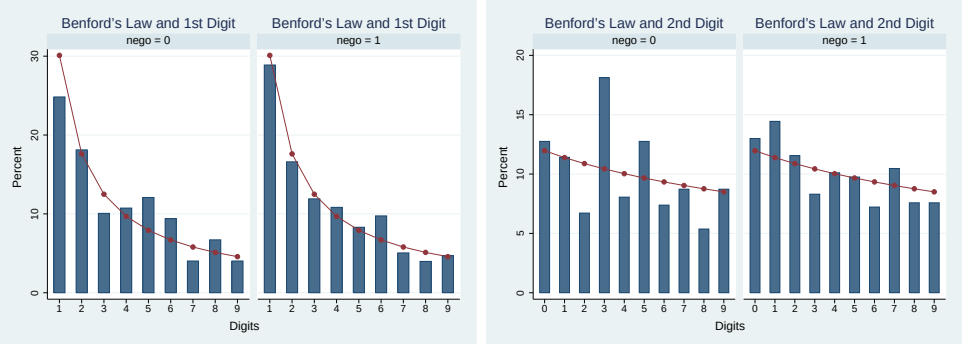


Table 3.10: Goodness of Fit Tests for Benford's Law

First Significant Digit of Winning Bids

Test	P-Value for Auctions	P-Value for Negotiations
Pearson's X2	0.0205	0.4540
Log likelihood ratio	0.0256	0.4682

Second Significant Digit of Winning Bids

Test	P-Value for Auctions	P-Value for Negotiations
Pearson's X2	0.2678	0.8694
Log likelihood ratio	0.2926	0.8507

First Significant Digit of Distance to Estimation

Test	P-Value for Auctions	P-Value for Negotiations
Pearson's X2	0.3595	0.6885
Log likelihood ratio	0.4021	0.7345

Second Significant Digit of Distance to Estimation

Test	P-Value for Auctions	P-Value for Negotiations
Pearson's X2	0.0773	0.6886
Log likelihood ratio	0.1011	0.6867

Chapter 4

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

1 Introduction

Although public procurement markets represent a major part both of economic activity and public spending (around 19% of European GDP in 2009)[61], 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

*This chapter is based on a joint work with Stéphane Saussier and Anne Yvrande-Billon. We thank Javier Asensio, Dakshina G. De Silva, Marian Moszoro, Ludivine Roussey, Elodie Rouvière, Giancarlo Spagnolo, Steve Tadelis and Andrei Yakovlev for their helpful comments on preliminary versions of the paper. We also thank conference participants - of the French Association of Economics, September 2011; 8th ESNIE Day, October 2011; Public Procurement and Sustainable Growth, October 2011; The Economics of the Public-Private Partnerships, April 2012; International Society on New Institutional Economics, June 2012 - for their comments and questions on the preliminary version of this chapter

[61]See the OECD report, entitled "Performance Measurement" (2011), dedicated to public procurement

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], Levin and Smith [1994], Kim [1998]). To our knowledge only one empirical study has investigated whether limiting entry might enable relational contracts to be implemented.[62]

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 (hereafter thresholds).[63] 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

[62] Coviello et al. [2013a] 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.

[63] These thresholds vary regularly; over the period of study, they were around 200 000 euros.

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 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.

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).[64] However, the buyer's discretionary power may also be detrimental to economic efficiency if it is used to manipulate the market (see, *e.g.*, 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

[64]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"*

contracts deal with services attached to construction works and are associated with short-lived, simple,[65] 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, 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.

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. We show that there is a selection bias (*i.e.* the unobservables in our bidder selection model are correlated with the unobservables in our posted bids model). The results suggest that the unobservable 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.[66] Our findings also show that mitigating competi-

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

[66] See, for instance, the Green Paper related to the revision of EU directives. On page 11 of

tion 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. We discuss the effect of reduced competition on final bids in section 5. We provide conclusions in the final section.

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

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"*.

contractual incompleteness [Bajari et al., 2013], 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., 2013b], 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 4.1 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.

