To Allot or Not to Allot? Managing Local Public Services in Europe

Julie de Brux
GREGOR
Sorbonne Business School
julie.de-brux@univ-paris1.fr

Claudine Desrieux
ERMES (EAC 441), TEPP (FR3126 CNRS)
Université Paris II Panthéon-Assas
claudine.desrieux@u-paris2.fr

Abstract

Using an incomplete contract framework, we evaluate the total net effect of allotment in public procurement, which has been promoted by the recent European Directive 2004/18/EC. More precisely, we explore the consequences of this legislation on the global surplus and on the payoff of the public authority. Our results show that allotment does not maximize the total surplus but may maximize the payoff of the public authority representing the citizens.

JEL Codes: L14, L22, L24, L33.
Keywords: Public procurement, Allotment, Competition, Innovation, Incomplete Contract

1 Introduction

Public procurement accounts for a substantial share of total government expenditure. The World Bank estimates that this spending represents between 12 and 20 percent of the GDP in the developed countries, and may be even higher in developing countries.[1] The efficiency and quality of procurement processes are central for how much citizens will benefit from government spending. Procurement reforms are efforts to change current procurement practices. Since the last decades, they have typically focused on changing the legal and institutional framework to improve the efficiency of public procurement process. One of these significant reforms in Europe is the introduction of allotment in the awarding of public procurement contracts (Directive 2004/18/EC of the European Parliament). Our paper aims to determine the efficiency of such a practice in an incomplete-contract framework.

Let us precise what allotment is. It can be considered as the horizontal segmentation of services into different lots that can be awarded to different private operators. The Directive

[1] Source: World Bank
http://web.worldbank.org/wbsite/external/countries/menaext/extmnaregtopgovernance

2004/18/EC states that "In view of the diversity of public works contracts, contracting authorities should be able to make provision for contracts for the design and execution of work to be awarded either separately or jointly (...) The decision to award contracts separately or jointly must be determined by qualitative and economic criteria, which may be defined by national law". The transcription of this directive in the European national legislations has been progressively made. For instance, the article 10 of the new French *Code des Marchés publics* allows for allotment in public procurement, and underlines the benefits in terms of competition of this practice.
An example of allotment is given in the recent call for tenders for some works to perform in September 2011 in the *Musée d'Orsay* in Paris, stating that those works have been divided in four lots.[2] Another illustration is provided by the bus transportation service in London. Since 1995, around 20% of the London bus network is tendered each year. This network is divided into several routes, and bidders can submit bids on any number of routes and route packages. The criterion for selection of a winning bid is the "best economic value" that is to say that the contract is awarded to the lowest bidder but that other qualitative factors may also be considered at the margin (Amaral et al. [2011]). Another recent example is given by

Dividing proposed acquisitions of supplies and services into reasonably small lots aim to permit offers on quantities less than the total requirement, and then to increase the competitive pressure during the competitive tendering, since the participation of small and medium enterprises in the competitive tendering is made easier. However, allotment also implies that the different operators in charge of the lots could not exploit large economies of scale, since they only manage one part of the service. On this subject, the Article 10 of the new French *Code des Marchés publics* underlines that allotment has to be promoted to the extent that the division of the service into several lots does not entail too large damages by lowering the economies of scale. In our paper, we aim to take into account these two effects of allotment: the increase in competition and the reduction of economies of scale. As far as we know, the previous literature on allotment (Amaral et al. [2011] and Morand [2002]) seems to focus on the competitive dimension, and does not explore the consequences on the economies of scale, while it is a strong restriction to the practice of allotment as underline in the article 10 of the *Code des marchés publics*.

To analyse whether allotment in public procurement is efficient or not, we use an incomplete contract framework (Grossman and Hart [1986], Hart and Moore [1990], Hart [1995]), to focus on the incentives a manager may have to implement innovative solutions. The assumption of contractual incompleteness is often used to study contracts signed between public and private partners (Hart et al. [1997], Hart [2003], Bennett and Iossa [2006], Hoppe and Schmitz [2010]), mainly because the quality of service often cannot be fully specified by public authorities, nor can they write verifiable objectives for all possible contingen-

[2] www.e-marchespublics.com/annoncemarchepublic125112153.html

cies. The framework developed by Grossman, Hart and Moore allows us to account for the difficulties to contract on all aspects of the quality of a service, and on the ability of private operators to innovate. Indeed, two strong justifications motivate the use of public procurement: by organizing a competitive for the field, public authorities hope to benefit from lower costs and from the higher capacity of the private operators to innovate. The recent guide book on dealing with innovative solutions in public procurement (European Parliament and industry [2007]) and the directives 2004/18/EC and 2004/17/EC regarding public procurement regulation underline the concern of public authorities for favoring innovations in the delivery of public services.[3] As a consequence, we follow the basic idea of Hart et al. [1997] and assume that, during the execution of the contract, the operator may undertake some non-contractible efforts to find innovations which improve the quality of the service or reduce its costs. More precisely, we extend the static framework of Hart et al. [1997] to propose a model dealing with public procurement contracts. Public procurement are neither public provision nor privatization (described in Hart et al. [1997]) but "hybrid" structures that allow a private operator to manage a public service for a contractually-defined period.
With such a framework, our results show that allotment does not maximizes the global surplus (and then is not optimal), but may maximize the benefits of the public authorities (representing the citizens). This result raises an important question about the determinants of the decision made by public authorities: should they favor the general interest (i.e. the global surplus made up of the surplus of the citizens they represent and the firms) or only the interests of their citizens? The answer to such a question determine whether allotment has to be promoted or not.

