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RESEARCH IN ECONOMICS AND RURAL SOCIOLOGY

A measurement of the effect of delegation on the price of drinking water in France

Nowadays, a little more than half of French municipalities delegate the management of water services to private companies. The effect of the management system on the service cost and the differences observed between private and public management are topical questions. Our assessment of the impact of the delegation system on the prices of drinking water services in France shows that the operating conditions of these services help explain the existing differences between the average prices charged by private and public services in 1998. Our results demonstrate that municipalities facing difficult operating conditions are more likely to choose a private management.

Water prices and delegation, a topical debate

Sector organization

Historically in France, the management of water supply was in the hands of municipalities, essentially because of the high cost of water transportation and the need of not keeping water for too long in tanks and water pipes in order not to damage its quality. Each French municipality can choose whether to manage water services on its own or to join other municipalities in an inter-municipality body. Today, about 23,000 French municipalities are grouped into more than 2,000 inter-municipal bodies as far as water distribution is concerned. Conversely, more than 13,000 municipalities manage water supply in an isolated way. As a whole, there are around 15,500 water services in France.

These services may be managed by a municipality or a group staff (direct or public management) or they may be delegated to a private company (delegation or private system). Although private operators have been present in this sector since the 19th century, an important shift towards the delegation system has been observed over the past few years. Municipalities have, to a large extent, turned to private operators for water supplies (75% of the population gets water through a private operator) and, to a lesser degree, for wastewater collection and treatment (35% of the population). Large-sized municipalities have predominantly chosen the delegation system while rural municipalities usually prefer to manage water services by themselves.

The main arguments in favour of public management are a better control of the service by the municipality, a good fit between the municipality's public service targets and those of the service itself as well as tax exemption (exemption from local business tax, land tax and, essentially, no corporate tax). By comparison, private operators can put forward greater

technical and economical efficiency thanks to the sharing of experience, research and development, raw material or equipment purchases inside the group they belong to.

The debate

The debate between private and public management crystallized around the question of prices. Hence, private operators have often been criticized for implementing higher prices than publicly-managed services. Several explanations have been put forward: first, the objective of a municipal council (coverage of expenses related to water supply, users' satisfaction) is not the same as the objective of a private firm (profit making). If the municipality allows water resources to be managed by a private firm, the firm will get payment for the service provided through the price charged to water users. Another reason frequently put forward is a bad management of water resources in some municipalities run by a "régie". These municipalities choose to yield direct management because they can no longer face recent obligations (European directives 98/83/EEC, 86/278/EEC and 91/271/EEC, for example) in terms of quality and resource management or facilities. Lastly, the local authorities' lack of information about the cost of different services, the opaque nature of management, and the dominant position of firms in the water sector are also evoked.

The water agencies-IFEN-SCEES survey

We use data from the water agencies-IFEN-SCEES survey "Prix de l'eau dans les collectivités territoriales". The initial sample of this survey is exhaustive for municipalities over 10,000 inhabitants, while smaller municipalities have been sampled according to their size and their administrative district or "département". The questionnaire provides information about the characteristics of wastewater treatment and supply services in each municipality in 1998. We have complemented

this sample with data on municipality classification in vulnerable or sensible areas (IFEN), data from the BDCOM basis (INSEE) and data on the municipality budgets (Direction Générale de la Comptabilité Publique).

Our survey only deals with water production and supply (excluding, then, collection and wastewater treatment operations). The price taken into consideration in the following analysis is the price per cubic meter paid by residential users for the water production and supply service and corresponding to a typical consumption of 120 cubic meters. We show, hereafter, results concerning 3,135 municipalities under 10,000 inhabitants, 1,793 of which being under delegated management (57.2%) and 1,342 under municipal management (42.8%). Results for municipalities over 10,000 inhabitants are more ambiguous and will not be presented here.

A direct comparison between the private operator and the *régie's* average water price (Box 1) shows that private management leads to a higher price for water users. Indeed, in the sample, the average price charged by private operators is 34% higher than the price charged by *régies*. However, it would be inappropriate to conclude that the water service delegation entails, *ipso facto*, an additional cost of 34%. Indeed, this difference in prices between the two management systems is measured using prices from municipalities with different characteristics. The prices that would have been chosen in the municipalities currently under delegated management if these municipalities had been under direct management cannot be identified, and *vice versa*.

A “treatment effect” approach

Due to the problem of partial observation of prices, we can only measure the average delegation effects on prices for the studied municipalities. A description of the econometric technique, the so-called “treatment effects approach”, is provided in Box 1. This approach allows to estimate jointly the average price differential and the choice of management system, as functions of observed municipality’s characteristics.

