Horizontal Integration and Relational Contracting: An Application to Local Public Services

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Abstract

Legal frameworks, especially in Europe, encourage private participation and competition in the management of public services. However, many local public authorities concentrate the various services they have in charge in the hands of a single operator, leading to horizontal integration which a priori minimizes the positive effects of competition. The following article tries to understand why vertical disintegration is regularly combined with horizontal integration. Results of our model show that under some conditions, this may lead to better performance at lower cost for the public authority. Such a proposition is tested and corroborated using an original database concerning the contractual choices made by 5000 French local public authorities in 1998 and 2001.

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1 Introduction

In the past few decades, the European Union has been promoting private participation and competition in public services, considered as a way to increase efficiency in the management of public services.[1] More precisely, in a first communication in 1996,[2] the Commission explained the interplay for the citizens' benefit between Community measures in the areas of competition and free circulation and public service tasks. This communication was updated in 2000[3] in order to increase the legal certainty for operators as regards the application of competition and internal market rules to their activities. In 2001, these two communications were complemented by a Report to the Laeken European Council.[4] This report responds to concerns with regard to the economic viability of operators entrusted with public service tasks. It highlights the guarantees offered by Article 86 (2) of the Treaty,[5] Community action and the responsibility of the Member States, in particular as regards the definition of public service obligations (European Commission [2003]).

However, statistics about the management of public services seem rather disconnected with such a trend, aiming to promote competition. Many local public authorities concentrate the various services they have in charge in the hands of a single operator, which a priori minimizes the positive effects of competition. Therefore, it seems that public authorities have been rather con-

[1]Let us note however that both notions are different: private participation does not necessary mean competition, as a private firm can be a monopole, and competition does not exclude the participation of public firms, that can be in competition with private firms on some markets. In the European union, both private participation and competition are promoted.

[2]"Services of general interest in Europe", OJ C 281, 26.9.1996, p.3

[3]"Services of general interest in Europe", OJ C 17, 19.1.2001, p.4

[4]COM(2001) 598 final, 17.10.2001

[5]Article 86 (2) provides: "Undertakings entrusted with the operation of services of general economic interest ... shall be subject to the rules contained in this Treaty, in particular to the rules on competition, insofar as the application of such rules does not obstruct the performance, in law or in fact, of the particular tasks assigned to them. The development of trade must not be affected to such an extent as would be contrary to the interests of the Community".

vinced to "vertically disintegrate" services (at least in France), but surprisingly enough, have in parallel choose to "horizontally integrate" them.

When observing management practices more precisely, most private operators are global groups capable of providing many local public services. As a consequence, the market for public services is rather oligopolistic, especially for "environmental services" such as water, sanitation, waste or energy managements, as illustrated by table 1.

Table 1: Market shares in % of French urban population, year 2004.

	Water management	Garbage collection and treatment	Urban warming
Veolia	40%	37 %	38 %
Suez	20 %	21 %	47 %
SAUR	10 %	9 %	
Independent operators	1 %	6 %	8%
In house provision	29 %	27 %	7 %

Source: *Direction des affaires économiques internationales, Ministère de l'équipement*

Therefore, public authorities often rely on the same operator to provide different services they choose to contract out. This seems surprising when one thinks of the egalitarian and transparency principles of the European Union for attribution of markets.[6]

How then to explain the gap between the will to promote competition and the observation of a rather concentrated market for public services? Is competition effective or does it reduce to a goal mentioned in formal official speeches ?
Up to now, few works have been done on this theme. As previously shown,

[6]Such concentration is not specific to France. In a guide for Nova Scotia Municipalities that might be interested by PPPs (p.9), a warning is written about limited competition: "Where municipalities are seeking to increase private partner participation in services that have been provided by the public partner, there may be a limited number of firms with the experience or expertise to compete for the contract. In such cases, a public monopoly may simply be replaced with a private monopoly that nullifies many of the advantages of a partnership." See $http://gov.ns.ca/snsmr/muns/fin/pdf-ppp/ppp_1.pdf$

