Private information, competition and the renewal of delegation contracts: An econometric analysis of water services in France

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Résumé

In France, water supply and sanitation can be delegated to private operators by local communities. The renewal of delegation contracts is often considered to be insufficiently competitive. We hypothesize that this may be due to the fact that the incumbent operator knows the existing network better than his competitors. This type of private information creates what is referred to as a winner's curse during renewal auctions. We propose a methodology that makes it possible to distinguish this type of information from the more standard private information parameter that characterizes the idiosyncratic productivity of each operator. We have built a model that simultaneously explains the choice of operator made by the local community and the degree of competition during the renewal process. This selection model makes it possible to estimate prices in a second step without a selection bias.

Keywords : Incentive contract, asymmetric information, common value, selection model, water utilities

JEL : C34, D82, L95

1 Introduction

One of the major characteristics of water service management in France is the important role played by public-private partnerships. Private drinking water supply (DWS) operators serve three quarters of the French population and treat the wastewater of approximately half of the population. They generally operate within the framework of lease contracts with the local authorities. This management model for a sector that has the characteristics of a natural monopoly (local) is qualified as competition for the market (Demsetz 1968). Williamson (1976) emphasized the limits of competition for the market and, in particular, the lack of competition when the contract is renewed.

Since 1993, local authorities have been required to follow a specific procedure for delegating public services, which, in theory, should lead to increased transparency and competition. However, available data shows that a very small number of operator changes have taken place. It is possible to link this characteristic to the fact that the DWS and the sanitation sectors are quite concentrated, with a small number of major companies (Veolia Environnement, Suez Environnement, Saur) and several smaller ones. Another explanation could be the collusion between the authorities in charge of the local municipality and the incumbent operator, which may be strong enough to make competition ineffective.

In this article, we give special weight to an additional hypothesis that would explain this inertia in the choice of the utility's operator. The incumbent operator benefits from asymmetric information that hinders free competition during the bidding process and, therefore, the effectiveness of delegation contract attribution rules. On the one hand, the incumbent operator knows the service better than his competitors simply because he operated the network for a long time. This type of private information is important for his competitors because it determines their earning power if one of them becomes the new operator. This private information, known as the "common value", creates what is referred to as the "winner's curse" during contract renewal negotiations. In other words, each outsider understands that he can only win the contract if the network quality is poor, reducing anticipated profits. This explains why competition remains low. Few studies have analyzed common value auctions (Hausch 1987), but the effects of such asymmetric information may be significant (see Aubert et al. (2006) for the water sector). On the other hand, "normal" private information linked to productivity or to the competency of a company and known as the "private value" is important for each potential operator since he can use it strategically to increase his profits. It is shown that

private value auctions converge towards complete information when the number of bidders is high. In contrast, when the number of bidders is low, the incumbent operators have a greater chance of winning the contract. The local authorities have a choice between two types of contracts : a high-incentive contract to efficiently operate the network with high information rents that explains the high prices observed, and a lower incentive contract that reduces information rents, as well as efforts to reduce service costs. Concerning this point, Boyer and Garcia (2008) modeled the interactions between management regimes (municipal vs. delegated) and operating costs of DWS utilities in France in order to compare their performance and pricing.

In this article, we particularly focus on the factors that influence competition and operator changes when delegation contracts are renegotiated. To do this, we used a set of data related to bidding procedures for the DWS and sanitation sectors in France between 1998 and 2004. First of all, we tested the criticism of Williamson on competition for the market by studying the factors that affect competition and operator change during bidding procedures. In particular, the delegation procedure makes it possible for local authorities to use outside consultants for their evaluation and the assessment of the water service provider, in order to transmit information about network quality to potential competitors. We attempted to determine whether or not this tool made it possible to reduce the "common value" effect during the bidding process by showing its positive impact on competition and operator change. Since operator change can only occur if competition exists during the procedure, we built a model to explain competition during the procedure and another for operator change. The two discrete variables to describe competition and operator change, as well as the simultaneity of events led us to choose a bivariate probit model with sample selection (Van de Ven and Van Praag 1981).

We then attempted to determine the impact of competition and operator change on price variations when contracts are renewed by taking account of the bias problems that these variables generate in the estimation process. Our database includes the identity of the operator and we are therefore capable of testing the presence of private information (in the sense of "private value") simply by checking if the same company had similar parameter values when it operated different water utility networks.

Model results show that the organization of the procedure plays an important role in the competition and the possibility of changing operators, just like the network characteristics and local competition conditions. Even if competition for the market does not appear to be the ultimate

solution, our model and the data illustrate the role of the institutional framework of the bidding process. The regional organization of French water utilities could also contribute to strengthening the competition.

2 Water utilities in France : organization and questions

2.1 Organization of water utilities in France

The organization of DWS and sanitation services in France is the responsibility of municipalities. They can organize the service at the level of the municipality or form syndicates or communities (groups of municipalities). Despite these possibilities, the organization of water utilities in France has remained dependent on the communal breakdown that resulted from the French Revolution (Canneva and Pezon 2008). Approximately 12,000 DWS services and more than 15,000 collective sanitation services exist at this time, most of which are very small and with limited internal resources.

Since the beginning of these network services, French municipalities have had the possibility of delegating water management to private operators in the form of a concession (when the operator finances the infrastructures) and in the form of a lease (when it is the municipality that finances the infrastructures). In all of the cases, the municipality is responsible for the effective operation of the utility and maintains the possibility of managing its water services itself, by means of local government control (*Régie*). At this time, delegation management is predominant : it represents 75% of the population provided with drinking water and a little over 50% of the population connected to a collective sanitation network (BIPE/FP2E 2008). Within the framework of delegated management, lease contracts are highly prevalent, with municipalities providing the majority of infrastructure financing. Operators only contribute up to 13%, corresponding to equipment with the shortest lifetimes (Pezon and Canneva 2009). The private operator market is particularly concentrated. Three major groups (Veolia Environnement, formerly Vivendi or Générale des Eaux ; Suez Environnement, Lyonnaise des Eaux (LDE) in France ; Saur) share 97% of the delegated management between them, with only 3% attributed to independent private operators. From a legal point of view, DWS and sanitation services are separate when even their perimeters are identical. Their budgets are separate and not included in the overall budgets of the municipalities. Virtually all of the water utility resources are covered by the water bill. When the utility is managed in the form of a lease, one part is paid to the farmer in exchange for service management and another part to the municipality in

order to finance the infrastructures.