Our paper contributes to a better understanding of the new legislation on the allotment of public procurement contracts. Few papers have investisgated the problem of allotment, and many of them focus on the impact of allotment on competition (Amaral et al. [2011]) without taking into account economies of scale, and the consequences of allotment on the incentives of the operators to innovate. Morand [2002] compares two strategies to favor the role of small and medium-sized entreprises in public procurement: allotment and subcontracting. In our paper, we rather focus on the consequences for public authorities.
Even if the question of allotment has been few explored, a large part of the economic literature has dealt with contracts between public and private sectors these last years. Using an incomplete contract framework, some papers (Hart [2003], Bennett and Iossa [2006] and Hoppe and Schmitz [2010]) explore the question of bundling *vs.* unbundling between the building and operation stages. Thus, they focus on the vertical division of public services, while we focus on the horizontal segmentation. Moreover, these papers mainly compare public procurement to *Private Finance Initiative* (PFI) to wonder which

[3]The Directive 2004/17/EC states for instance that " requirements in terms of functional performance or standards [should allow] suppliers to produce any configuration of technology they feel can meet the need".

of these two contractual agreements is preferable. We do not explore this question, and takes the choice of public procurement for granted. What draws our attention is to know whether the service under public procurement should be alloted or not. Last, many papers dealing with contracts between public and private partners rely on asymetric information (Laffont and Tirole [1991, 1993]). We rather contribute to the growing literature using the incomplete contracting approach (and assuming symmetric information between the parties) to stress the impact of unforeseen contingencies (by both parties), and because many problems of public procurement are problems of *ex post* adaptation rather than *ex ante* screening (Bajari and Tadelis [2001]). Last, our paper is also related to Cambini and Filippini [2003] that discusses the optimal size of service area (*too complete!*).

The paper is organized as follows: the next section describes the functioning of public procurement contracts in Europe. We also explain the recent change introduced in the legal environment of the managemenent of local public services. Some examples and statistics illustrate the interest of our research question. Section 3 presents the general framework of the model. In section 4, we derive the optiam contractual choice (whether to allot or not) under public procurement. In section 5, we investigate the consequences for the payoff of the public authority, and show the conditions under which she has better allot or not. Section 6 concludes.

2 The institutional framework of European public services

2.1 Public procurement contracts in Europe

Public procurement refers to acquisitions of goods and services by public institutions in a country. The recent European legislation defines public procurement as contracts that "cover supplies, services and works purchased by the public sector".[4] It concerns contracts between the government and the private sector in many different areas such as health services, education, roads, water supply, the police and defense. During the contract period, the public authority keep ownerhsip rights on the good to provide or on the facility supporting the public service.

Be it at the local level or at the national level, public procurement is observed in the 27 countries of the European Union. The private partner is generally selected through a competitive tendering, which allows to create competition for the field when competition in the field is not possible. Once a private operator is selected[5], he has to provide the public service or the public good. This allows to differentiate public procurement from public provision, where a public employee performs those tasks. One of the main criteria to select the private operator is the fixed price he requires to perform the tasks. This price is his only source of revenue, and is paid by the public authority. Thanks to the competition

[4] *http : //europa.eu/scadplus/glossary/publicprocurementen.htm*

[5] Very few countries in Europe have the possibility to contract-out towards public agencies. Then, we only focus in this paper on contracting-out towards private firms.

between the candidates to win the contract, the public authority hopes to benefit from low prices.[6]

Another positive expectation of the involvement of a private firm in the delivery of a public good or service is the higher ability of the private sector to innovate (European Parliament and industry [2007]). Recent examples of innovations in the delivery of public services are the creation of "Veolia Innovation Accelerator" in 2010, by the company Veolia Environment, enabling to increase the performance of waste treatment in several European municipalities.[7] Several billions of research and development have been invested to deal with waste treatment and renewal. In the transport sector, efforts to promote electric mobility have been made by VINCI Park, a private company in charge of hundreds of car parks in France.[8]

2.2 Allotment: promotion and practices

As recalled in the introduction, by dividing the good or service to provide into several lots, allotment allows small and medium-sized enterprises to be selected and then increase the number of bidders during the competitive tendering. These enterprises would not have the financial capacities to face a bid for a whole market otherwise.

The following figure illustrates this competitive effect with the case of the London bus transportation. We can see that the higher the number of bidders, the lower the awerage winning bidding is.

Figure 1: Number of effective bidders and costs per mile in the London bus transport (May 1999-May 2008)

Number of effective bidders per route	Number of auctions	Average bus.miles (10,000)	Average winning bid (£)	Average cost per mile of the awarded contract (£)
1	128	46.99	2,217,554	8.63
2	213	47.24	1,933,647	6.20
3	232	38.20	1,522,683	4.82
4	140	44.14	1,727,877	4.56
5	58	41.84	1,647,772	4.01
6	10	34.15	1,452,628	5.43
7	5	32.25	1,044,786	3.61
8	1	57.97	1,797,000	3.10
9	1	21.53	645,878	3.00
>5	*17*	*36.47*	*1,105,743*	*3.78*

Source: Amaral et al. (2011)

[6] These *competition effects* expected thanks to a higher number of candidates during the competitive tendering have been analyzed in Gomez-Lobo and Szymanski [2001], Brannman et al. [1987]. Other papers show that a large number of candidates could also increase the price, because of the *winner's curse effect*(Milgrom [1989], Hong and Shum [2002]), or lead to *ex post* opportunistic renegotiations (Guasch [2004]). We will discuss these effects in section 5.

[7] Source: http://www.veolia.com/fr/innovation/recherche-innovation/via/

[8] Source:

However, another interesting fact about alloted markets is that many operators are awarded several lots, or lots including a large part of the service to deliver. Figure 2 shows that in the London bus transport, the 4 biggest operators share around 80 % of the market.

