

## Public-Private Partnerships and Prices: Evidence from Water Distribution in France

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**Abstract.** We use an original database of 5000 French local public authorities to explore the impact of organizational choice and performance as measured by consumer prices. In quantifying the impact of the choice of public-private partnerships (PPPs) on performance, we consider the related issue of the determinants of organizational choice. We estimate a switching regressions model to account for the endogeneity of organizational choice, and find that in our sample, (i) the choice by local public authorities to engage in a PPP is not random, and (ii) conditional on the choice of a PPP, consumer prices are significantly higher on average.

**Key words:** Contractual Choices, Public-Private Partnerships, Public Services, Transaction Costs, Water supply.

**JEL Codes:** H0, H7, K00, L33.

### I. Introduction

Following the privatization program of the UK in the 1980s, there has been increased recent interest in alternative organizational arrangements for the provision of public services: what is the optimal level of involvement of private operators when addressing problems of market failure? If ownership of infrastructure utilities is transferred from the public to the private sector, then market forces could improve performance in the provision of public services by, *inter alia*, protecting management from the vagaries of political interference (See Boyco et al., (1996) for a specific model and Vickers

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and Yarrow (1991) and Vining and Boardman (1992) for a more general discussion on this issue). Incentives under private operation and ownership could lead to reduction of costs (and prices if competition exists), improve quality, and stimulate innovation.

However, public-private partnerships (PPPs) present an alternative solution to full privatization. There are a range of organizational arrangements between fully public provision of services and complete privatization. These differ in their allocation of decision prerogatives, risks, and revenues, across the public and the private parties to a contract. Such a hybrid arrangement might dominate both fully public and private service provision by inducing minimization of production costs by the private operator while reducing potential market failures (e.g. supra-competitive prices) that could occur under complete privatization. While PPPs could harness the benefits of both public and private solutions, they may still be sub-optimal because they oblige public authorities to contract for the provision of a service with a private partner. Long term contracting is costly as illustrated by the now old debate around “franchise bidding” as an organizational solution in the case of local monopoly (Demsetz, 1968; Goldberg, 1976; Williamson, 1976). Thus individual heterogeneity may drive the optimality of different alternative governance structures, contractual arrangements and institutional environments in providing public services. The literature has greatly advanced the theoretical state of the art in identifying the parameters that drive the (in)efficiency of PPPs (See Hart et al., 1997; Hart, 2003; Guash et al.<sup>1</sup>, 2002; Williamson, 1999). However, we are aware of few empirical studies that quantify the consequences for efficiency of using PPPs for service provision.

In this paper, we use these theoretical developments to specify a model that we apply to an original database of 5000 organizational choices and associated retail prices in French municipalities in 2001, to explore the empirical link between organizational choice and performance in water distribution. We use a variety of econometric techniques to assess the impact of organizational choice on performance, including a switching regressions model in which we allow for endogeneity of the local public authority’s organizational choice. In all specifications, we find that consumers pay more when municipalities choose PPPs, controlling for other aspects of supply and demand in water distribution that could affect prices. To our knowledge, this is the first empirical study on a large sample with precise details of contracts signed between local authorities and private operators.

The paper proceeds as follows. First, we recall problems associated with the use of public-private partnerships for delivering public services and

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<sup>1</sup> Guasch, J.L., J.J. Laffont, and S. Straub (2002) Renegotiation of Concession Contracts in Latin America, working paper.

discuss how these problems may be attenuated via public institutions or contractual arrangements in the French case. Next we present our econometric methodology, data and results. Finally we conclude.

## **II. The use of PPP for the distribution of water in France**

### **1. THE CASE OF WATER SUPPLY IN FRANCE: OVERVIEW**

In France, as in most European countries, local public authorities must provide local public services that have public good characteristics. There is no national regulator for these services, thus local public authorities define the general principles governing the service. They monitor prices, control entry and exit of firms into the market, organize competition (where it exists), and ensure uninterrupted service.

However, while the responsibility for service provision is public, its management can be either public or private.<sup>2</sup> Local public authorities may decide to transfer some of their decision and revenue rights to an external operator (Desrieux, 2005).<sup>3</sup> In this case, they may choose between alternative contractual arrangements that differ according to the extent of the operator's investments in the service and the allocation of risk across the two parties.

At one extreme, the public authority may choose "direct public management" and itself undertake all operations and investments needed for the provision of the service. Alternatively, the local public authority may choose to involve an outside firm in the operation of the service choosing a "gerance" contract in which it pays an external operator a fixed fee, or an "intermediary management" contract that is similar to the gerance contract except that a small part of the operator's revenues depend on its performance. These contracts proffer few incentives to reduce costs and transfer no (or few) risks and decision rights to a private operator.