Network utilities such as DWS and sanitation are considered to be natural monopolies. Even when the infrastructures belong to the municipalities, they can only be operated by a single operator, at least for a given territory. After a period of great contractual freedom for the municipalities that led to several cases of corruption, the "Sapin Law" introduced a specific procedure in 1993 for public service delegations. The law aimed at ensuring more transparency than the existing discretionary procedure and, as a result, encouraging competition (see Fig. 1 and the description in Section 4.3.1). It nevertheless left ample room for negotiations between the municipality and the applicants. After negotiations, an incomplete, long-term contract specifies the general obligations of the operator and the price at which the service may be billed.

[Fig. 1 here]

Since 1995, entry fees (paid to the municipality at the beginning of the contract and sometimes extremely high) have been prohibited and the term of the contract has been limited to 20 years. The obvious aim of these measures was to encourage competition by limiting entrance barriers and increasing the frequency of contract renewals. This procedure is quite complex and fairly uncommon for the municipalities. As a result of legal risks (invalidity of the contract in the event of non-compliance with the procedure, penal risk for elected officials), as well as technical and economic issues, the municipalities often surround themselves with specialized consultants. Until recently, this type of support was provided to municipalities in rural areas by government agencies (Departmental Directorate of Agriculture and Forests (DDAF), or the Departmental Facilities Directorate (DDE)).

2.2 Key factors and propositions

A significant part of water services are based on a model of competition for the market, limited to utility operation. Demsetz (1968) showed that this model could be effective for regulating natural monopolies. Competition at the time of the delegation procedure makes it possible to obtain the price that could have been obtained by a permanent competition process. Nevertheless, several objections can be raised, particularly at the time of the delegation procedure and when the contact is renewed after delegation.

At the time of the procedure, the mechanism presented by Demsetz only functions when competition is effective. However, as we mentioned above, the sector is very concentrated, increasing the risk of tacit collusion. Moreover, utility operation is based on economies of scale at several levels : at the national level (for example, customer management through a call center, research and development), as well as at a more local level (sharing technology and specialized personnel among several utilities, taking the small size of the utilities into account). An operator will benefit from these economies of scale if he is established at the local level. The presence of several operators already established at the local level should therefore strengthen the competition at the time of the procedure. The size of the utility should also be a factor in promoting competition since a bigger utility would be less dependent on these local economies of scale. This proposition can be summarized as follows :

P 1 *The local concentration of the water service delegation market reduces competition at the time of the procedures. This effect is limited for larger utilities.*

A corollary to the proposition would be :

P 2 *The presence of an independent operator at the time of the delegation procedure encourages competition and operator change.*

Finally, we assumed that a utility with interesting economic prospects (high former price, growth of volume sold and number of customers) would encourage competition.

P 3 *The economic characteristics of the preceding contract have a positive impact on competition.*

Moreover, during the implementation of the preceding contract, the operator developed specific assets (physical or human) what Williamson (1985) refers to as the "fundamental transformation". As a result of these specific assets, competition is biased when the contract is renegotiated, limiting the interest of the competitive system for the market.[1] Following is an overview of the different mechanisms at work.

The incumbent operator benefits from private information about the quality of the infrastructures that he will be responsible for or about the customers ("common value"). This advantage

[1]Laffont and Tirole (1988) showed that preference will be given to the incumbent operator at the time of contract renewal when the investment is transferable. In fact, investment initiatives undertaken during the preceding contract can benefit the new operator (because they reduce the future operating costs of the service) and therefore decrease the incentive to invest or even to maintain existing assets.

allows him to better predict his costs and revenues. Without this precise information, competitors can make overly optimistic estimations. If one of them wins the contract, there is a big chance that he will have underestimated the operating difficulties ("winner's curse"). This phenomenon could explain the small number of operator changes and its anticipation could limit competition. To better understand the importance of the development of this private information with a common value, we assume that it is particularly linked to the period of the contractual relationship, which leads us to establish the following proposition :

P 4 *The term of the former contract has a negative influence on competition and operator change.*

To reduce the importance of private information with a common value, municipalities can use the services of specialized outside consultants to audit the existing service, prepare more detailed contracts and ensure the fairest possible treatment of applicants during the procedure. In the public transportation sector in France, Yvrande-Billon (2006) also points out how the lack of internal expertise within municipalities strengthens asymmetric information and the advantage of the incumbent operator.

P 5 *Using a specialized outside consultant promotes competition and increases the probability of an operator change.*

Moreover, the change of the utility's operating conditions could be the sign of less vital private information with a common value.

P 6 *Changes in new contract terms have a positive impact on competition and operator change.*

As we mentioned above, tangible physical assets (such as meters) only represent a limited share of the investments, those that are depreciable during the contract term. The water sector in France does therefore not differ that much from other sectors where assets are generally considered as being less specific. Operator personnel ("human assets") are protected by labor laws that provide for their transfer in the event of a change of operators. These provisions, however, are aimed at protecting workers and not at ensuring the maintenance of the specific know-how necessary for managing the utility for the new operator. Beyond the regulations, the transfer of these assets in the event of an operator change remains uncertain, making the start-up of operations risky and costly. These elements can therefore reduce competition even further and stand in the way of obtaining an optimal price at the time of the procedure. The presence of an outside consultant can facilitate the transfer

in the case of an operator change, particularly by anticipating it at the time of the procedure. The propositions that result from these considerations partially overlap those already formulated, for complementary purposes : P4 (the scope of these specific assets is linked to the term of the former contract), and P5 (the specialized outside consultant increases the likelihood of an operator change).