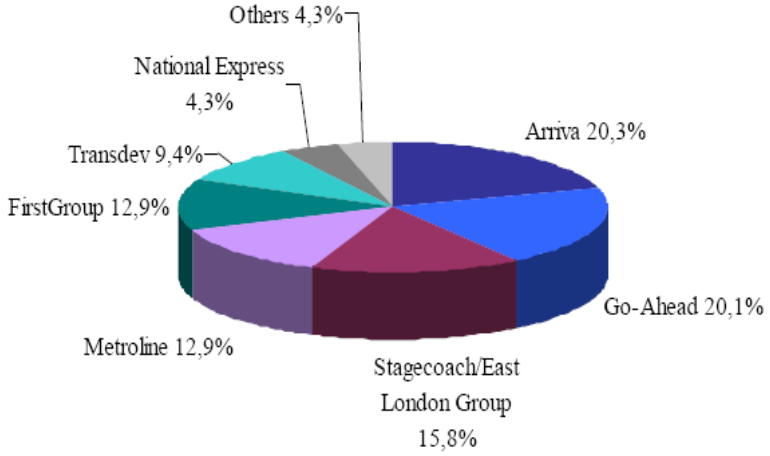

Figure 2: The market structure in the London bus transportation in 2009

Source: Amaral et al. (2011)

Another example is provided by the car park sector in France: municipalities can either contract out all their parkings to a same operator, or contract them out separately.[9] Figure 3 shows some statistics from the French leader company in this sector: even if this company is generally awarded only one parking per city, there is a growing tendency to award this company with several parkings. This tendency seems in contradiction with the principle of allotment.

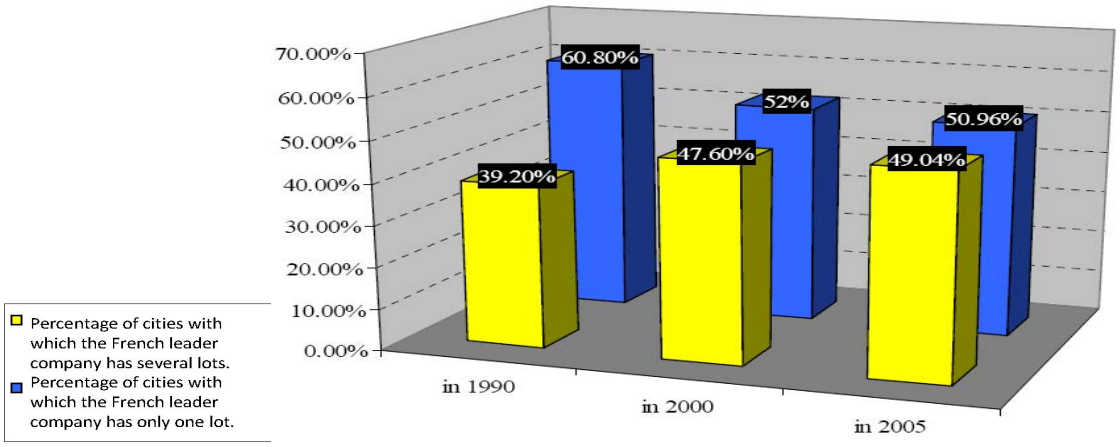

Figure 3: The evolution of the number of parkings operated by the French leader company per city in January 2009

Source: De brux et al. (2011)

Then, even if allotment seems to be promoted by the European legislation and implies some positive consequences on the prices paid by public authorities, allotment is not always practiced in public procurement, and the division into several lots seems to be limited so that private operators still manage a significant percentage of the service. Our model attempts to give some content to these stylized facts.

3 General framework

Let us note G, a benevolent (local or national) public authority (whom we refer to as "she"), in charge of a public service. We study the case where G chooses to outsource the provision of a public service to a private operator (whom we refer to as "he") through public procurement. We assume that the service has N components: for instance, the service can be urban transportation by bus, and the components are the different routes composing the bus network of the city. Another example is the parking service made up of

[9]The main operators in this sector are VINCI Park, Q-Park, Epolia, Efia, Interparking, Parking de France, UrbisPark, AutoCité and SAGS. However, some of them are established in some regions only, others are specialised, for car parking in train stations for instance.

different parkings in the city. Either the public authority chooses not to allot, and to give the N components to one manager, or she chooses to allot and to give L1 components to a private operator, and L2 components to another private operator (L1+L2=N).

Following Hart et al. [1997], we assume that contracts are incomplete. More precisely, the public authority and the selected operator are able to write contracts, specifying some aspects of each component of the service to be provided. However, the operator may make some efforts that cannot be contracted on in advance: these efforts may be researching innovations to improve the service, or efforts to adapting the service to the realized contingencies (that are assumed to be too numerous to be described *ex ante* in the contract). Such efforts (or investments) are then non contractible *ex ante* but verifiable *ex post*: for instance, while it is not possible to contract *ex ante* on the delivery of an innovation, once a potential innovation has been discovered, its implementation is verifiable.
In our incomplete contract setting, ownership rights convey residual control rights: the owner of the facility during the contract period has the power to decide whether any given innovation can be implemented or not.[10] Under public procurement, the local public authority remains the owner of the facility, so that renegotiations between the private operator(s) and the public authority must take place before any innovation may be implemented.