Between these contracts and outright privatization are two types of "delegated management" contracts, differentiated according to how outside operators are compensated for service provision and for investments that they could be required to undertake. In particular, local public authorities may choose a "lease" contract in which the operator invests only in maintaining the network (all the other investments are made by the local authority) and is compensated directly through customer receipts, exposing the operator to operating risks. Finally, under a "concession" contract, the external operator also undertakes construction risk, as it must finance a large part of investments over the duration of the contract. Moreover,

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<sup>2</sup> For more details, see Huet and Saussier (2003).

<sup>3</sup> This is generally, but not necessarily, a private firm.

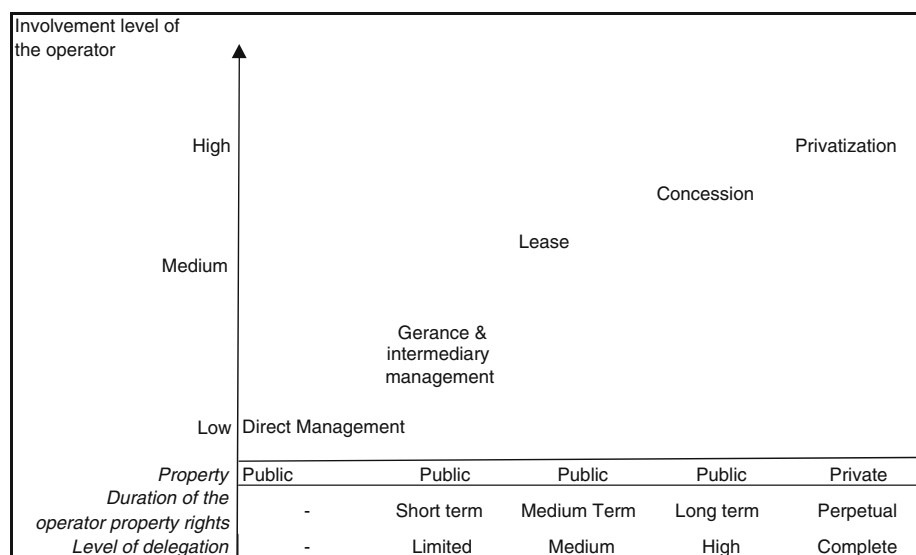


Figure I. Contractual options for local public services in France.

the infrastructure is typically transferred to the local public authority at the end of the contract, most often without financial compensation. These contractual agreements differ from the previous ones in that they give operators incentives to reduce costs, and operators share risk in exchange for greater decision rights and claims on revenues.<sup>4</sup> Figure 1 below summarizes the full set of possible PPPs.

In France, each local public authority may choose a particular contractual form from the differentiated set of alternatives. Thus the "French system" of management of local public services confers great flexibility and freedom on local public authorities in the organization and management of local public services, and provides an exciting laboratory to analyze the links between organizational choice and performance in local service provision.<sup>5</sup>

<sup>4</sup> These contracts employ price-caps.

<sup>5</sup> This system is not unique in Europe, but the predominance of public management in most other European countries limits the number of options local public authorities have in organizing the management of local public services. In some countries, private participation is prohibited (e.g. Denmark, Sweden, Greece, Germany, Italy). However, in some of countries that use public management (Germany, Italy, Benelux), governments and local public authorities have become increasingly interested in public/private partnerships as they face increasingly binding financial and budgetary constraints. England and Wales use an alternative system in which local public authorities compete with private firms for the management of local public utilities, but are monitored by the government in an attempt to limit anti competitive behavior of the municipalities.

## 2. POTENTIAL PROBLEMS WITH THE USE OF PUBLIC-PRIVATE PARTNERSHIPS

The literature on economic regulation has shown that regulatory intervention in the case of “market failures” may well lead to their replacement with “regulation failures”. In this spirit, Demsetz (1968) argued that even when natural monopoly precludes competition within a market, competition for the market via contracts between public and private agents could lead to an efficient allocation of resources avoiding regulation failures. This idea has since been challenged. Critics such as Williamson (1976) have highlighted several fundamental problems with Demsetz monopoly franchise bidding: organizing competition for the market is not easy, the world is not static, transaction costs make contracts necessarily incomplete, and switching costs make public authorities who enter contracts vulnerable to *ex post* contractual opportunism.

The local public authorities’ problem is to organize competition for the market in order to select the most efficient partner to provide a service. This is challenging because the selection process, itself, may be complex, requiring the specification of a vector of prices for different types of customers, consuming at different times, and for different levels of quality. Moreover, if operators are selected according to price bids, then public authorities are vulnerable to “winner’s curse”, since the best offer may come from the most “optimistic” operator who unintentionally underestimates production costs or overestimates future revenues. Alternatively, public authorities may also be victims of aggressive bids when prospective operators strategically underestimate production costs or overestimate future revenues in order to win the deal and then provoke renegotiations with a “captive” local public authority in the future.