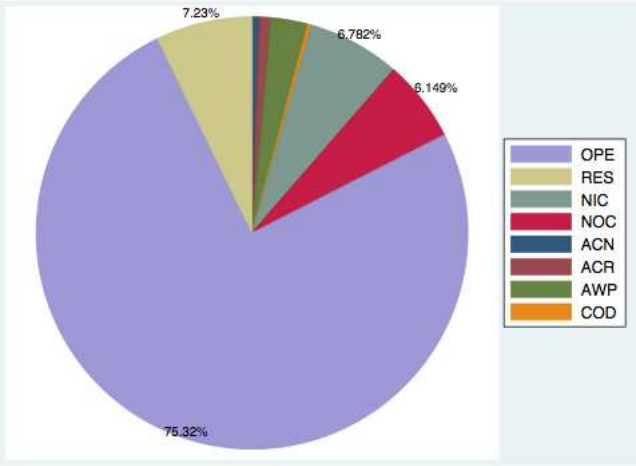
Table 4.1: Threshold of projects published in the OJEU/TED

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 4.1 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.

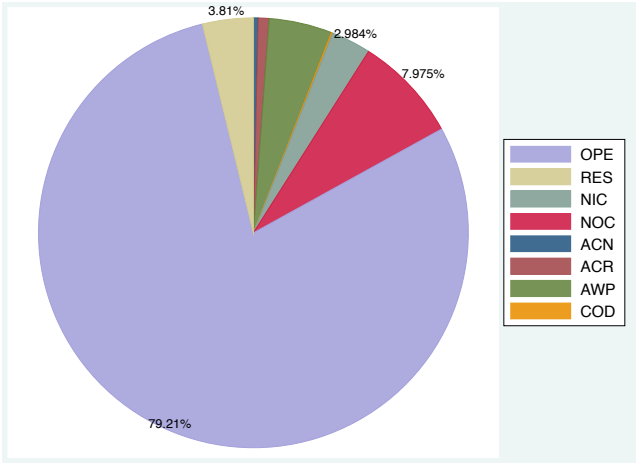
Figure 4.1: Share of award procedures used in the EU for procurement projects regulated by EU directives, 2008-2012



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

It is interesting to note from Figure 4.2 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 4.1. This leaves open the question of the rationale of such award procedures that restrict competition for small contracts.

Figure 4.2: 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

2.2 Award procedures and *ex ante* transaction costs

Both theoretical [Bajari and Tadelis, 2001; Manelli and Vincenti, 1995] and empirical studies [Bajari et al., 2013, 2009; Decarolis, 2013] 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,[67] 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.

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).[68] 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.[69] 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

[67]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

[68]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])

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

case of small contracts.[70] 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, 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

[70] 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.

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 (Coviello et al. [2011]).

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 4.3). First, for each of the different types of architectural activity[71] managed through restricted auction, the buyer pre-qualifies candidates who then belong to a pool of short-listed suppliers for a fixed period. [72] 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.[73]

Figure 4.3: 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 4.3). 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

[71] For example, woodworking, isolation, etc.

[72] The pools are generally renewed every two years.

[73] 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.

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 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[74] 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 4.3.

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

[74]For each project, the buyer makes his own estimate.

Table 4.3: Descriptive statistics

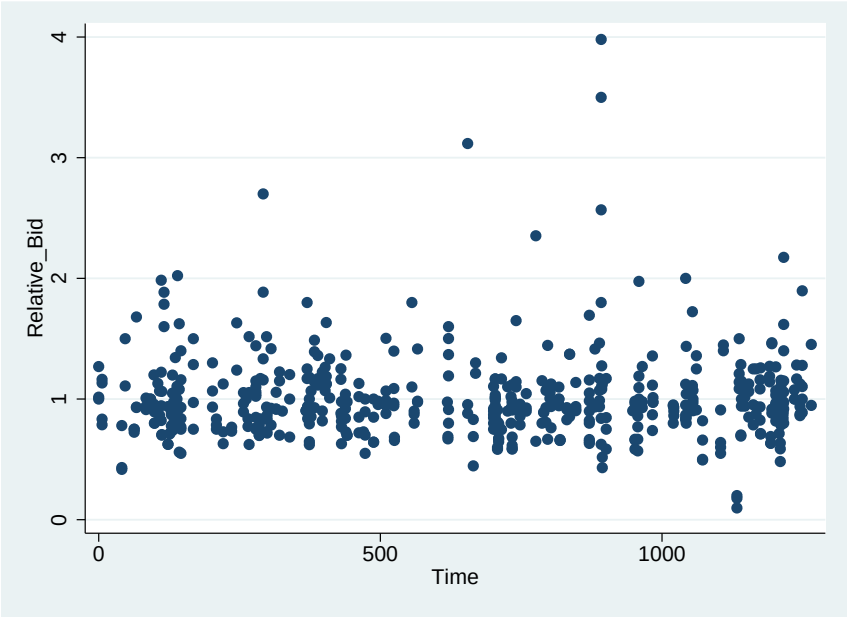
Variable	Description	Mean	Std. dev.	Min	Max	N
	Selections and auctions' outcomes					
$Selected_{ijt}$	Equals 1 if the candidate i is invited to post a bid for contract j at time t, 0 otherwise	0.25	0.43	0	1	2476
Bid_{ijt}	Posted bid of candidate i for contract j at date t (in euros)	45 014	42 283	2 250	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

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.