The service is made up of N components and each component $j \in [1; N]$ of the service yields a benefit B_j to the society, and costs the operator C_j to produce. The operator can manipulate B_j and C_j through his effort choices. He can devote efforts to two types of innovations relative to a basic service: quality innovations and cost innovations that reduce the cost of provision but may create an adverse effect on quality. We denote the effort devoted to quality innovation i, and that devoted to cost reduction e.[11] Those efforts leading to innovations are observable, but not verifiable. Then, the *ex-post* cost (C_j) and benefit (B_j) functions derived from the provision of the service j are the following:

$$B_j = B_j^0 - b(e) + \beta(i)$$
$$C_j = C_j^0 - c(e) + i + e$$

B_j^0 and C_j^0 are the (contractible) social benefit and cost of the service j as described in the basic contract; $c(e) \geq 0$ represents the cost decrease implied by an innovation in cost reduction e and $b(e) \geq 0$ corresponds to the adverse effect on quality due to an investment in cost reduction. We assume that such investments are always efficient ($c'(e) - b'(e) > 0$).[12] As for $\beta(i)$, it is the net quality increase of the service following an investment i.

[10] For a more general discussion about the notion of ownership rights and decision rights in public-private partnerships, see Desrieux [2009] and Hoppe and Schmitz [2010].

[11] We interchangeably call e and i "investment" or "effort", and do not make any difference between the cost to search for innovation and the cost to implement it (as in Hart et al. [1997], Bennett and Iossa [2006], Hoppe and Schmitz [2010]).

[12] Assuming that the cost-reducing innovation could be inefficient would not change our qualitative results, as shown in footnote

A private operator has L components, $L \in \{L1; L2; N\}$, and we allow for some possible economies of scale between all the components he has to manage. In this case, investments e and i are made once, but they are implemented on all the components of the service managed by this private operator. For simplicity, we assume that the impact of innovations is the same for all the components on which they are applied.

As a consequence, the total *ex post* cost and benefit functions for the management of L components become:

$$\sum_{j=1}^{l} B_j = (\sum_{j=1}^{l}(B_j^0)) + \mathrm{L}[-b(e) + \beta(i)]$$
$$\sum_{j=1}^{l} C_j = (\sum_{j=1}^{l}(C_j^0)) - \mathrm{L}c(e) + i + e$$

We make the following standard assumptions concerning c and b: $b(0) = 0$, $b'(e) \geq 0$, $b''(e) \geq 0$; $c(0) = 0$, $c'(0) = \infty$, $c'(e) \succ 0$, $c''(e) \prec 0$, $c'(\infty) = 0$; $c'(e) - b'(e) > 0$, $\beta(0) = 0$, $\beta'(0) = \infty$, $\beta'(i) \succ 0$, $\beta''(i) \prec 0$, $\beta'(\infty) = 0$.
As in Hart et al. [1997], we assume that innovations can be introduced without triggering a breach of the contract for the basic good.

The timing of the model is as follows:

- In $t = 0$, the public authority chooses to allot or not the service, and selects her operator(s) through a competitive tendering.
- In $t = \frac{1}{2}$, efforts e and i are made by the operator(s)
- In $t = 1$, renegotiations may occur and innovations may be implemented on the components of the service managed by the operator(s)

In our model, the "contractual choice" represents the decision to allot or not the service. Our goal is to determine the optimal contractual choice (section 4), and the choice made by the local public authority resulting from Nash Equilibrium (section 5).

4 The optimal contractual choice under public procurement

To determine whether allotment is optimal or not, we solve the game by backwards induction: we first determine the incentives to invest under public procurement in cost reduction and quality increase in $t = \frac{1}{2}$ (whether the service is alloted or not), and then the optimal contractual choice made in $t = 0$.

4.1 The incentives to invest under public procurement

Let us assume that the public authority proposes L ($\in \{N; L1; L2\}$) components of the service to manage, and organize a competitive tendering to select a private operator. The public authority pays a fixed price to the private operator for the management of these L components, and this price results from the bid made by the operator during the competitive tendering. We denote this price P_L.

When the operator finds a way to innovate or to adapt the contract to the relevant contingencies, the parties renegotiate the contract, since the operator needs the approval of the public authority who is the owner of the facility supporting the service. If parties fail to reach an agreement, there is no other possibility to implement innovations, since the manager is considered as indispensable to the implementation of these innovations. We use the Nash bargaining solution to model the renegotiation in this situation. Then, during renegotiations, the parties share the surplus generated by the new investments according to their *ex post* bargaining powers. We denote $\sigma \in [0;1]$ the *ex post* bargaining power of the operator(s).

The payoffs of the operator UM and of the public authority UG become respectively:

$$UM_L = (P_L - \sum_{j=1}^{L}(C_j^0)) + \sigma \mathrm{L}[c(e_L) - b(e_L) + \beta(i_L)] - e_L - i_L$$
$$UG_L = (-P_L + \sum_{j=1}^{L}(B_j^0)) + (1-\sigma)\mathrm{L}[\beta(i_L) + c(e_L) - b(e_L)]$$

Consequently, we find the following incentives to invest e_L^P and i_L^P:

$$\begin{aligned} e_L^P &= \arg\max_e UM_L \\ i_L^P &= \arg\max_i UM_L \end{aligned}$$

The first-order condition gives us the investment level e_L^P and i_L^P such as[13]:

$$\begin{aligned} L \quad & \sigma[c'(e^P) - b'(e_L^P)] = 1 \\ L \quad & \sigma\beta'(i_L^P) = 1 \end{aligned}$$

From appendix 1, we can establish that:

Lemma 1. *The incentives to invest under public procurement are increasing in the ex post bargaining power of the operator(s) (σ) and in the number of components they manage (L).*

Under public procurement, the total *ex post* surplus reached when an operator manages L components of the service is:

$$S_L^P = (\sum_{j=1}^{L}(B^0 - C^0)) + \mathrm{L}(c(e_L^P) - b(e_L^P) + \beta(i_L^P)) - e_L^P - i_L^P$$

4.2 The optimal decision regarding allotment

The optimal contractual choice (*i.e.* the decision to allot or not the service) maximizes the total *ex post* surplus. Since allotment leads to a surplus $S^A = S_{L1}^P + S_{L2}^P$ and non-allotment leads to S_N^P, we have to determine which surplus is the highest.