Renegotiation may also occur because conditions change over the duration of a contract, necessitating an efficient adaptation mechanism for its terms. Public and private parties may either attempt to write a “complete” contingent contract from the outset, or to establish a review process to periodically evaluate and change prices (Athias and Saussier, 2005; Bajari et al., 2003<sup>6</sup>). However, either approach will lead to institutions and procedures that converge to the very regulation they were designed to avoid.

The public authority faces switching costs in changing suppliers that induce it to stick with an inferior operator that it has awarded a franchise. If a public authority switches suppliers, it could face political embarrassment and service interruption, reduce incentives for private parties to invest (fearing early contract termination), and would need to organize a new (costly) auction. On the flip side, these switching costs give firms incentive

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<sup>6</sup> Bajari P, R. McMillan and S. Tadelis (2003) Auctions versus Negotiations in Procurement: An Empirical Analysis, NBER Working Papers n°9757.

to renegotiate contracts to obtain higher prices, misrepresent costs, and provide low quality service (to the extent that this behavior is not monitored and/or that quality is not perfectly contractible). The problems that stem from imperfect and asymmetric information are even greater if the incumbent creates knowledge-specific capital that gives him a cost advantage.<sup>7</sup> At the contract renewal stage, the winner of the original competition has an advantage due to the “fundamental transformation” that gives rise to specific human assets for the winner compared to other potential bidders. Furthermore, the winner is best informed with regard to quality and the amount of future investments needed to operate the service.

This transaction costs critique of franchise bidding has dominated the literature (see Littlechild, 2002) even if it has not been verified empirically (Zupan, 1989a, b).

### 3. INSTITUTIONAL AND CONTRACTUAL SOLUTIONS

While there are unavoidable problems with franchise bidding and PPPs generally, these may not be important enough to disqualify their use in public service provision. Institutional and contractual solutions may reduce hazards enough that PPPs could be the most efficient organizational choice for providing public services in some cases.

In the French case, the local public authority’s organizational choice is embedded in an institutional framework that gives it greater powers than its (private) partners through the “*intuitu personae*” principle and the rules of “administrative contracts”. These rules may mitigate contracting problems both in selecting a partner and enforcing the contract.

#### *Negotiation and competition for the field: the “intuitu personae” principle*

If the public authority chooses a lease or a concession contract, it selects its partner in two steps. First, the public authority launches a classical invitation to tender that is open to all interested operators. Second, there is a phase of negotiation between the public authority and potential entrants that it shortlists. At the end of the negotiation, the public authority chooses its final partner for the duration of the contract.

This process is not truly competitive, even if the initial invitation to tender is open to all participants. In inviting tender, the local public authority is not legally constrained in setting the criteria according to which it short-lists and ultimately chooses an operator. Moreover, it need not publicize its subjective criteria, creating an informational asymmetry between the local public authority and prospective operators and giving the local public authority greater latitude in selecting a partner. This could reduce

<sup>7</sup> Williamson (1976). Also see Goldberg (1976).

competition for the field and facilitate collusion among operators or between the local public authority and (some) operators, but it could also incite prospective operators who lack information on the subjective selection criteria to submit bids, which correspond to their true “values”. Furthermore, negotiation as opposed to a “competitive” mechanism in the second stage may serve to reduce *ex post* transaction costs in the case of complicated contracts where renegotiation will be required, perhaps even enhancing efficiency as in Bajari and Tadelis (2004).<sup>8</sup> It remains an empirical question whether the “*intuitu personae*” principle results in more or less efficient contracts, and, thus, better or worse performance in water distribution.

*PPP and the rules of administrative contracts*

In France, contracts signed between local authorities and private operators are considered to be “administrative contracts”. Such contracts give public local authorities asymmetric ability to change the terms of contracts and constrain the ability of private operators to renegotiate higher prices.

In administrative contracts, the local public authority may unilaterally change the contract terms after signing. The public authority must justify changes (e.g. for public safety reasons), and the private operator may claim fair compensation, however, in the event of conflict, the private operator must satisfy the demands of the local authority before bringing suit. Even if local authorities do not often use this power, it could help to prevent a private operator from acting opportunistically by providing a credible threat of a unilateral end or change to the contract.

Furthermore, *ex post* opportunistic behavior by private operators, for example in renegotiating prices, is further constrained by the fact that in administrative contracts, all renegotiations that significantly change the value (by more than 5% of the value of the initial contract) of the contract oblige local authorities to re-initiate a procedure for the selection of a (potentially) new private operator.<sup>9</sup>

Finally, opportunistic behavior by operators who reduce quality after having signed a contract is constrained by the existence of precise definitions of quality: European water distribution norms specify more than 60 verifiable quality parameters that are monitored by public agencies.<sup>10</sup>

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<sup>8</sup> Of course, negotiation according to subjective criteria can only be efficient in the absence of corruption.

<sup>9</sup> Sapin Law (1993). Despite this statutory requirement, we have no indication of how often this rule is followed.