Empirical results

Factors explaining the choice to delegate water services

The results of the management choice model show that municipalities for which operating conditions are the most difficult tend to delegate water production and distribution services. Being localised in a vulnerable area, using non-protected catchments and using elaborated treatments lead municipalities to choose delegation. In the same way, the decision to turn to private firms is more frequent in municipalities where the network is more difficult to manage (greater number of interconnections, higher proportion of water sold to residential users, complementary supply from neighbouring operators, low-density network). Groups of associated municipalities more often choose a private management system.

Common and differentiated effects of observed variables on the price of water

Relying on surface water instead of groundwater tends to increase the price of water, the latter being in general of better quality than the former. The type of treatment has little impact on the price. Generally speaking, variables indicating a

complex management of the service induce a higher water price: number of interconnections, high proportion of water sold to residential users, volume of water purchased over volume of water supplied. The size of the network has a negative effect on the price of water, which indicates the existence of increasing returns to scale. On the other hand, the network length per residential consumer has an increasing and positive effect on the price of distributed water, indicating that the network density is an important element in the cost of water distribution. Finally, the negative relationship between water price and consumption accounts for the major part of fixed costs and provides evidence for a scale effect. The fact that municipalities belonging to a group of municipalities apply prices 26% higher than those of municipalities managing water services alone is, on the other hand, quite surprising. If the sign of this effect was expected, its value is quite high and probably expresses a tendency towards grouping in case of difficult operating conditions, confirmed by the lack of significant difference in tariffs between groups under direct and private management.

With regard to the differentiated effect of the explanatory price variables, results show that private managers use lower prices than public managers do when the network is complex, which could express the greater “technical” efficiency of private operators. Thus, the network structure and the choice of joining a group of municipalities are the most important factors explaining this differential.

Breakdown of the price differential

Table 2 presents the price breakdown, indicating the average difference in price as well as the contributions of the observed and unobserved characteristics in the differential between direct and delegated management.

The average effect of delegation seems quite high. If all municipalities decide to delegate their water service to private firms, they would pay, on average, 15.2% more than if they were all in *régie*. This gap (ATE) is significant from a statistical point of view. If we only consider municipalities that have already chosen a delegated management, the additional cost borne by users (in comparison to a situation where these municipalities would have chosen a direct management in *régie*) is only 5.6%. This effect (ATE1) is almost significant from a statistical point of view.

Table 2 also shows evidence of the importance of the selection bias on operating conditions in the choice of management system, this effect being quite dominant over self-selection. These results also show the importance of the unobserved effects in the price differential, which is in part due to the strong heterogeneity between municipalities only partially captured by observable variables. A positive selection effect for municipalities that have chosen the delegated system means that these municipalities have unobserved characteristics that would have led to higher tariffs if they had chosen direct management: this effect may be called “the operating conditions effect”. As regards their unobserved characteristics, these municipalities seem to encounter difficult operating conditions (from a technical or/and financial point of view). However, a negative self-selection effect shows that specificities of municipalities under delegation allows them to obtain tariffs lower than those they would have obtained under direct management. This result may be interpreted as a “price

effect” (of municipalities under delegation): municipalities choosing delegation do so in order to benefit from this effect and the specific difference in prices between delegated and direct management may also influence the choice of management system.

Conclusion

The results presented here illustrate the contribution of the treatment effects approach to measure the impact of delegation on the price of water. We show that differences in terms of operating conditions of the water services can partially explain the average difference of 2.27 FF/m³ between delegated firms and *régies* water price. Indeed, a simple analysis of the delegation effects shows that municipalities which delegated their water service would have gained almost nothing in terms of prices if they had chosen a direct management mode.

According to our estimations, in 1998, domestic users in municipalities of less than 10,000 inhabitants under delegated

management paid an average of 15.2% more for drinking water services than users located in similar municipalities having chosen a direct management mode, that is to say 0.98FF/m³. Municipalities of less than 10,000 inhabitants under delegated management in 1998 would have paid only 5.6% less for their drinking water services if they had chosen a direct management mode, which corresponds to 0.41FF/m³.

The main implication of these results is that the water service market is stable “on average”. If municipalities do not gain by choosing direct management in terms of drinking water tariffs, they do not lose much on average. Regarding the effects of observed and unobserved variables, the results show that there is a selection in the sense of a relationship between difficult operating conditions and the choice of delegation, since private firms appear more “efficient” in these conditions. However, these results only reflect average effects and may hide contrasted local situations.

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Alain Carpentier, INRA ESR, Rennes

Céline Nauges, Arnaud Reynaud et Alban Thomas, INRA LERNA, Toulouse

Alain.Carpentier@roazhon.inra.fr – cnauges@toulouse.inra.fr – Areynaud@toulouse.inra.fr – thomas@toulouse.inra.fr

For further information

Alain Carpentier; Céline Nauges; Arnaud Reynaud et Alban Thomas (2004). *Effets de la délégation sur le prix de l'eau potable – Une analyse à partir des résultats de la littérature sur les « effets de traitement »*. Rapport interne, INRA, 102p.