[13] Let us notice that in case innovations would be inefficient such that $c'(e) - b'(e) < 0$ or $\beta'(i) < 0$ then no innovation would be implemented. Then, assuming that the innovations could be inefficient would not change our qualitative results, since they would not be implemented.

By defining the average surplus function $F(L) = \frac{S_L^P}{L}$, we can show that this function is increasing in L (see appendix 2), so that $S_N^P \geq S_{L1}^P + S_{L2}^P$. The contractual decision maximizing the total surplus is not to allot.

Proposition 1. *Under public procurement, the optimal contractual choice maximizing the total surplus is not to allot the service so as to benefit of the economies of scale on all the components of the service. Allotment reduces the incentives to innovate and the total surplus.*

5 The contractual choice made by the public authority

In this section, we determine whether allotment is preferable or not for the public authority. We explore two scenarios: (1) that of perfect price competition, and (2) that of imperfect price competition.

5.1 Contractual choice under perfect price competition

Let us assume here that the competitive tendering allowing to select the private operator(s) creates price competition (*à la* Bertrand). Then, the price equals the cost to perform the service.
Since the parties are able to anticipate *ex ante* their future investment behavior[14], the price for which L components are managed is: $P_L = (\sum_{j=1}^{L}(C_j^0)) - L \times \sigma[c(e_L^P) - b(e_L^P) + \beta(i_L^P)] + e_L^P + i_L^P$. This results in the public authority getting all the surplus, $UG_L^P = S_L^P$.

Then, under perfect price competition, the contractual choice maximizing the payoff of the public authority is then the choice maximizing the total surplus. From proposition 1, this implies that the public authority chooses not to allot the service.

Proposition 2. *Under perfect price competition, the public authority chooses the optimal contractual decision, i.e. not to allot the service.*

5.2 Contractual choice under imperfect competition price

In this subsection, we explore a second assumption, that of imperfect price competition. We assume that the number of candidates participating to the competitive tendering determines the intensity of the competition, and the prices charges by the private operator(s). The larger the number of candidates, the lower the price the public authority pays. We first justify this assumption (subsection 5.2.1) and then draw its consequences (subsection 5.2.2).

[14] They can make such anticipation even if they cannot make such behavior contractible (Hart [2003], Hoppe and Schmitz [2010]).

5.2.1 Imperfect price competition in public procurement

By selecting the private operator through a competitive tendering, the public authorities aim to create competition for the field, when competition in the field is not possible. However, the number of candidates may vary from one service to another, and in many cases, only few candidates participate in the competitive tenderings of many local public services. Moreover, numerous empirical studies have shown that an increase in the number of bidders encourages more aggressive bidding, and a decrease in prices (Amaral et al. [2011], Gomez-Lobo and Szymanski [2001], Brannman et al. [1987]), so that competition prices (equal to the cost to perform the service) should be obtain only when there are a large number of candidates.[15] Figure 1 in section 2 also illustrates this competition effect in the case of the London bus transport.
These empirical results recall the so-called "Bertrand paradox" in the public procurement sector.[16]

To account for such a competition effect, we now assume that the winner of the competitive tendering gets a price above his marginal cost, *i.e.* the price is equal to the cost to perform the service and a mark-up. To determine this mark-up, we introduce an *ex ante* bargaining power of the operator(s) $\gamma \in (0,1)$ so that the mark-up is equal to a proportion γ of the total surplus. Since the number of candidates is higher under allotment than under non-allotment, we assume that the *ex ante* bargaining power of the private operators are lower under allotment, *i.e.* $0 \leq \gamma^A < \gamma^W \leq 1$, where γ^A is the *ex ante* bargaining power of the winners of the competitive tendering under allotment, and γ^W is his bargaining power when there is no allotment ("'W"' stands for "'*without allotment*"').
The price for managing L components is then defined as follows:

$$P_L = C_L + \gamma^{\{A;W\}} S_L^P$$

where C_L denotes the global cost to manage L components of the service so that $C_L = \sum_{j=1}^{L}(C_j^0) - L \times \sigma[c(e^P)_L - b(e_L^P) + \beta(i_L^P)] + e_L^P + i_L^P$.

[15] Let us also add that some other studies report that an increase in the number of bidders could also lead to higher prices because of the winner's curse effect (Hong and Shum [2002]). This effect mainly appears in common value auctions, i.e. a situation where the actual value of the item for sale is the same for everyone but bidders have different private information about what that value is. The winner tends to be the bidder with the most overly optimistic information concerning the service or object's value. When a bidder bids only as regards to his private information, this would lead to negative expected profits. Consequently, in equilibrium, we should expect a rational bidder to internalize the winner's curse problem by bidding less aggressively (Milgrom [1989]). Compte [2004] shows that such effect can persist in pure private-value auctions. However, in our model, since the cost to perform the service is observable by all the parties, there is no possibility of winner's curse effect. Then, an increase in the number of bidders should only leads to a competition effect, *i.e.* a decrease in prices (as it has been empirically shown in the case of the London bus transport (Amaral et al. [2011])).

[16] This paradox is that it usually takes a large number of firms to ensure that prices equal marginal costs, while the competition (in prices) between only two firms should theoretically be sufficiently to charge a price equal to the marginal cost.