<sup>10</sup> Even if quality is contractible and there is surveillance by independent bodies, since many contracts do not impose penalties for breach of the quality parameters, many public and private operators do not ultimately meet legal quality standards for drinking water (see Ménard and Saussier, 2002). Thus, opportunistic behavior in the form of underinvestment in water treatment may exist.

Thus, the rules of French “administrative contracts”, coupled with quality standards may reduce ex post vulnerability of local public authorities who enter a PPP. However, PPPs may still fail to be efficient because of inadequate *ex ante* competition between the local authority and private operators or between different private operators that collude instead of competing for the field.<sup>11</sup>

Thus the theoretical debate remains unresolved regarding whether or under what circumstances PPPs will lead to more or less efficient water distribution. We examine this question empirically by looking at how consumer prices differ across fully public versus PPP water distribution for municipalities in France. In the next section, we discuss our empirical strategy, including how we attempt to control for the endogeneity of contract choice when measuring its impact on performance.

### III. The efficiency of PPP for water distribution in France: an empirical analysis

#### 1. EMPIRICAL MODEL

We seek to estimate the impact of organizational choice on performance, as measured by consumer prices, across a cross-section of municipalities. We begin by estimating a least squares regression of price on a set of indicator variables for organizational choices and a set of exogenous factors that should shift the supply and demand, and thus the retail price of distributed water:

$$p = D\delta + X\beta + u \text{ with } u \sim (0, \Sigma) \quad (1)$$

where  $p$  is price,  $D$  contains indicators for each type of contract,  $X$  is a set of exogenous controls, and  $u$  is the (heteroskedastic) stochastic error. We are interested in the coefficients  $\delta$  which measure the average shift in price across different contract types ranging from direct public management to concessions.

An econometric problem arises, however, from the fact that a local public authority's choice of contract type is endogenous. In particular, there may be individual heterogeneity across local public authorities that is unobserved by the econometrician, but that is correlated with both organizational choice and performance. In this case,  $E(Du|X) \neq 0$ . Least Squares estimates of (1) will be biased and inconsistent.

<sup>11</sup> Re-franchising at the end of the contracts is possible. Data concerning the percentage of renegotiated contracts with a change of private operator in France shows that more than 10% of renegotiated contracts go to new private operators (Guérin-Schneider et al., 2003).



While a full structural model of the determination of organizational choice is beyond the scope of this paper, we separately estimate a probit model of the decision to use a PPP versus direct public management as a function of  $X$  and  $Z$ , a set of variables that should affect organizational choice but not price. We find that indeed there is non-random sorting of local public authorities across organizational choices.

Thus in order to obtain unbiased estimates of the impact of (endogenous) organizational choice on performance, we estimate a switching regressions model with endogenous switching allowing cross-equation correlation in the errors:

$$\begin{aligned} p &= \delta D^{PPP} + X\beta + u \\ D^{*PPP} &= X\alpha + Z\gamma + v \\ D^{PPP} &= \begin{cases} 1 & \text{if } X\alpha + Z\gamma \geq v \\ 0 & \text{if } X\alpha + Z\gamma < v \end{cases} \end{aligned} \quad (2)$$

Here  $D_{PPP}$  is an indicator that takes the value one for lease contracts and zero for direct public management, and we no longer consider other contract types (see discussion in Results section below). The  $D_{PPP}$  equation is normalized by the standard deviation of  $v$ , and we assume that  $(p \ D_{PPP})$  is distributed bivariate normal with mean zero and variance-covariance  $\Gamma = \begin{pmatrix} \sigma_u^2 & \sigma_{uv} \\ \sigma_{uv} & 1 \end{pmatrix}$ . This procedure accounts for endogeneity in the choice,  $D^{PPP}$ , and yields unbiased estimates of  $\delta$ , the unconditional mean premium or discount paid by consumers in a municipality that has chosen a PPP.<sup>12</sup> We now discuss our dataset and our measures of performance,  $p$ , organizational choice,  $D^{PPP}$ , and the exogenous controls,  $(X \ Z)$ .

## 2. DATA

There are several descriptive case studies on water distribution in France that compare mean performance or quality across organizational choice and highlight their drawbacks (Cour des Comptes, 1997, 2003). We are not

<sup>12</sup> Applying conditional normal theory and change of variables yields the individual contribution to the likelihood:  $f(p_i, D_i^{PPP}) = \frac{1}{\sqrt{\sigma_u^2}} \phi\left(\frac{u_i}{\sqrt{\sigma_u^2}}\right) \left[ 1 - \Phi\left(\frac{(-x_i\beta - z_i\gamma - v_i)/\sqrt{\sigma_u^2}}{\sqrt{1-\rho^2}}\right) \right]^{D_i^{PPP}} \left[ \Phi\left(\frac{(-x_i\beta - z_i\gamma - v_i)/\sqrt{\sigma_u^2}}{\sqrt{1-\rho^2}}\right) \right]^{(1-D_i^{PPP})}$ . In our switching regressions model, the  $\beta$  are not separately identifiable because the  $X$  enter both the  $P$  and  $D^{PPP}$  equations, however our initial Least Squares estimation of (1) is sufficient for predictive purposes, and allows us to interpret the estimated  $\beta$ .