many works deal with PPPs but focus on their design (Bennett and Iossa [2006]), on the trade-off with public provision (Hart et al. [1997], Hart [2003]), or on factors causing their renegotiation (Guasch et al. [2003], Guasch [2004]). To our knowledge, no work specifically deals with horizontal integration in PPPs, and the reasons for the concentration of services, with the exception of Gence-Creux [2001]. The latter documents a tendency for local public authorities in France to rely on the same operator for providing several different public services such as water, cable television, garbage collection etc. He shows that a mayor who has electoral concerns may be led to favor a unique manager even though this choice proves to be inefficient. However, no explanation has been proposed for such a market concentration in case of benevolent government. Our paper tries to propose such an explanation by relying on "relational contracts", as defined by Baker et al. [2002] or Baker et al. [2004]. Contractual incompleteness is here taken for granted: Indeed, quality of services public authorities want is often difficult or prohibitively costly to specify in details ex ante, at least in a way to be enforced by courts (Hart et al. [1997]). As a consequence, renegotiations occur ex post. Yet, parties may also tacitly agree on the way uncontractible parameters can be managed. As these dealings cannot be enforced by courts, their self-enforcement comes from perspectives of future business between partners, and the need for a good reputation.

In order to take into account the relational dimension we develop a model in which a public authority decides to contract out the management of two services, whose uncontractible investments have different impacts on social benefit. The public authority can decide either to "horizontally" integrate the services by delegating them to one single private operator, or she can choose two different managers. The key question in our paper is whether such a choice has consequences on promises about how to deal with non-contractible outcomes. We show that in a static framework, these informal dealings prove to be irrelevant, and whether transactions are horizontally integrated or not has no impact. Private provision leads to optimal incentives for the service with low adverse effect, but over-optimal investments for the service with high adverse effect. We thus confirm results already obtained by Hart et al. [1997], considering two transactions instead of one as they did.

Nevertheless, when parties have concerns for future business, relational contracts can encourage useful actions. We explore this and we show that a private partner may accept to invest at a level that is socially optimal, if he is rewarded for such a behavior, by a bonus or a promise to be chosen again in subsequent periods. His deviation can be punished in the long run. We found that with two different services, with and the other without adverse effects of cost reduction on social benefits, horizontal integration disproportionately increases the sanction compared to the gains in case of deviation. In other words, with such a configuration, informal agreements are more easily sustainable when the private manager has both contracts in charge. The bonus the public authority has to pay to achieve the social optimum is then lower, which means that the total price paid to manage both services is lower in case of horizontal integration than in case of horizontal disintegration. Our main result is thus to show that, under some conditions, horizontal integration may force the private manager to respect the informal dealing at lower costs. In such a perspective, horizontal integration appears as an instrument in the service of the parties' relationship.

We then test such a proposition on an original database combining data from the French Environment Institute (IFEN) and the French Health Ministry (DGS), concerning 5000 local public authorities and their contractual choices in force in 1998 and 2001. Our results show that the choice of the same operator in order to operate both distribution and sanitation of water is not random and is not neutral. Our main proposition is confirmed.

We believe our paper is a contribution to the relational contracting literature by highlighting the fact that it is necessary to study several transactions, and not one in isolation, in order to understand contractual choices and performances. Our model provide a rational basis for this, focusing on the fact that problematic transactions (i.e. with non contractible investments) might be adequately bundled with more simple ones in order to ease their enforcement. Furthermore, we provide, as far as we know, the first econometrical test of this proposition on a public private contracts database.

The paper is organized as follow. In a first section (section 2) we present our theoretical framework in a static context. Then, we extend our results to a dynamic context, using a repeated game framework leading to our main propositions (section 3). Then, in a last section (section 4) we present our data and test our propositions. Conclusions follow.