5.2.2 Payoffs of the parties under imperfect competition

From the previous subsection, under imperfect price competition:

- When there is no allotment ($L = N$),

$$\begin{aligned} P_N &= C_N + \gamma^W S_N^P \\ UM_N &= P_N - C_N \\ &= \gamma^W S_N^P \\ UG_N &= (1-\gamma^W) S_N^P \end{aligned}$$

- When there is allotment,

$$\begin{aligned} P_{L1} &= C_{L1} + \gamma^A S_{L1}^P \\ UM_{L1} &= P_{L1} - C_{L1} \\ P_{L2} &= C_{L2} + \gamma^A S_{L2}^P \\ UM_{L2} &= P_{L2} - C_{L2} \\ &= \gamma^A S_{L2}^P \\ UG_{L1+L2} &= (1-\gamma^A)(S_{L1}^P + S_{L2}^P) \end{aligned}$$

Let us note that when there is no allotment, the mark-up charged by the private operator is $\gamma^W S_N^P$, while under allotment, the first operator charges a mark-up of $\gamma^A S_{L1}^P$ and the second $\gamma^A S_{L2}^P$.
The mark-up charged by the firm is then lower in case of allotment: because of their lower bargaining power, the private operators grab a lower part of the total surplus, compared to the share the operator gets under non-allotment. This result is shown in equation (1). Indeed, from proposition 1, we can establish that:

$$\begin{aligned} S_N^P &\geq S_{L1}^P + S_{L2}^P \\ \Leftrightarrow \gamma^W S_N^P &\geq \gamma^W S_{L1}^P + \gamma^W S_{L2}^P \geq \gamma^A S_{L1}^P + \gamma^A S_{L2}^P \end{aligned}$$

$$\Leftrightarrow \gamma^W S_N^P \geq \gamma^A S_{L1}^P + \gamma^A S_{L2}^P \quad (1)$$

This implies that thanks to allotment the public authority saves on the mark up given up to the private party by an amount: $\gamma^W S_N^P - \gamma^A S_{L1}^P - \gamma^A S_{L2}^P \geq 0$.

5.2.3 Decision of the public authority under imperfect competition

The public authority has better not to allot the service when $UG_N \geq UG_{L1+L2}$, *i.e.* when:

$$\begin{aligned} & (1-\gamma^W)S_N^P \geq (1-\gamma^A)(S_{L1}^P + S_{L2}^P) \\ \Leftrightarrow \quad & S_N^P - S_{L1}^P - S_{L2}^P \geq \gamma^W S_N^P - \gamma^A(S_{L1}^P + S_{L2}^P) \end{aligned}$$

- The public authority decides not to allot (*i.e.* makes the optimal contractual choice) when the loss in total surplus caused by the fewer economies of scale under allotment ($S_N^P - S_{L1}^P - S_{L2}^P$) is higher than the reduction in the mark-up charged by the private operators in case of allotment ($\gamma^W S_N^P - \gamma^A(S_{L1}^P + S_{L2}^P)$).

- However, when $S_N^P - S_{L1}^P - S_{L2}^P \leq \gamma^W S_N^P - \gamma^A(S_{L1}^P + S_{L2}^P)$, *i.e.* when the reduction in the mark up given to the private operator because of allotment is higher than the loss in total surplus allowed due to allotment, then the public authority has better to allot.
  In this situation, the decision (*to allot*) that maximizes the public authoriy's interest is not the optimal decision that maximizes the total surplus (*not to allot*).

5.3 Public authorities: what choice?

We believe that our results raise the question of the role of public authorities in the management of local public services. If we consider that public authorities have to defend the social interests, and then have to look for the solution that makes the payoff of the citizens they represent the highest, then allotment is a good strategy to implement, whenever $S_N^P - S_{L1}^P - S_{L2}^P \geq \gamma^W S_N^P - \gamma^A(S_{L1}^P + S_{L2}^P)$ as shown above.

On the contrary, if we consider that public authorities have to represent the whole society, and if they care about the benefits of the citizens as well as the benefits of the firms, then they should choose the solution that maximizes the size of the surplus, and refuse allotment. In other words, public authorities have to choose between global efficiency and their own benefits.
This results allow us to ask what the "public interest" is: Legal scholars underline that the public interest is represented by the interests of the citizens, and not of the firm. As a consequence, this can help to justify the recent legislation in favor of allotment. However, the normative economic perspective that define optimality by the maximization of the payoffs of all parties (firms and citizens) shows that allotment may be sub-optimal.

It is also interesting to notice that the new procedure of the *Code des Marchés Publics* in France (introduced to apply the European Directive aiming to encourages the use of

allotment) is mainly justified by its expected positive effects on competition. Our model shows that allotment cannot be reduced to its competitive effect on *ex ante* prices, but has also some effects on the incentives to innovate during the execution of the contracts, and the *ex post* surplus (by lowering the economies of scale).

Proposition 2. *Under some conditions, allotment allows to increase the payoff of the public authority at the expense of the firms operating the market.*

5.4 Discussion about allotment and *ex ante* prices

Let us recall that the main motivation for the introduction of allotment is to increase competition so that prices can decrease. We determine here the impact of allotment on the *ex ante* prices:

- Under non-allotment, $P_N = C_N + \gamma^W \times S_N^P$
- Under allotment, $P_{L1} = C_{L1} + \gamma^A \times S_{L1}^P$ and $P_{L2} = C_{L2} + \gamma^A \times S_{L2}^P$

Allotment leads to:

(i) an increase in the cost to perform the service because of the economies of scale: $C_{L1} + C_{L2} \geq C_N$.