*Table I.* The management of water distribution in France

Management of water distribution	Number of Observations	%
Direct Public Management	1132	31
Intermediary Management	152	4.2
Gérance	128	3.5
Lease contract	2073	56.8
Concession contracts	164	4.5
Total	3 650	100

aware of studies that attempt to assess the performance of PPPs, conditional on the endogenous nature of organizational choice.

We have developed a unique dataset by combining data from the French Environment Institute (IFEN) and the French Health Ministry (DGS), on 5000 local public authorities in 2001.<sup>13</sup> This sample represents the total population of French local public authorities: all sizes of local authorities are proportionally represented, with the exception of large local authorities that are all included in the sample. Local authorities may make different organizational choices for water production and distribution, so we restrict to observations where water production and distribution are organized in the same way (i.e. through exactly the same type of contractual arrangement). This reduces our sample to 4443 observations. Eliminating observations with missing data, further reduces the sample to 3650. The unit of observation is a municipality in 2001. Table 2 provides definitions of all variables used in the empirical model along with descriptive statistics.

#### *Price*

To assess the performance of PPPs, we use the retail price of water in a local public authority for a yearly consumption of 120 cubic meters. The price measure includes is the amount that consumers pay, including national subscription fee but net of local and national taxes (Variable PRICE).<sup>14</sup>

<sup>13</sup> All data comes from the IFEN and SCEES, with the exception of data concerning the type of treatment used for water before it is distributed, which comes from the DGS (Direction Générale de la Santé). All data concern the year 2001.

<sup>14</sup> In the case of PPPs, price consists of shares that go to the local public authority for its investments and the private operator for its investments and operating the service. Because we cannot identify who makes what investments, we consider the whole price paid by consumers rather than constructing a “wholesale” price. In considering the performance of PPPs, it is ultimately the retail price paid by consumers that is of interest and that will reflect efficiency and consumer welfare.

*Governance choice*

Our data allows us to identify the organizational choice of each local public authority.<sup>15</sup>

For each local public authority, we know the precise contract type and, in particular, if they decided to externalize the provision of water by using a private operator (Variables LEASE, CONCESSION, GERANCE, INTERMEDIARY MANAGEMENT).<sup>16</sup>

*Explanatory Variables: X*

We include a set of variables that might shift the costs, and therefore price, of water distribution.

We include a set of variables that accounts for the complexity of the water treatment performed by the operator before the water is distributed (Variables TREATA2, TREATA3, TREATMIXA3, TREATMIXA2). These variables proxy not only for the complexity of service provision, but also the level of (specific) investments needed to operate the service, an important variable from a transaction cost perspective (Williamson, 1999). We expect the price to increase with the complexity of water treatments.

The variable UNDERGROUND is used to control for the water source, underground surface. The quality of underground water is generally more stable over time, reducing uncertainty about the evolution of the kind of treatment over the life of the contracts. We expect price to be lower when water comes from under the ground.

The variable INDEPENDENCE RATIO reflects the extent to which the local public authority needs to import water in order to satisfy demand. Greater independence should lead to lower price.

We include the variable TOURISTIC AREA to account for volatility of demand (due to seasonal variation in the population) that might necessitate overcapacity in order to satisfy peak-load demand.

We also include a set of variables to proxy for economies of scale in distribution: DENSITY of the distribution network, and an indicator for if the service is provided jointly at the level of several local authorities, INTERAUTHORITY. Such inter-authority organization is typically chosen when the service is hard to provide. These variables should increase the price of

<sup>15</sup> We leave treatment of the objective function of local public authorities to future work, but we do allow for the fact that concerns other than efficiency could enter in the utility functions of local public authorities, hence underlying both their organizational choice, and consequent performance in allowing for endogeneity of organizational choice in the switching regressions model.

<sup>16</sup> In all regressions, direct public management is our reference and therefore does not appear in regression results.

the distribution of water.<sup>17</sup> We also include INHABITANTS and its square to account for the size of the market.

We also include the variable INHABITANTS and its square to control for the effects of market size. Market size could also influence economies of scale and the negotiating power of a local public authority that seeks to contract with a private operator. Small towns have fewer internal resources either to produce water themselves or to pay external experts and to monitor and control private operators. At the same time, private operators have little incentive to set up shop in small towns. This may explain the tendency of small towns to create pools, which then either provide water directly through a joint bureau or outsource. Conversely, when the population is large, local authorities have greater resources to hire technical experts, and, simultaneously, their market is more attractive to private operators.