Finally, the incumbent operator has intangible specific assets essential for the good management of the utility (such as the list of customers). Billing is done by the DWS service for the sanitation service (a user of the two services generally receives only one bill, sent by the DWS service). We can therefore consider that the DWS service has a higher specific asset level than the sanitation service. This leads to the formulation of the last proposition :

P 7 *Sanitation services benefit from a higher degree of competition and more frequent operator changes than DWS services.*

The aim of the contract renewal process is to allow the municipality to limit the income that the operator has accumulated over the years through productivity gains or through expediency. In fact, during the performance of the contract, the uncertainty of the environment and the contractual incompleteness provide opportunities for renegotiating the terms. In this case, the municipality and the operator are in a bilateral relationship where competition no longer counts, and the latter can then opportunistically renegotiate a profit margin (Williamson 1976). We can therefore take a look at the effects of the contract renewal process on prices, independent of competition and operator change. If competition occurs at the time of a procedure, we expect it to have a beneficial effect on prices in the new contract. In the same way, we expect that an operator change will be accompanied by a drop in prices. This can also be linked to operators' strategies for making inroads into new areas, even at the risk of temporarily sacrificing a portion of their profit margin.

As we have shown, competition, operator change and price evolution are closely related. We have therefore developed an original model for the joint assessment of these decisions in order to better identify the exogenous and endogenous effects.

3 Modeling

3.1 Contract renewal and choice of an operator

The local municipality that wishes to renew its delegation contract launches a competitive bidding procedure that primarily stipulates the level of service. We assumed that the choice of an operator is based on the comparison of prices for a given level of service. In particular, the municipality makes the decision to renew the contract with the same operator by basing itself on the price discrepancy between the former contract and the new one. The choice is described by a criterion function (or a selection equation) that indicates that the local municipality i changes its water utility operator if :

$$E(P_i^0) - E(P_i^1) > \kappa_i, \tag{1}$$

where $E(P_i^0)$ and $E(P_i^1)$ are the price expectations for the former contract and the new contract, respectively. The municipality decides to change operator if the price difference is greater than a non-observed reserve value κ_i. This variable κ_i can be interpreted as the predisposition of the local municipality to continue with the incumbent operator and can therefore be positive or negative. We assume that κ_i is a function of the characteristics of the service CAR_i, as well as of the variables that are linked to the past contract with the incumbent operator ($CONTRACT_i$), those of the local competition situation ($COMP_i$), plus the procedure characteristics ($PROC_i$).

$$\kappa_i = \alpha_0 + \alpha_1 CAR_i + \alpha_2 CONTRACT_i + \alpha_3 COMP_i + \alpha_4 PROC_i + u_i, \tag{2}$$

where u_i is an error that takes random factors that cannot be observed by the municipality and the operator into account, and that follows a $N(0, \sigma_u^2)$ distribution. Thus, on the basis of Equations (1) and (2), we can write the structural selection equation as follows :

$$I_i^* = \delta_0 + \delta_p\big[E(P_i^0) - E(P_i^1)\big] + \delta_1 CAR_i + \delta_2 CONTRACT_i + \delta_3 COMP_i + \delta_4 PROC_i - u_i. \tag{3}$$

By normalizing $\sigma_u^2 = 1$, Equation (3) as the form of a probit model. Therefore, if $I_i^* > 0$, the local municipality i decides to change its utility operator. The parameters δ are the parameters of the structural model to be estimated. In particular, for a positive price differential of $E(P_i^0) - E(P_i^1)$, we assume that δ_p will be positive.

3.2 Contract award procedure and competition

The degree of competition during the contract attribution procedure is not directly observable and difficult to measure with a continuous variable. We therefore modeled competition using a latent variable C_i^* :

$$C_i^* = \gamma_0 + \gamma_1 CAR_i + \gamma_2 CONTRACT_i + \gamma_3 COMP_i + \gamma_4 PROC_i + v_i, \tag{4}$$

where v_i is the random error term that represents the set of non-observable factors and follows a standard normal distribution.

Competition and operator change are two processes that are obviously linked. Operator change can only take place if the level of competition is sufficiently high. In fact, as many examples in France (and in our sample) have shown, the presence of a single incumbent operator at the time of the contract renewal process can only lead to the reappointment of the same operator. In contrast, a large number of applicants and the submission of several bids increase the probability of operator change. Moreover, observable and non-observable factors affect the two processes and thus lead to a selection bias problem. As a result, the competition and operator change processes are estimated simultaneously by taking selected service sub-samples into account.

4 Data description

4.1 The "Sapin Law" survey

In order to answer questions about problems linked to water services in France and to analyze the factors underlying competition and operator change, as well as their impact on price evolution, we based our study on data resulting from the "Sapin Law" survey. The purpose of this survey, ordered by the French Ministry of the Environment, was to analyze the application and repercussions of the law of the same name, from two specific angles :

- to measure the impact of the law on the operation and prices within French water utilities ;
- to more effectively assess the needs of municipalities in terms of support and advice about the bidding process.

The data that we obtained covers the period from 1998 to 2004, the years during which the "Sapin Law" survey was entrusted to ENGREF (*Ecole Nationale du Génie Rural, des Eaux et des Forêts*).

The construction of the database was the outcome of a close partnership between the different local municipalities concerned and their consultants. As soon as the announcement of a delegation contract renewal procedure for DWS or sanitation was published, it was surveyed by ENGREF. Once it was completed, ENGREF transmitted a questionnaire to the municipality and its consultant, if the case may be, related to the period before the renewal, the contract negotiation period, as well as the situation provided for by the new contract. Data collection was carefully followed up.

The bid call survey made it possible to create a database with 4,062 procedures initiated, spread out over the entire country. The information recorded could be broken down into five categories :

- characteristics of the municipality : name, type of municipality, geographic location, population, etc.
- Information about the former contract : operator concerned, contract term, revenues of the operator and the municipality, consumer prices, etc.
- Information about the newly signed contract : new operator, forecasted term, fixed prices, forecasted revenues, etc.
- How the Sapin procedure was carried out : consulting firm, presence of an independent competitor, study of the possibility of a return to local government control.
- Situation in terms of competition : perceived impression of the competition, number of bid call applicants, number of bids, etc.

Overall, more than sixty variables, quantitative and qualitative, were collected.

4.2 Preparation of the database

The working database was established on the basis of requests for data from the procedure database. For the set of procedures surveyed, only approximately 1,500 could be used for our study. Many of them had to be eliminated because they presented one or several of the following problems :

- absence of all or a large portion of the data, resulting from the non-response of some municipalities to the survey, or from incomplete responses.
- Some municipalities that manage their networks themselves were surveyed because they decided to delegate their service, but are not within the framework of our study. It should be emphasized that changes in management methods represent only a marginal part of the services.
- Some municipalities have a particular delegation method that does not correspond to leasing,

and we chose not to take them into account because of their specificities.