(ii) a reduction in the mark-up grabbed by the private party from an amount : $\gamma^W \times S_N^P - (\gamma^A \times (S_{L1}^P + S_{L2}^P))$

As a consequence, allotment leads to lower prices whenever:

$$
\begin{aligned}
&P_N \geq P_{L1} + P_{L2} \\
&C_{L1} + C_{L2} + \gamma^A \times S_{L1}^P + \gamma^A \times S_{L2}^P \leq C_N + \gamma^W \times S_N^P \\
&\Leftrightarrow C_{L1} + C_{L2} - C_N \leq \gamma^W \times S_N^P - \gamma^A \times (S_{L1}^P + S_{L2}^P)
\end{aligned}
$$

Allotment allows to reduce the prices paid by the public authority to the private parties when the cost increase caused by allotment[17] $(C_{L1} + C_{L2} - C_N)$ is lower than the gain the public authority gets under allotment thanks to the lower mark-up given up to the private parties $(\gamma^W \times S_N^P - \gamma^A \times (S_{L1}^P + S_{L2}^P))$.
Then, allotment is expected to decrease the prices only when the impact on the mark-up is higher than the impact on the economies of scale on the cost to perform the service.

[17] This cost increase is explained by the fewer economies of scale in case of allotment.

6 Conclusion

In Europe, for many public services, public authorities are encouraged to allot their markets. We show that this choice has different implications as regards to the allocation of surplus between the public and the private parties.
Our results first show that the *ex post* global surplus reached is different, depending on whether allotment is practiced or not, because allotment entails different incentives to make non-contractible efforts for the operator. Moreover, we also stress how allotment shares differently the gains for the parties, depending on the *ex ante* level of competitive pressure. Last, our results stress how the strategy of allotment may be beneficial to the public authority at the expense of the global surplus under some circumstances. Then, in practice, public authorities may face an "efficiency dilemma": alloting a market enables public authorities to get a large payoff, but the total surplus is less prone to grow. Alternatively, choosing not to allot a market provides strong incentives to private operators to increase the surplus, but this surplus is partly kept by operators. In this regard, our analysis is both normative (as it highlights the consequences for the global surplus) and positive (as it gives some indications to better understand the choice of public authorities).
More broadly, our paper highlights the fact that the environment of the relationship - and especially the legal environment- is not neutral on the *ex post* efficiency of public procurement contracts.

Besides, although our model is justified by the European new legislation on public procurement, the results can be extended to many situations where public authorities can allot their public services. For instance, the World Bank regularly discusses the guidelines of public procurement, and the question of allotment.[18]. Moreover, our reasoning can be extended to other forms of public-private agreements, such as concession contracts. Although the European reform is specific to public procurement, the issue of horizontal segmentation (although it is no named allotment) is also at stake for concessions, as it is the case with highways, or airport concessions for instance.

In this regard, our paper might be related to other research on the optimal size of a service area (Cambini and Filippini [2003]).

Regarding this question of optimal size, one could argue that the directive on allotment (i.e. spliting horizontally the public services into several components) goes in the opposite direction from an even more recent reform adopted by most European countries (in France, the law n° 2010-1563 was adopted on December 16th 2010), consisting in grouping municipalities into intermunicipalities.[19] It seems that this reform trend of intermunicipalities

[18]The 2001 report of the world bank "Indonesia, Country Procurement Assessment Report. *Reforming the public procurement system*" is an illustration of the problem of allotment of contracts in developing countries.

[19]In some countries, intermunicipalities are a cooperation between municipalities, while in others they consist in municipalities mergers. These questions have been recently analyzed by the public choice liter-

was originally launched to reduce administrative costs and rationalize public budgets, but the question of whether public services should finally be alloted or not within intercommunalities is not tackled in the legislative texts. As the reform is not fully applicable yet, it will be interesting to observe in the coming years if the intermunicipal authorities go towards more allotment or more pooling of their contracts with private operators.

By and large, our analysis is a first step to better understand the consequences of contractual incompleteness and allotment in public procurement. For a complete analysis, some more investigations could be led about benchmarking, which is another argument in favor of allotment. In this paper, we have ruled this question out, since it did not seem realistic to us to foresee that local authorities, such as municipalities, will launch into benchmarking, given the difficulties met by experienced regulators with more financial means.

Finally, we based our model on the incomplete contract framework, which does not consider organisational costs. Indeed, it is likely that they are more important when allotment is practiced, since there are more operators to manage. Moreover, allotment may raise the question of interferences between the differents components of the service. Introducing these effects, and studying their evolution and learning effects could be the object of future works.

Appendix

Proof 1

By the implicit function theorem,

$$\begin{aligned} \frac{d(e_L^P)}{dL} &= -\frac{(c'(e_L^P) - b'(e_L^P)}{L(c''(e_L^P) - b''(e_L^P))} > 0 \\ \frac{d(i_L^P)}{dL} &= -\frac{(\beta'(i_L^P))}{L(\beta''(i_L^P))} > 0 \end{aligned}$$

Proof n°2

Let us show that F(L), the average surplus function, is increasing in L, where L denotes the number of lots, $L_i (i \in 1;2)$.

$$F(L) = \frac{S_L}{L} = \frac{1}{L}[\sum_{j=1}^{L}(B_j^0 - C_j^0) + L(c(e_L^P) - b(e_L^P) + \beta(i_L^P) - d(i_L^P)) - i_L^P - e_L^P]$$

ature: Hirota and Yunoue [2011], Di Porto et al. [2011], Frère et al. [2011]

$$= (\tilde{B_j^0} - \tilde{C_j^0}) + (c(e_L^P) - b(e_L^P) + \beta(i_L^P) - d(i_L^P)) - \frac{i_L^P + i_L^P}{L}$$

where $\tilde{B_j^0}$ and $\tilde{C_j^0}$ denote the average contractible social benefit and the average contractible cost.