Finally, we include a set of variables to control for the quality of network infrastructure. However, quality, and particularly the condition of the network infrastructure, could be endogenous from the perspective of both price and organizational choice. Poor infrastructure could motivate a particular organizational choice and associated price, or *vice-versa*. We include the variables LEAK RATIO, INVST PROGRAM, EXTENSION, and REPLACEMENT to account for the nature of infrastructure and efforts to adequately maintain and even extend it. We run several auxiliary regressions (including regressing LEAK RATIO on price and the PPP indicator), and do not find evidence that these particular quality measures are endogenous.<sup>18</sup>

Finally, to control for heterogeneity that is not related to organization choice, and that we may have measured imperfectly with our other explanatory variables, we employ fixed effects for the “Department” (French geographical and administrative entities) in which the service is provided.

#### *Explanatory Variables: Z*

In the selection equation (organizational choice) of our switching regressions model, we include all of the X variables, but must also include at least one “instrument” that does not enter the price equation. A structural model of organizational choice is beyond the scope of this paper, but we do include several instruments in the organizational choice equation. We include sanitation, an indicator that takes the value one when a local public authority chooses a PPP for sanitation and 0 otherwise. There is no reason that a local public authority’s choice of contract for sanitation should

<sup>17</sup> As defined in Table 2, larger values of the variable DENSITY correspond to *less* dense networks, so since prices should be lower for *more* dense networks, the sign on our variable should be positive.

<sup>18</sup> The quality variables are at best marginally significant in our analysis but we retain them because we believe they should be included from a theoretical perspective.

Table II. Definitions of Variables and Descriptive Statistics

VARIABLE	DEFINITION	MEAN	MIN	MAX
PRICE	Price in euros, for production and distribution of water, taking into account fixed fee but not taxes	149.51	50.6	378.7
DIRECT MANAGEMENT	Takes value 1 if the local authority operates the service itself	0.36	0	1
GERANCE	Takes value 1 if the local authority signed a gerance contract	0.044	0	1
INTERMEDIARY	Takes value 1 if the local authority chose the intermediary management solution	0.038	0	1
MANAGEMENT LEASE	Takes value 1 if the local authority signed a lease contract	0.53	0	1
CONCESSION	Takes value 1 if the local authority signed a concession contract	0.025	0	1
TREATA2	Takes value 1 when raw water needs a disinfection treatment	0.16	0	1
TREATA3	Takes value 1 when raw water needs a heavy disinfection treatment	0.19	0	1
TREATMIXA2	Takes value 1 when raw water needs mix kind of treatment (A1 and A2 because water comes from different sites)	0.047	0	1
TREATMIXA3	Takes value 1 when raw water needs a heavy disinfection treatment (A1 or A2 and A3 because water comes from different sites)	0.05	0	1
UNDERGROUND WATER	Takes value 1 when water origin is underground	0.65	0	1
TOURISTIC AREA	Takes value 1 when the area where water is distributed is a touristic area	0.13	0	1
EXTENSION	Number of Km of network developed to extend the network	0.46	0	51
INVST PROGRAM	Takes value 1 when the contract specifies an investment program	0.66	0	1
REPLACEMENT	Number of Km of network developed to replace the network	0.54	0	23

Table II. Continued

VARIABLE	DEFINITION	MEAN	MIN	MAX
LEAKRATIO	Volume of lost water / size of the network	0.26	0.0008	0.94
INTERAUTHORITY	Takes value 1 if the local authority is organizing the distribution of water in cooperation with other local authorities	0.68	0	1
LIMITATION OF WATER VOLUME	Takes value 1 if consumed volume of water is constrained by reglementation at some period of time during the year	0.03	0	1
INDEPENDENCE RATIO	Total volume distributed / (total volume distributed + imported volume)	0.9	0.0009	1
INHABITANTS	Number of inhabitants concerned by the contract / 10 000	9.37	0.02	2 125
INHABITANTS <sup>2</sup>	Square (Number of inhabitants concerned by the contract) / 1000 000	9.37	0.02	2 125
DENSITY	Number of Km of network / Number of Inhabitants	22.52	0.31	1 438
SANITATION	Takes value 1 for a local authority that chose the same organizational choice for distribution & sanitation of water, considering only direct public management vs. lease and concession choice	0.42	0	1

impact the price of water distribution, however, if local public authorities have preferences for certain organizational reforms, their organizational choice for water distribution might be correlated with their organizational choice for sanitation. Additionally, we include a set of fixed effects for the French “Region”, the most important political entity in which a local public authority is situated. This should proxy for the effects of the political colors of local government on organizational choice.