– Some values appear to be abnormally high or low. This is probably due to misunderstandings or input errors concerning the questionnaire, making the data inconsistent.

We thus kept individuals whose data was viable, for an exact total of 1,435 municipalities.

4.3 Description of variables

4.3.1 Endogenous variables

Competition In order to assess the factors that influence competition, we first have to be able to measure them. Nevertheless, competition at the time of a delegation procedure is not directly observable. We therefore have to quantify it using an observable variable that best translates the concept that it represents.

With this in mind, we will briefly summarize a public service delegation procedure in France (see Fig. 1). First, the municipality publishes a bid call that contains the major service characteristics. Interested companies submit their application, highlighting their technical and financial capacity to manage the utility on the long term. These applicants do not have a very specific character (they are used in several procedures). The municipality then establishes the list of applicants allowed to submit a bid. Second, it sends a detailed bid package, including the contract model to be completed, to all of the companies whose application was accepted. The companies that are still interested in operating the utility then submit a bid on this basis. The municipality receives the bids, analyzes them and draws up a list of the companies with which it would like to negotiate. Third, the municipality negotiates on its own conditions with the selected companies on the basis of their bids. At the end of the negotiation process, it chooses the company that it feels is the most capable of fulfilling the public service functions laid out in the contract at the most advantageous price. We therefore have three possible proxies for competition :

– the number of applications submitted to the municipality ;

– the number of bids submitted to the municipality ;

– the perceived impression of the competition during the negotiation phase by the municipality or by its consultant (who returned the survey).

The number of applications submitted to the municipality is a precise and objective observation. Nevertheless, it may not faithfully represent the competition because many companies submit an

application (which does not require much effort) without being really interested in the contract but, instead, in the specific information about the utility contained in the bid package.

The number of bids submitted to the municipality is another precise and objective observation that could constitute an interesting proxy. It takes a considerable amount of time to draw up bids adapted to each municipality. We can therefore imagine that the bias specific to the number of applicants would not exist. Nevertheless, the water service delegation sector is very concentrated and the presumption of tacit collusion is high. The French Competition Council (*Conseil de la Concurrence*) has already sanctioned companies in the water service sector for not having submitted a bid during procedures, considering that it was proof of tacit collusion between operators (see, for example, the decisions of June 30, 1987, or July 11, 2002). Some bids can then be considered as "cover bids". Therefore, several bids are not a guarantee of competition during the negotiation phase.

The proxy that we chose here is therefore a measure of the competition through its perceived impression during the delegation procedure. This perception of competition is recorded in the questionnaire sent to each municipality or consultant. The responsible parties declare if, yes or no, they feel that they benefited from a real competitive process. This variable has the considerable advantage of not being biased by "false" applications or cover bids, because if there are many applicants but if they do not really compete for the market, the perception of competition will be diminished. Even though the impression of competition is subjective, it seems to be the least biased to us. This variable is referred to as *Compet*. We assumed that competition was only observed when the people surveyed responded to the "yes" category.

Operator change For municipalities that delegate water service management to a private operator, the "Sapin procedure" is essential. Its outcome can be summed up by the following alternative : either the municipality rewards the incumbent operator by entrusting the management of its network to him once again for a fixed term, or the municipality decides to change operators and thus entrusts the operation of its network to a competing company. If, according to Demsetz, neither of these two outcomes appears to be preferable to the other after a good expression of competition, in reality, this is not what actually occurs. In fact, we have observed that it is almost always the incumbent operator who is awarded the new contract at the end of the procedure : only 12% of all of the contract renewal procedures launched between 1998 and 2004 resulted in an operator change. To explain this low rate of change, we advance the following hypotheses :

– the municipality's satisfaction with the incumbent operator for the work he has done. It may therefore want to extend his contract.
– The asymmetric information between competitors that we mentioned earlier and that gives the advantage to the incumbent operator.
– The aversion of the municipality to risk, which may induce it to keep the company that it knows and with which it is used to working, even when a competitor makes a more interesting bid.
– The transaction costs involved in changing from one operator to another that are not negligible, even for the municipality.

In our study, a binary variable indicates operator change. It is referred to as $Newop$.

Prices Although prices may change during the contract performance thanks to a reactualization formula based on cost performance, our approach consisted of assessing price performance at the time of contract renewal in order to determine the explanatory factors. The price of water can be broken down into two parts, a part that is paid to the operator and a part that is paid to the municipality to reimburse its investments. We only take the part paid to the operator into consideration since we are interested in the procedure for determining it, and because the part paid to the municipality is decided unilaterally and on a yearly basis. In order not to be influenced by pricing effects that include different elements (fixed shares, tranches, etc.) that vary from one utility to another, the price is calculated by establishing the ratio of the operator's forecasted revenues to the distributed forecasted volume (Garcia et al. 2005). We thus create a variable that represents the difference between the price paid to the operator before the contract was renewed and the price after the new contract is signed :

$$Diffp = P_i^0 - P_i^1$$

4.3.2 Explanatory variables

Many factors have an impact on delegation renewal procedures, which will then have an effect on competition that will benefit the municipality, as well on eventual operator change at the end of the procedure. Some of these factors will be favorable to competition (or encourage an operator change), whereas other factors may reduce competition (or contribute to the choice of maintaining the same operator). Therefore, as we mentioned above, we can consider that the following factors

(among others) may influence competition and/or operator change :

- the type of service concerned (DWS or sanitation).
- The size of the service.
- The type of municipality : depending on the type of management (community, group of municipalities or syndicate) and the extent of its expertise, competition can more or less express itself in one of the categories. Syndicates are generally only competent in their specific area (water, in this case), whereas a community may be qualified to manage other public services (transportation, waste, etc.). We can assume that the more qualified the municipality is, the more effectively it will control the delegation procedure and the more willing it will be to change operators if a better offer presents itself.
- Consulting firms.
- The presence of an independent competitor : a competitor that does not belong to one of the three major groups can have a more competitive attitude.

Moreover, we introduced dummy variables per year of procedure launching to control eventual changes over time in terms of competition and the municipality's choice. The descriptive variables of the set of variables used are given in Table 1.

[Table 1 here]

5 Econometric analysis

The structural model to be estimated consists of a bivariate probit model (competition and operator choice) with sample selection (Van de Ven and Van Praag 1981) and a price regression equation. We used estimation procedures with a correction of the sample selection bias.