Let us show that F(L) is a decreasing function:

$$\frac{d(F(L))}{L} = (c'(e_L^P) - b'(e_L^P) - 1)\frac{d(e_L^P)}{dL} + (\beta'(i_L^P) - d'(i_L^P) - 1)\frac{d(i_L^P)}{dL}$$

From the first-order conditions (1) and (2), $(c'(e_L^P) - b'(e_L^P)) = \frac{1}{\sigma}$ and $\sigma\beta'(i_L^P) = \frac{1}{\sigma}$. As a consequence, $c'(e_L^P) - b'(e_L^P) - 1 \geq 0$ and $(\beta'(i_L^P) - d'(i_L^P) - 1) \geq 0$.

Moreover, from proof n°1, we show that $\frac{d(e_L^P)}{dL} \geq 0$ and $\frac{d(i_L^P)}{dL} \geq 0$.

Consequently, $\frac{d(F(L))}{L} \geq 0$: the average surplus function is increasing in L.

Since $N \geq L_1$ and $N \geq L_2$, it follows that:

$$F(N) \geq F(L_1) \Leftrightarrow \frac{S_N^A}{N} \geq \frac{S_{L_1}^A}{L_1} \Leftrightarrow L_1\frac{S_N^A}{N} \geq S_{L_1}^A$$
$$F(N) \geq F(L_2) \Leftrightarrow \frac{S_N^A}{N} \geq \frac{S_{L_2}^A}{L_2} \Leftrightarrow L_2\frac{S_N^A}{N} \geq S_{L_2}^A$$

By addition, $L_1\frac{S_N}{N} + L_2\frac{S_N}{N} \geq S_{L_1} + S_{L_2} \Leftrightarrow N\frac{S_N}{N} \geq S_{L_1} + S_{L_2} \Leftrightarrow S_N \geq S_{L_1} + S_{L_2}$.

References

Amaral, M., Saussier, S., and Yvrande-Billon, A. (2011). Does competition for the field improve cost efficiency? evidence from the london bus tendering model. *Journal of Transport Economics and Policy*.

Bajari, P. and Tadelis, S. (2001). Incentives versus transaction costs: A theory of procurement contracts. *RAND Journal of Economics*, 32(3):387–407.

Bennett, J. and Iossa, E. (2006). Buiiliding and managing facilities for public services. *Journal of Public Economics*, 90(10-11):2143–2160.

Brannman, L., Klein, J. D., and Weiss, L. W. (1987). The price effects of increased competition in auction markets. *The Review of Economics and Statistics*, 69(1):24–32.

Cambini, C. and Filippini, M. (2003). Competitive tendering and optimal size in the regional bus transportation industry: An example from italy. *Annals of Public and Cooperative Economics*, 74(1):163–182.

Compte, O. (2004). Prediction errors and the winner's curse. Working Paper.

Desrieux, C. (2009). Owner or holder? a critical study of property rights in local public services. *Journal of Institutional and Theoretical Economics*, 165(2):230–249.

Di Porto, E., Paty, S., and Merlin, V. (2011). Determinants of fiscal cooperation decision-making: The case of french municipalities. *CREM Working Paper*.

European Parliament, D.-g. f. e. and industry (2007). Guide on dealing with innovative solutions in public procurement: 10 elements of good practice. Technical report.

Frère, Q., Leprince, M., and Paty, S. (2011). The impact of inter-municipal cooperation on local public spending. *Working Paper*.

Gomez-Lobo, A. and Szymanski, S. (2001). A law of large numbers: Bidding and competitive tendering for refuse collection contracts. Technical Report 1.

Grossman, S. J. and Hart, O. (1986). The cost and benefits of ownership: A theory of vertical and lateral intégration. *Journal of Political Economy*, 94(4):691–719.

Guasch, J.-L. (2004). *Granting and Renegotiating Infrastructure Concessions: Doing It Right*. The World Bank, Washington.

Hart, O. (1995). *Firms, Contracts and Financial Structure*. Oxford University Press, Oxford.

Hart, O. (2003). Incomplete contracts and public ownership: Remarks, and an application to Public Private Partnerships. *Economic Journal*, 113(485):C69–C76.

Hart, O. and Moore, J. (1990). Property rights and the nature of the firm. *The Journal of Political Economy*, 98(6):119–1158.

Hart, O., Shleifer, A., and Vishny, R. W. (1997). The proper scope of government: Theory and an application to prisons. *Quarterly Journal of Economics*, 112(4):1127–1161.

Hirota, H. and Yunoue, H. (2011). Municipal mergers and special provisions of local council members in japan. *Working Paper*.

Hong, H. and Shum, M. (2002). Increasing competition and the winner's curse: Evidence from procurement. *Review of Economic Studies*, 69(4):871–898.

Hoppe, E. and Schmitz, P. (2010). Public versus private ownership: Quantity contracts and the allocation of investment task. *Journal of Public Economics*.

Laffont, J.-J. and Tirole, J. (1991). The politics of government decision-making: A theory of regulatory capture. *The Quarterly Journal of Economics*, 106(4):1089–127.

Laffont, J.-J. and Tirole, J. (1993). *A Theory of Incentives in Procurement and Regulation*. MIT Press, Cambridge.

Milgrom, P. (1989). Auctions and bidding: A primer. *Journal of Economic Perspectives*, 3(3):3–22.

Morand, P.-H. (2002). Accès des PME aux marchés publics : allotissement ou groupement ? *Economie Publique*, 10(1):73–100.