### 3. RESULTS

We present our estimates in Table 3. The first column contains robust (heteroskedasticity corrected) estimates of equation (1) using least squares.<sup>19</sup> In

<sup>19</sup> We have also estimated each specification separately for small and large municipalities, and we do not find a significant difference in the results for the two sub-samples.

this regression, we do not attempt to control for the potential endogeneity of contract choice, and we include indicator variables for each contract choice to measure the shift in price that is associated with the choice of one of the four contract types that involves a private operator over direct public management. The coefficients on each contract indicator are significant and positive: choosing any kind of PPP over direct public management seems to increase the average retail price of water in a municipality. For example, *ceteris paribus*, the average price (for delivery of 120 cubic meters of water in a year) jumps from approximately 151 € to 176 € when a public authority chooses a lease contract instead of managing its own water distribution. Moreover, this regression is generally significant, and estimated coefficients typically have the expected sign, meaning that observed prices reflect cost considerations in addition to the governance choice. The coefficients on the water treatment variables (TREATA2 and TREATMIXA3) are estimated to be significantly positive, while the coefficient on UNDERGROUND is negative and significant. The proxies for potential economies of scale (DENSITY, INHABITANTS and its square, and INTERAUTHORITY) are all significant with the expected signs. However our proxies for quality are marginally significant. A Wald test for the joint significance of the Departmental fixed effects suggests that they should be retained.

In the second column, we display our results for the same regression, but where we simplify the contracts into a single binary choice variable that takes a value of one for lease contracts and zero for direct public management. We drop observations where other contracts were chosen, reducing the sample size to 3370 observations. Our results are robust across the two regressions, and the coefficient on PPP is positive and significant, again increasing average price by about 26 € compared to direct public management.

In column 3, we estimate a probit where we include the full set of instruments, including both  $X$  and  $Z$ , to explain the choice of a PPP. This model is generally significant, and suggests that local public authorities do not choose private versus public governance randomly. Moreover, this also suggests that efficiency consideration more than political one drive their choices.<sup>20</sup> The  $X$  variables tend to have the same signs as in the least squares regressions of columns 1 and 2: a variable that increases the probability of choosing a PPP also tends to increase price. This begs treatment of the potential endogeneity of organizational choice. As for the  $Z$  (variables that affect organizational choice but not price), the coefficient on SANITATION

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<sup>20</sup> This question is still open. Nevertheless, the point we would like to stress here is that economic variables such as those we used instead of variables reflecting political concerns (political colour of the local authority, proximity of elections ... ) explain observed organizational choices. This suggests a possible underlying economic rationality.

Table III. Price and Organizational Choices

Method Dependent Variable	OLS PRICE	OLS PRICE	Probit PPP	Switching Regression PRICE
TREATA2	8.400*** (2.047)	9.124*** (2.126)	0.227* (0.100)	11.130*** (2.166)
TREATA3	5.928* (2.567)	6.099* (2.739)	0.561*** (0.134)	9.211** (2.807)
TREATMIXA2	2.691 (3.622)	1.695 (3.844)	0.403* (0.178)	5.243 (3.660)
TREATMIXA3	4.403 (3.441)	5.374 (3.575)	0.042 (0.148)	7.548* (3.261)
UNDERGROUND	-6.931** (2.230)	-6.758** (2.341)	0.104 (0.106)	-4.760* (2.280)
TOURISTIC AREA	-0.594 (2.219)	-0.682 (2.362)	0.072 (0.101)	-0.944 (2.128)
INVEST PROGRAM	0.967 (1.440)	1.396 (1.471)	-0.118 + (0.066)	0.966 (1.454)
EXTENSION	-0.401 (0.376)	-0.775 (0.543)	0.041 (0.028)	-0.473 (0.465)
REPLACEMENT	1.237 (0.763)	1.339 (0.848)	-0.067* (0.030)	0.959 (0.642)
LEAKRATIO	9.904 + (5.180)	8.502 (5.386)	-0.359 (0.223)	4.774 (5.084)
INTERAUTHORITY	20.534*** (1.680)	19.708*** (1.676)	0.354*** (0.070)	21.111*** (1.567)
WATER USE RESTRICTIONS	-1.110 (6.116)	-1.688 (6.642)	0.174 (0.227)	-0.686 (4.680)
INDEPENDENCE RATIO	-7.112* (3.224)	-7.412* (3.541)	-0.278 (0.169)	-11.341** (3.626)
DENSITY	0.162* (0.068)	0.155* (0.067)	0.003* (0.001)	0.146*** (0.018)
INHABITANTS	0.006*** (0.001)	0.006*** (0.001)	0.000 (0.000)	0.006*** (0.001)
INHABITANTS <sup>2</sup>	-0.277*** (0.050)	-0.252*** (0.055)	-0.006 + (0.003)	-0.265*** (0.050)
LEASE	25.017*** (1.454)	-	-	-
CONCESSION	39.600*** (2.544)	-	-	-
INTERMEDIARY MANAGEMENT	36.636*** (3.644)	-	-	-



Table III. Continued

Method Dependent Variable	OLS PRICE	OLS PRICE	Probit PPP	Switching Regression PRICE
GERANCE	22.269*** (4.186)	—	—	—
PPP	—	26.279*** (1.430)	—	11.340 ** (3.673)
SANITATION	—	—	1.602*** (0.070)	—
DEPART FIXED EFFECTS	included	included	included	included
REGION FIXED EFFECTS	—	—	—	included
INTERCEPT	150.741*** (7.898)	150.218*** (8.071)	0.195 (0.510)	143.098*** (20.474)
RHO				0.328*** (0.076)
R-sq/ Pseudo R-sq	0.46	0.41	0.37	
Observations	3650	3370	3195	3195

Note: Robust standard errors are presented in parentheses. Fixed effects jointly significant where included. Coefficients of selection equation in Switching Regressions Model not displayed.