5.1 Estimation procedure

It is assumed that the price functions have a linear form, so that the price difference equation can also be written linearly :

$$\begin{aligned} Diffp_i = \beta_0 + \beta_1 CAR_i + \beta_2 CONTRACT_i + \beta_3 COMP_i + \beta_4 PROC_i \\ + \beta_5 dCAR_i + \beta_6 dCONTRACT_i + \varepsilon_i, \end{aligned} \tag{5}$$

where it is assumed that the random error term ε_i follows a normal distribution $N(0, \sigma_\varepsilon^2)$, and $dCAR_i$ and $dCONTRACT_i$ are the differences before and after contract renewal of the variables CAR_i and $CONTRACT_i$, respectively. We assume that the variation in price is different depending on whether or not there is an operator change when the contract is renewed. '0' designates the N_0 services that signed the delegation contract with the incumbent operator, and '1' the N_1 services that changed operators.

The choice of operator is made on the basis of the difference in prices (and their determining factors) between the former contract and the new contract. It is possible to rewrite the structural selection equation (3) in the following reduced form :

$$\begin{aligned} I_i^* &= \delta_0 + \delta_1 \big[\beta_0 + \beta_1 CAR_i + \beta_2 CONTRACT_i + \beta_3 COMP_i + \beta_4 PROC_i \\ &\quad + \beta_5 dCAR_i + \beta_6 dCONTRACT_i + \varepsilon_i\big] \\ &\quad + \delta_1 CAR_i + \delta_2 CONTRACT_i + \delta_3 COMP_i + \delta_4 PROC_i - u_i \\ &\equiv \lambda R_i + \nu_i, \end{aligned} \tag{6}$$

where R_i is the vector of explanatory price variables. The new error term ν_i can thus be written as follows :

$$\nu_i = \delta_1 \varepsilon_i - u_i. \tag{7}$$

The error term ν_i depends on ε_i and on u_i that have a normal distribution. ν_i therefore also follows a normal distribution with mean of zero and standard deviation of σ_ν^2. The estimate of the price equation must take the choice of the municipality into consideration because it introduces a correlation between the error term ν_i and the ε_i. This results in a bias selection.

After standardization of $\sigma_\nu^2 = 1$, ν_i follows a standard normal distribution and Equation (6) becomes a probit model. If $\Psi = \lambda R_i$, the probabilistic decision rule of the model can be written as follows :

$$\begin{aligned} Prob(I_i = 1) &= Prob(I_i^* > 0) = Prob(\Psi > -\nu_i) = \Phi(\Psi) \\ Prob(I_i = 0) &= Prob(I_i^* \leq 0) = Prob(\Psi \leq -\nu_i) = 1 - \Phi(\Psi), \end{aligned}$$

where Φ is the function of the cumulative distribution of the standard normal distribution (ϕ is the probability density function).

Because of the selection bias, it is necessary to adjust the error terms of the price equation so that their mean is equal to 0. Within the framework of the probit model, we can write :

$$E(\varepsilon_i^0|I_i = 0) = \rho^0 \frac{\phi(\Psi)}{1 - \Phi(\Psi)}$$
$$E(\varepsilon_i^1|I_i = 1) = \rho^1 \frac{-\phi(\Psi)}{\Phi(\Psi)},$$

where $\frac{\phi(\Psi)}{\Phi(\Psi)}$ and $\frac{\phi(\Psi)}{1-\Phi(\Psi)}$ are the inverse Mill's ratios for the price equation with operator change and the price equation without operator change, respectively. Moreover, we have $\rho^0 = \delta_1 cov(\varepsilon_i^0, \nu_i)$ and $\rho^1 = \delta_1 cov(\varepsilon_i^1, \nu_i)$, with standard deviations of ε_i^0 and ε_i^1 for utilities without operator change and utilities with operator change, respectively.

We thus consider the following price equations (conditionally on operator change or not) :

$$\begin{aligned} Diffp_i^0 = {} & \beta_0^0 + \beta_1^0 CAR_i^0 + \beta_2^0 CONTRACT_i^0 + \beta_3^0 COMP_i^0 + \beta_4^0 PROC_i^0 \\ & + \beta_5^0 dCAR_i^0 + \beta_6^0 dCONTRACT_i^0 + \rho^0 \left(\frac{\phi(\Psi)}{1 - \Phi(\Psi)} \right) + \xi_i^0, \end{aligned} \tag{8}$$

$$\begin{aligned} Diffp_i^1 = {} & \beta_0^1 + \beta_1^1 CAR_i^1 + \beta_2^1 CONTRACT_i^1 + \beta_3^1 COMP_i^1 + \beta_4^1 PROC_i^1 \\ & + \beta_5^1 dCAR_i^1 + \beta_6^1 dCONTRACT_i^1 + \rho^1 \left(\frac{-\phi(\Psi)}{\Phi(\Psi)} \right) + \xi_i^1. \end{aligned} \tag{9}$$

By including $\frac{-\phi(\Psi)}{\Phi(\Psi)}$ and $\frac{\phi(\Psi)}{1-\Phi(\Psi)}$ in the price equations, we correct the selection bias so that $E(\xi_i^0|I_i = 0) = 0$ and $E(\xi_i^1|I_i = 1) = 0$, where $\xi_i^0 = \varepsilon_i^0 - \rho^0 \left(\frac{\phi(\Psi)}{1-\Phi(\Psi)} \right)$ and $\xi_i^1 = \varepsilon_i^1 - \rho^1 \left(\frac{-\phi(\Psi)}{\Phi(\Psi)} \right)$ are the new error terms of the price equations.

The estimation procedure takes place as follows :

1. The reduced operator choice model (6) is estimated at the same time as the competition equation (4) within the framework of a bivariate probit model with selection (Van de Ven and Van Praag 1981) using the maximum likelihood method.
2. Moreover, the estimated parameters $\hat{\lambda}$ allow us to calculate the inverse Mill's ratios $\phi(\hat{\Psi})/\Phi(\hat{\Psi})$ and $\phi(\hat{\Psi})/(1-\Phi(\hat{\Psi}))$ where $\hat{\Psi} = \hat{\lambda} R_i$. The latter are then put into the price equations, and the parameters β and ρ are estimated consistently by the ordinary least squares method. Standard errors of the estimated parameters are obtained using the Jackknife method.
3. The predicted price differences are put into the bivariate probit model, enabling us to estimate

the structural model (3). Standard errors are also obtained using the Jackknife method.