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Box 1.

Let p_{ci} denote the price of water under direct management, P_{1i} being the price under delegated management. The price p_i for a municipality i is decomposed as follows:

$$P_i = m_0 + (m_1 - m_0)d_i + a_0(x_i - \bar{x}) + (a_1 - a_0)(x_i - \bar{x})d_i + (u_{1i} - u_{0i})d_i + u_{0i}, \quad [1]$$

where $d_i = 1$ if municipality i is under delegated management and 0 otherwise, m_0 and m_1 are, respectively, the average prices under direct and delegated management, x_i is a vector of explanatory variables, with empirical mean \bar{x} , u_{0i} and u_{1i} are, respectively, the unobservable components of the price under direct and delegated management, a_0 and a_1 are vectors of parameters (possibly different) associated with determinants x_i , under direct and delegated management, respectively.

Average effects of the delegation

From equation [1], the average effect of the delegation can be computed for all municipalities (Average Treatment Effect): $ATE = E(p_{1i} - p_{0i}) = m_1 - m_0$, and the average effect for municipalities under delegation: $ATE_1 = E(p_{1i} - p_{0i} | d_i = 1)$, where $E(\cdot)$ represents the mathematical expectation.

The price p_{0i} (respectively p_{1i}) is not observable if $d_i = 1$ (respectively $d_i = 0$), but the difference in price between the two forms of management can nevertheless be estimated from the price equation by $E(p_{1i} | d_i = 1) - E(p_{1i} | d_i = 0)$, this difference being observed

Effects of observed and unobserved characteristics

In equation [1], the term $a_0(x_i - \bar{x})$ represents the “common” effect of the **observed variables** on the price, whereas the term $(a_1 - a_0)(x_i - \bar{x})d_i$ captures their differentiated effect associated with delegation in comparison with direct management. The **unobserved effects** u_{0i} and $(u_{1i} - u_{0i})d_i$ correspond to all the factors that can have an impact on the price but for which the econometrician does not have information (in particular, we think of variables such as investments made or financial results of the service, elements that are not available in the Water Agency-IFEN-SCEES survey).

Let us observe the difference in prices between direct and delegated management in what follows:

$$\begin{aligned} E(p_{1i} | d_i = 1) - E(p_{1i} | d_i = 0) &= ATE + (a_1 - a_0)E(x_i - \bar{x} | d_i = 1) + a_0[E(x_i - \bar{x} | d_i = 1) - E(x_i - \bar{x} | d_i = 0)] \\ &\quad (1) \qquad (2) \qquad (3) \\ &\quad + E(u_{1i} - u_{0i} | d_i = 1) + E(u_{0i} | d_i = 1) - E(u_{0i} | d_i = 0) \qquad [2]. \\ &\quad (4) \qquad (5) \end{aligned}$$

In model [2], terms (3) [resp. (5)] correspond to the so-called “selection” effects on observed (resp. unobserved) variables. They illustrate the existing correlation between the choice to delegate and the operating conditions. In other words, they take into account the fact that certain characteristics specific to the municipality can explain both the choice of the management system and the price level. The selection effect will be positive if the municipalities with characteristics that make operation difficult (that is to say more expensive) have a tendency to switch to delegated management. Terms (2) and (4) capture the so-called “self-selection” effects, respectively on observed and unobserved variables. They show the fact that the municipalities’ decision to delegate or not depends on the difference in price applied in the two modes, independently of operating conditions. A negative self-selection effect shows the fact that municipalities choose the management mode that gives them a more advantageous price.

Assessment approach

We first estimate the equation of the management mode, which helps identify its observable determinants, possibly shared with the price determinants. Second, we estimate the price model by linear regression, introducing the adjustments for the bias of selection and the self-selection effect described above (Heckman’s latent variables approach which uses parameters estimated during the first stage). Finally, we compute the difference in price for each municipality in the sample, that we then decompose into an average effect (ATE), and observable and unobservable effects (selection and self-selection).

Table 1: average price of water supply

	Average price FF/m3	Standard deviation	Number of municipalities
Full sample	7,88	2.90	3135
Delegated management	8,85	2.93	1793
<i>Régie</i> management	6,58	2.29	1342
Difference delegation/ <i>régie</i>	+34%		

Table 2: Breakdown of the price of drinking water

	Measured effect (in percent)
Gap between average observed prices	35.9
Average effect (ATE) (1)	15.2
Self-selection on observable ones (2)	-0.9
Self-selection on unobservable ones (3)	-7.6
Selection effect on prices (2) + (4)	-8.5
Selection on observable ones (3)	13.1
Selection on unobservable ones (5)	16.1
Selection effect on management (3) + (5)	29.2