\*\*\* denotes significance at 0.1% level, \*\* denotes significance at 1 % level, \* denotes significance at 5% level, + denotes significance at 10% level.

is positive and significant, and a Wald test suggests that the regional dummies are jointly significant. Thus local public authorities that choose a PPP for sanitation are more likely to choose a PPP for water distribution.

Finally, we display our maximum likelihood estimates of the price equation from the system (2), where we also estimated  $\rho$ , the cross-equation correlation. The parameter  $\rho$  is estimated to be positive and significant suggesting that there is something unobserved by the econometrician that leads local public authorities to choose PPPs and also affects performance as measured by price. The positive  $\rho$  is consistent with separate estimates of equation (1) and the probit presented in column 3: the same municipalities that see high prices also have a propensity to choose PPPs.<sup>21</sup> The coefficient on PPP remains positive and significant, but correcting for endogeneity of organizational choice, its magnitude declines to an average price premium of about 11 € (instead of 26 € before correction) relative to the direct public management. The other parameter estimates using maximum likelihood on the switching regressions model are broadly consistent with those in columns 1 – 3. We also estimated the system (2) using maximum likelihood allowing all coefficients to vary across regimes. Very few of the other  $\alpha$  coefficients were significantly different across regimes, so we do not display these results in Table 3.

#### 4. DISCUSSION OF THE RESULTS

Our results underscore the potential trade-offs at stake in using PPPs. Our results suggest that failing to account for the endogeneity of organizational choice yields estimates that overstate the superior performance of direct public management relative to PPPs, but nonetheless, even after controlling for endogeneity, direct public management continues to dominate PPPs. This is consistent with the literature that points to high transaction costs of PPPs. As noted earlier, the institutional environment in which such contracts take place leave room open for inadequate ex ante competition and possible collusion between operators. Possible renegotiation and corruption are another concerns. All this may lead to higher prices when the public solution is not retained. Our ability to draw further conclusions is constrained by the fact that efficiency of organizational choices is connected to the specific details of contracts, and these may vary even within a type of contract (e.g. lease). Within and across contract types, some contracts may provide more incentives than others, anticipate investments differently, and share risk differently. Our data concerns only the organizational choice, with no details on

<sup>21</sup> Note that if  $\rho$  were estimated to be statistically indistinguishable from zero, the likelihood function for the switching regressions model simplifies to independently estimated least squares regression of the price equation and a probit of the organizational choice equation.

duration, price provisions, penalties, controls, or other contractual provisions that could affect performance within and across governance categories.

However, in the particular case of French water distribution, the lack of contractual details poses less of a problem. Until 1982 all water contracts were signed according to an obligatory contract model that specified duration, price provisions, etc., resulting in relatively homogeneous contracts. Furthermore, in a previous study, we found that even after 1982, price provisions were mostly identical from one contract to another, comparing 150 French Water contracts (Ménard and Saussier, 2003). Water contracts are all price-cap contracts. Thus, there should be no trade off between price cap and cost plus contracts as a function of the complexity of the transaction (See Bajari and Tadelis, 2001). For these reasons we are confident that the primary trade-off is between the public solution (low incentives but few transaction costs) and PPP (price cap contract with a private operator – high incentives but possible *ex ante* and *ex post* transaction costs) in an environment that is uncertain.

#### IV. Conclusion

This study examines the link between organizational choice made by local public authorities and performance, as measured by price for water distribution in France.

We find that in the case of water distribution in France, different forms of PPPs correspond to greater prices, all else equal. Moreover, there is unobserved heterogeneity that leads both to greater prices and a greater probability of choosing a PPP across our sample of local public authorities. These results are robust to different specifications, and remain when we account for and confirm the endogeneity of decision to use a PPP.

Our findings suggest interesting directions for future research. Our results are consistent with a theory in which high transaction costs make the use of PPPs inefficient. Thus it would be interesting to look at greater depth into what reduces competition under PPPs in practice, leading to lower efficiency/higher consumer prices. How do particular dimensions of governance structures (contractual choices but also the prospect of repeated contracting that may differ from one local authority to another) influence performance. Also, we need to consider collusion strategies and multi-contact markets in the negotiation of prices between external operators and local public authorities as well as corruption that may exist. Finally, we could also extend our framework to examine the impact of organizational choice on other measures of performance.

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