5.2 Estimation results and discussion

Competition and operator change reduced model Table 2 contains the parameter estimates of the operator change model that represents the selection equation in its reduced form (6), jointly estimated with the competition equation (4) by a bivariate probit model with selection. First, a χ^2 test makes it possible to confirm the dependence of competition and operator change models. In fact, the null hypothesis, $\rho = 0$, where ρ represents the correlation coefficient between the error terms of each of the two equations, is rejected with a confidence level of 10%. The estimated parameters allow us to calculate the inverse Mill's ratios that are used to correct a possible selection bias in the estimate of price difference regressions. It should be remembered that the set of factors that determine operator choice (in its reduced form) consists of explanatory price variables, designated R. The price functions are then estimated by the ordinary least squares method. The results are presented in Table 3.

Many variables have a significant impact on competition, thus confirming our propositions. The local presence of several operators, measured by the Herfindhal-Hirschman index, hhi, at the departmental level, has a very significant strong influence on competition. The negative sign associated with this variable signifies that the competition has much less opportunity of expressing itself if the number of locally established operators is low. Taking the interdependencies between competition and operator change into account, the local concentration indirectly decreases the probability of an operator change. Moreover, the size of the service (measured by a distributed volume logarithm) has a significant positive impact on competition, thus diminishing the effect of the local market concentration. Proposition P1 is therefore validated by our model. The presence of bids in the procedure from operators not belonging to the three major groups very significantly strengthens competition, confirming proposition P2. Contrary to what was expected (P3), the economic characteristics of the preceding contract (price, predicted increase in volume) did not appear to significantly influence competition, at least not more than the presence of a consultant at the time of the procedure (P5). The evolution of the contract has a positive and significant impact on competition, confirming our proposition P6. This evolution could be a signal that the municipality would like a change, of service quality, for example. This could limit the initial impression of asymmetrical competition. The DWS sector appears to be less competitive than the sanitation sector. As we suggested in proposition P7,

this could be explained by the more specific assets associated with DWS service management. It could also be a reflection of effects that did not appear to be significant. For example, intercommunal management is greater in the DWS sector than in the sanitation sector. Moreover, the identity of the incumbent operator does not seem to have an impact on competition. The variables that indicate the dates of bid call publication clearly reveal an increase in the impression of competition over the years, which could be interpreted as a form of learning on the part of the actors.

Concerning operator change, the model confirms the interdependency between competition and operator change. The significant factors that influence competition have indirect and concurring repercussions on the probability of operator change. In contrast, the coefficient associated with the "volume" variable is significantly different from zero and negative, and seems to indicate that the probability of an operator change is greater for smaller utilities. The size of the utility therefore has an ambivalent impact on competition and operator change. This can be interpreted as a difficulty to make changes in the case of bigger contracts where the specific assets are obviously greater because of the size of the utility. Even though the term of the former contract has no effect on competition, our results indicate that it has a negative and significant impact on the probability of changing operators (P4). The presence of certain consulting organisms has a positive impact on operator change (including the "Service Public 2000" association, with a significant level of 10%), validating proposition P5. These relationships precisely explain the common value problem : the longer the incumbent operator's contract was, the greater opportunity he will have of increasing his knowledge about the infrastructure and the operation of the utility, as well as of winning the confidence of the municipality that awarded him the contract. This, therefore, increases his private information and the value of the contractual relationship with the municipality, giving him a considerable advantage over his competitors, which does not have a significant impact on competition but, instead, on the probability of operator change. The presence of a consultant reduces asymmetrical information and allows the outsider to reduce the risk of "winner's curse". Just like in the case of the "size" effect, variables indicating the dates when bid calls were published evolve in the reverse sense of the competition, which would indicate that if competition increases over the years, the effect of operator change is offset by other phenomena. We can imagine, for example, that operators adapt themselves to the risk of change at the time of the procedure.

[Table 2 here]

Price impact on competition and operator change Estimated coefficients of the selection variable, referred to as inverse Mill's ratios, are given in Table 3. This variable is calculated using the formula $\phi(\hat{\Psi})/(1-\Phi(\hat{\Psi}))$ for the price difference function when the incumbent operator's contract is renewed, and $-\phi(\hat{\Psi})/\Phi(\hat{\Psi})$ in the case of operator change. This coefficient is significantly different from zero for both of the samples (5 and 10%, respectively). This well illustrates the existence of a selection bias when the choice of the municipality is not taken into account in the price function estimate. In other words, the explanatory factors of the price difference are not the same and do not necessarily play the same role, depending on whether the municipality renews or does not renew the incumbent operator's contract.

Table 3 presents the estimation results concerning the price differential between the past contact and the new contract. The first column of the table contains the results for the sub-sample of utilities that changed operators, whereas the second column consists of those for utilities that kept the incumbent operator. The positive impact of the volume on the price differential in the two equations appears to show that the competition effect of the contract renewal has a positive impact for the bigger utilities, whereas the negative effect of the volume differential highlights the problem of fixed costs. In fact, if the distributed volume decreases, the revenue/volume ratio must increase to maintain the budgetary balance. In contrast, prospects of an increase in volume over the contract term lead to price decreases. This effect is even more pronounced when the municipality changes operators. This can be interpreted as an effect of common value information. In the case of the prospect of an increase in the volume sold, a new operator can overestimate the increase in consumption in relation to the incumbent operator and propose a lower price. This is totally in agreement with the effect of the winner's curse.

The term differential between the past contact and the new contract has a positive impact on the price differential. New contracts are shorter and much more homogeneous in relation to their term (an average of 11 years). The differential is therefore mainly linked to the preceding contract term. Its impact can thus be explained by the fact that actualization formulas allow the price to increase during the contract, and particularly so with a longer contract term. The increase of prices in relation to the contract term is greater than that of the costs. When the contract is renegotiated, the new price readjusts this situation by a smaller increase. A new contract with a

longer term provides similar prospects, which is in keeping with the differential effect observed. The difference of the coefficient between the case of operator change and contract renewal confirms the effect of private information with a common value. The information gathered over the preceding contract term increases the price drop proposed by the outsider operator, which would tend to lead to a winner's curse. This could also reflect the effects of contract developments not taken into account elsewhere. Long contract terms may be associated with investments to be amortized over longer periods of time. A decrease in the term can be linked to the presence of investments in the preceding contract (or entry fees for contracts before 1995) assumed by the operator and under the responsibility of the municipality in the new contract (Garcia et al., 2005). We should nevertheless take the limited impact of private operators into account in the investments in this sector.