On average, the value of the received bids was 45 014 euros. The value of the variable $RelativeBid_{ijt}$ shows that these bids are very close from the buyer's point of view. Figure 4.4 reports the distribution of the relative bids over time:

Figure 4.4: Relative bid and 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,[75] 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

[75] We only have this information for the most recently constituted pools.

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, 2002b; De Silva et al., 2009]. Given that the contracts studied here are rather simple, these issues should not concern us. Nevertheless, 10% of the contracts 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

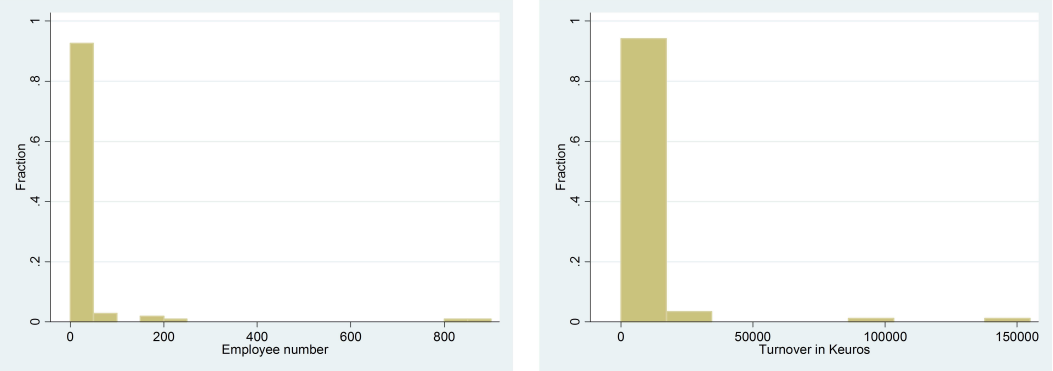
We collected information on firms' structural characteristics.[76] The average number of employees in the 109 pre-qualified firms is 29. For the sub-sample of 86 firms for which data are available, turnover is on average 4.6 million Euros. Figure 4.5 shows the distribution of these two variables. According to EU reports,[77] 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

[76] 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).

[77] See Evaluation of SMEs' Access to Public Procurement Markets in the EU (2010)

Figure 4.5: Pre-qualified firms' turnover and number of employees



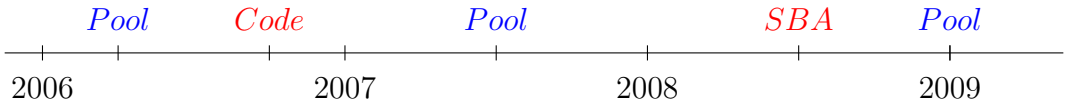
of firm i is below the median number of employees of the firms in the pool in which contract j is tendered and takes a value of zero otherwise. This last variable depends on firm i but also on the pool in which contract j is awarded; a firm can be "big" in one pool but "small" in another.

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 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 4.6), 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.

Figure 4.6: 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

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:

$$Selected_{ijt} = 1\Big[Selected^{*}_{ijt} = \gamma_1 + X_{it}\gamma_2 + Employee_i\gamma_3 + Small_{ij}\gamma_4 + U_{jt}\gamma_5 + (\tilde{Employee_i} * U_{jt})\gamma_6 + (Small_{ij} * U_t)\gamma_7 + C\gamma_8 + e_{ijt} > 0\Big] \tag{4.1}$$

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 $Employee_i$.[78] 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.[79]

Finally, e_{ijt} captures unobservable determinants of the invitation, depending on the fixed effects we add. These unobservable determinants might rely on the

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

[79] Table 4.3 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.

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.[80]

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 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

[80] Additional specifications were run and are explained below regarding the quality of low bids.