Finally, binary variables that represent the three major firms in the sector (Veolia, LDE and Saur) have a negative and very significant impact on the price differential for utilities that renew the incumbent operator's contract. First, the significance of operator identity on prices is the empirical validation of the existence of private information specific to each operator. In fact, this individual effect well reflects the private value of operators since each one has similar parameter values in the different water services. Second, this result appears to indicate that the price of the new contract decreases only slightly and may even increase in some cases thereby enabling the operator, thanks to his private information about the municipality, to increase his information-related rents.

[Table 3 here]

The structural model for operator choice Structural equation (3) of the municipality's choice that depends on price differentials and other explanatory variables can therefore be estimated. Results are given in Table 4. The parameter related to the price differential is significantly positive at a level of 1%, confirming that the municipality will chose operator change if the price proposed by the new operator is less that that of the incumbent operator in the initial contract. The other results of the structural model are in accordance with those presented above.

[Table 4 here]

6 Conclusion

The aim of this article was to empirically validate a set of theoretical hypotheses on competition and the renewal of public service delegation contracts. This study was carried out using a database containing over 1,200 DWS and sanitation services having launched a bidding procedure between 1998 and 2004. Our econometric tests were based on an economic model of choice of operator change that also attempted to explain the level of competition, as well as its impact on price variations before and after contract renewal. The presence of certain variables in our model (past contract term, outside consulting at the time of the procedure, etc.) made it possible to demonstrate the effect of private information with a common value on the effectiveness of competitive bidding within the framework of a delegation contract. Identification of private operators allowed us to verify the existence of a private value.

Operator change is explained in large part by the price variation at the time of contract renewal. Consequentially, bids from outsider companies are an important lever for the municipality, enabling them to reduce the price of the service and to limit operators' profit margins at the time of a competitive bidding procedure. However, several factors underline the risk of the winner's curse. Basically, the greater the probability that the incumbent operator's level of private information with a common value price is high, the greater the price decreases will be.

Competition plays an indirect role on operator change like a necessary condition, and our results show that several elements are decisive. Competition is particularly dependent on the local establishment of operators and the presence of companies that do not belong to the big groups in the sector and that are interested in the contract. These two elements lead us to think that beyond the risk of tacit collusion, operators have local establishment strategies that allow them to benefit from economies of scale for relatively small and even limited services. With the exception of certain independent companies, an operator will not be motivated to take over a new territory far from his existing base, unless the utility is quite big and would allow him to reach a critical size at the local level. This result is in agreement with those of Garcia et al. (2005) and Plunket et al. (2008), who demonstrate the importance of local effects on competition and price levels.

These considerations have led us to make several recommendations to promote competition : the increase in the size of municipalities managed by delegation is, for example, a positive element. The use of outside, independent and specialized consultants decreases private information with a

common value, and even if it does not significantly encourage competition, it nevertheless favors operator change. This reveals the importance of the organization of the procedure and precautions to be taken in the aim of reducing asymmetric information.

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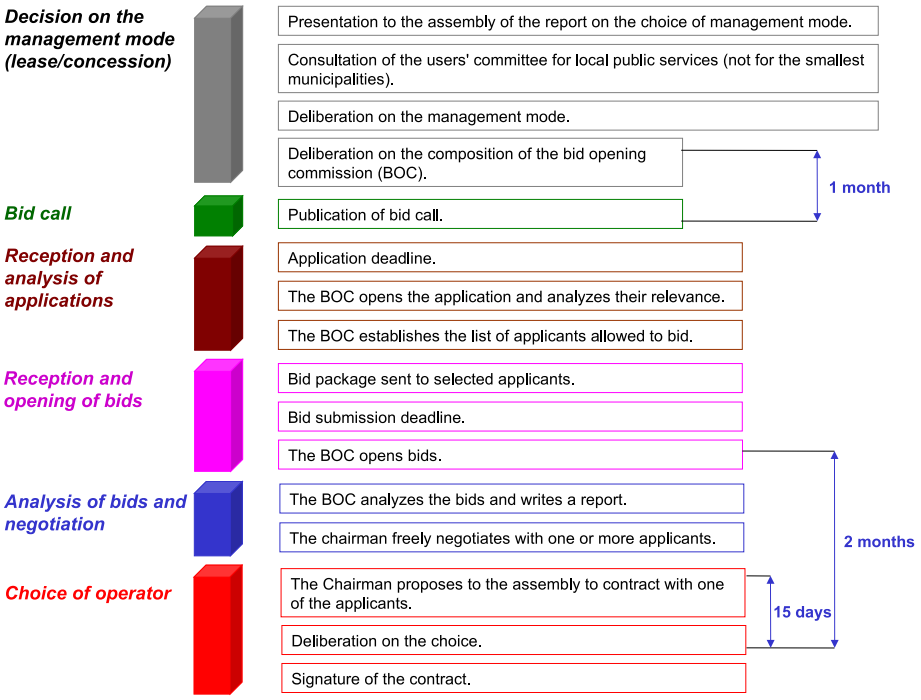
FIG. 1 – The "Sapin Law" procedure (from Guérin-Schneider et al. 2003)