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:

$$RelativeBid_{ijt} = \beta_1 + X_{it}\beta_2 + Employee_i\beta_3 + Small_{ij}\beta_4 + U_{jt}\beta_5 + Z_j\beta_6 + C\beta_7 + \epsilon_{ijt} \tag{4.2}$$

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 heterogeneity 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 4.5. 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 4.4: 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 result is not at odds with our expectations: it simply highlights that the buyer shares out contracts taking

into account firms' capacities. Our results therefore provide evidence that the buyer shares out contracts among firms of good repute; this may be coherent with the buyer's willingness to optimize relationships with SMEs. 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 4.5 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.

Table 4.5: 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.

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 4.5. 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 Robustness checks

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

Logarithm of the final bids

Table 4.6 is a repeat of Table 4.5, 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 [81] (The logarithm of the estimated value of the contract is added as a control variable). 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 4.7 we show the last four models of Table 4.5, 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.

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

Extreme values

Furthermore, we repeated our models of Table 4.5, 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 4.8.

Fixed effects

To save space in Table 4.5, 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 Tables 4.4 and 4.5, 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.

4.4 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]. 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 [European Commission, 2011b]): 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 con-

tracts 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.

6 Appendix

Table 4.6: 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 4.7: 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 4.8: 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

General Conclusion

Public procurement markets represent a major part both of economic activity and public spending. 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 necessity to avoid market manipulation and to attract the lowest bidders. In this respect, numerous quantitative studies underline that open competitive procedures allow to achieve cost savings and therefore, reduce the ability of purchasing stakeholders to extract rents. However, with regard to *ex post* dimensions of the purchasing process (*i.e.* the delivered quality and the potential costs of renegotiation), the ability of formal agreements and open competition to ensure an efficient contract governance is more and more subject to criticisms. As long as contracts are not enforced and/or incomplete, firms have some leeways to behave opportunistically. A first issue is thus about identifying and reducing enforcement costs. A second issue is about the ability of more discretionary awarding tools to increase the efficiency of procurement performances. This dissertation aims at giving some empirical insights about the difficulties associated with contract enforcement and about the use of discretion in public procurement.

In a first part of this dissertation, we have the unique opportunity to look at the

dynamic of quality provision in a procurement setting. Since the buyer operates in a highly regulated environment, the awarding phase has to go through an open call for tender. Consequently, contractual incentives are the only way to avoid firms' opportunistic behaviors during the execution of the contract. We first show that quality provision is a pervasive issue. While it is explained by the non-verifiability of firms' efforts in chapter 1, we show that reducing contractual incompleteness may improve contract enforcement in chapter 2. However, this solution is suspected to be exclusively appropriated for standard goods or services.

In a second part of this dissertation, we go one step further by considering a situation in which public buyers' leeways increase. In this case, the public buyer is no more required to use an open call for tenders. We thus investigate the ability of alternatives solutions to award single-use contracts. Chapter 3 and 4 respectively investigate the potential benefits of auctions with negotiation and restricted auctions. These solutions increase the discretionary power of the public buyer at the awarding stage. We find that such solutions seem to improve procurement efficiency. We interpret it to be a sign that the freedom of the buyer in the selection process can help in modernizing public purchasing.

As we go on reading this dissertation, the role of the public buyer in the governance of the transaction not only increases but also improves procurement efficiency. In chapter 1, we show that the public buyer's limited ability to act on the transaction governance results in generating a suboptimal low price/low quality equilibrium. In chapter 2, we give evidence that the buyer's efforts to reduce contractual incompleteness improve contract enforcement and result in long terms savings. Chapter 3 shows that completing competitive incentives with a negotiation phase enables to improve the matching between needs and offers. Finally, in chapter 4, it appears that replacing part of the competitive incentives with more discretion enables to limit the comparison of offers to the most efficient bidders. Consequently, we can wonder if the current European regulation that gives a particular emphasize on the risk of market manipulation and consequently reduces

public buyers' leeways does not result in limiting procurement efficiency.

A clear-cut answer would naturally require additional works. Although we find that public buyers' active behavior *can* be beneficial, we are unable to identify the underlying drivers of such beneficial effects. In other words, we still ignore the extend to which they rely on the public buyer we study or the institutional framework in which the transactions take place. First, the substantial resources and experience of Paris Habitat-OPH may naturally determine, for instance, its ability to write contracts, to collect quality indicators or to choose the appropriate procurement tool. These dimensions are suspected to have a crucial impact on our findings. Second, the French institutional environment may be sufficiently transparent to avoid some erratic behaviors, like abuses in discretion. The European Directives are indeed transposed into national levels through the French public procurement Code. In this respect, the 2004 reform of this Code 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. This is a proposition we are not able to test with the available data.

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