Tab. 1 – Descriptive statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
DWS	0.53	0.5	0	1	1365
hhi	0.51	0.17	0.2	1	1358
community	0.02	0.15	0	1	1365
syndicate	0.33	0.47	0	1	1365
municipality	0.64	0.48	0	1	1365
i_saur	0.31	0.46	0	1	1365
i_LDE	0.28	0.45	0	1	1365
i_vivendi	0.35	0.48	0	1	1365
i_other_op	0.05	0.22	0	1	1365
i_term	15.22	6.67	1	50	1307
i_users	2015.98	5118.66	33	122381	1344
i_vol	331813.2	1022638.59	205	24000000	1353
i_rpv	0.77	0.33	0.01	1.96	1293
ddaf	0.76	0.43	0	1	1334
dde	0.06	0.25	0	1	1334
sp_2000	0.05	0.22	0	1	1334
priv_cons	0.08	0.27	0	1	1334
study_govt_control	0.04	0.19	0	1	1296
indep_op	0.14	0.35	0	1	1365
f_LDE	0.25	0.43	0	1	1365
f_saur	0.29	0.45	0	1	1365
f_vivendi	0.33	0.47	0	1	1365
f_other_op	0.13	0.34	0	1	1365
f_term	11.02	2.59	1	26	1348
f_users	2098.73	5263.77	33	122381	1329
f_vol	339403.12	1047258.49	205	24000000	1321
f_rpv	0.76	0.34	0.01	2.47	1281
f_serv_modif	0.37	0.48	0	1	1365
nb_bids	2.26	1.17	1	9	1090
nb_appli	4	1.91	1	10	1280
newop	0.15	0.35	0	1	1365
compet	0.57	0.5	0	1	1365
diffp	0.02	0.3	-2.38	1.93	1365
diffterm	4.2	6.84	-12	40	1292
dum1	0.2	0.4	0	1	1365
dum2	0.16	0.36	0	1	1365
dum3	0.12	0.33	0	1	1365
dum4	0.12	0.32	0	1	1365
dum5	0.13	0.33	0	1	1365
dum6	0.13	0.33	0	1	1365
dum7	0.15	0.36	0	1	1365

TAB. 2 – Estimation results of the reduced model

Variable	Coefficient	(Std. Err.)
Equation 1 : newop		
DWS	0.198	(0.123)
li_vol	-0.138*	(0.066)
difflvol	0.377	(0.368)
i_term	-0.016†	(0.009)
f_serv_modif	-0.258	(0.168)
dde	0.319	(0.219)
sp_2000	0.455†	(0.245)
i_LDE	0.562*	(0.267)
i_saur	0.214	(0.277)
i_vivendi	0.304	(0.272)
dum2	0.658**	(0.222)
dum3	0.670**	(0.205)
dum4	0.438*	(0.200)
dum5	0.048	(0.227)
dum6	0.188	(0.223)
dum7	0.006	(0.216)
Intercept	0.607	(1.069)
Equation 2 : compet		
DWS	-0.188*	(0.083)
li_vol	0.242**	(0.032)
difflvol	-0.225	(0.175)
indep_op	0.741**	(0.191)
hhi	-1.059**	(0.259)
f_serv_modif	0.227*	(0.111)
ddaf	-0.181	(0.215)
dde	0.169	(0.267)
sp_2000	-0.227	(0.267)
priv_cons	0.141	(0.259)
i_LDE	0.114	(0.189)
i_saur	-0.252	(0.190)
i_vivendi	-0.205	(0.189)
dum2	0.076	(0.188)
dum3	0.352†	(0.193)
dum4	0.647**	(0.196)
dum5	0.538**	(0.197)
dum6	0.812**	(0.198)
dum7	0.655**	(0.193)
Intercept	-2.413**	(0.495)
N	1254	
Log-likelihood	-1094.895	
$\chi^2_{(31)}$	59.181	

Significance levels : † : 10% * : 5% ** : 1%

Specific regional effects were added to the model.

Tab. 3 – Estimation results of the price regression

	Operator change $Diffp^1$	Incumbent operator $Diffp^0$
DWS	-0.0888	-0.0749***
	(-1.29)	(-2.61)
li_vol	0.0814**	0.0802***
	(2.45)	(5.56)
difflvol	-0.762***	-0.356*
	(-3.01)	(-1.74)
diffterm	0.0131*	0.00490***
	(1.90)	(2.68)
i_LDE	-0.241	-0.168***
	(-1.45)	(-2.95)
i_saur	-0.0821	-0.112**
	(-0.50)	(-2.52)
i_vivendi	-0.0328	-0.0939**
	(-0.22)	(-1.98)
f_LDE	-0.164	
	(-1.56)	
f_saur	-0.204**	
	(-2.05)	
f_vivendi	0.00642	
	(0.08)	
dum1	0.100	0.00517
	(1.04)	(0.15)
dum2	-0.136	-0.117**
	(-1.24)	(-2.11)
dum3	-0.199*	-0.132**
	(-1.71)	(-2.50)
dum4	-0.0470	-0.0217
	(-0.53)	(-0.46)
dum5	0.0958	-0.0106
	(0.87)	(-0.25)
invmills	-0.500*	
	(-1.94)	
invmills0		0.357**
		(1.99)
Intercept	-0.0278	-0.935***
	(-0.08)	(-4.29)
N	162	1018

t statistics in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Specific regional effects were added to the model.

TAB. 4 – Estimation results of the structural model

Variable	Coefficient	(Std. Err.)
Equation 1 : newop		
$\widehat{Diffp}$	3.829†	(2.107)
DWS	0.294*	(0.144)
li_vol	-0.280†	(0.158)
i_term	-0.024*	(0.010)
i_LDE	0.896†	(0.503)
i_saur	0.701	(0.501)
i_vivendi	0.696	(0.543)
dum2	0.453*	(0.185)
dum3	0.458	(0.293)
Intercept	1.821	(2.090)
Equation 2 : compet		
DWS	-0.185*	(0.085)
li_vol	0.242**	(0.036)
indep_op	0.710**	(0.144)
hhi	-1.079**	(0.262)
f_serv_modif	0.249*	(0.116)
i_LDE	0.102	(0.203)
i_saur	-0.268	(0.207)
i_vivendi	-0.241	(0.204)
ddaf	-0.097	(0.228)
dde	0.272	(0.278)
sp_2000	-0.192	(0.288)
priv_cons	0.229	(0.266)
dum3	0.290*	(0.143)
dum4	0.613**	(0.152)
dum5	0.524**	(0.154)
dum6	0.787**	(0.154)
dum7	0.632**	(0.149)
Intercept	-2.435**	(0.651)
N	1256	
Log-likelihood	-1056.889	
F $_{(9,1255)}$	3.147	

Significance levels : $\dagger$: 10% $*$: 5% $**$: 1%

$\widehat{Diffp}$ represents the difference of the predicted price.

Specific regional effects were added to the model.