2 The theoretical model

2.1 The general framework

To study the issues at stake, we build a theoretical framework based on Hart et al. [1997]. More specifically, we assume that a benevolent public authority (PA, to whom we will refer to as "she") is in charge of providing two public services to users. We denote these services as $\mathscr{A}$ and $\mathscr{B}$. To provide those two services, we assume that PA has to rely on external operators through the use of contracts.[7]

More specifically, we assume that *ex ante*, PA may describe and specify in a contract some aspects of the provision of a good. However, when executing the

[7] Contrary to Hart et al. [1997], we will not consider the public provision case, to focus on horizontal integration and disintegration when contracting out.

contract, the private operator of a service may come up with new innovative ways to adapt the service to users' need, or to reduce the costs of provision of these services. Such innovations are often difficult and costly to anticipate *ex ante*, which leads to some contractual incompleteness as defined by Grossman and Hart [1986], Hart and Moore [1990] or Hart [1995]. Hence, when such innovations turn up, parties will revise the contract *ex post* when it is clear to them how the relevant contigencies are. This leads us to assume that such innovative efforts are *uncontractible ex ante*, but *observable ex post* (and then contractible) once relevant contingencies are realized.

2.1.1 Production technologies

To fix our ideas, we will assumed that, *ex ante*, for a given service, the cost of provision incurred by an operator is C_s^0, $s \in \{\mathscr{A}, \mathscr{B}\}$. For simplicity's sake, this cost is assumed to be the same for all operators, and it is known to all. In the same way, we denote the benefits to society that come from the provision of the basic service s as B_s^0, $s \in \{\mathscr{A}, \mathscr{B}\}$. Following Hart et al. [1997], we call this good the "basic" good, and denote its price P_s^0.

Yet, operators may undertake efforts to innovate on the service provided during the execution phase. Two types of innovations are considered: innovations that lead to a reduction in costs, and innovations that lead to a better quality of the provided service. Efforts devoted to cost-reducing innovations (resp. quality-enhancing innovations) for a given service s are denoted e_s (resp. i_s), $s \in \{\mathscr{A}, \mathscr{B}\}$. Upon implementing the innovations, the social benefits and costs of providing a given service s become

$$\begin{aligned} B_s &= B_s^0 - b_s(e_s) + \beta_s(i_s) \\ C_s &= C_s^0 - c_s(e_s) - i_s - e_s \end{aligned}$$

where $c_s(e_s) \geq 0$ is the reduction in costs corresponding to the cost innovation for service s, $b_s(e_s) \geq 0$ is the reduction in quality corresponding to the cost innovations for service s, and $\beta_s(i_s)$ is the quality increases net of costs from the quality innovations for service s, $s \in \{\mathscr{A}, \mathscr{B}\}$. The function b_s measures how much quality is affected because of a (noncontractible) reduction of costs for service s.

For our purpose, we assume that service $\mathscr{A}$ and $\mathscr{B}$ differ in terms of the perspectives for cost-reducing innovations and quality-enhancing innovations. In particular, we assume that for service $\mathscr{A}$, there are no perspective for quality-enhancing innovations, and that costs reductions do not have any impact on the quality of the service provided. In other words, $b_{\mathscr{A}}(e_{\mathscr{A}}) = 0$ and $\beta_{\mathscr{A}}(i_{\mathscr{A}}) = 0$. Then it is possible for parties to write a complete contract. On the other hand, the perspectives of innovation for service $\mathscr{B}$ and their impact on costs and social benefits to the society correspond to the classical case analyzed in Hart et al. [1997], *i.e.* include adverse effects in case of cost reduction, and potential quality innovations. This assumption is meant to capture the fact that cost-reducing perspectives and quality-enhancing opportunities differ across different services. Notice that we also assume that both services are not related in any way.

We make the following standard assumptions on c_s, $b_{\mathscr{B}}$ and $\beta_{\mathscr{B}}$: $b_{\mathscr{B}}(0) = 0$, $b'_{\mathscr{B}}(e_{\mathscr{B}}) \geq 0$, $b''_{\mathscr{B}}(e^{\mathscr{B}}) \geq 0$; $c_s(0) = 0$, $c'_s(0) = \infty$, $c'_s(e_s) > 0$, $c''_s(e^s) < 0$, $c'_s(\infty) = 0$; $\beta_{\mathscr{B}}(0) = 0$, $\beta'_{\mathscr{B}}(0) = \infty$, $\beta''_{\mathscr{B}}(i_{\mathscr{B}}) > 0$, $\beta''_{\mathscr{B}}(i_{\mathscr{B}}) < 0$, $\beta'(\infty) = 0$; $c'_{\mathscr{B}}(e_{\mathscr{B}}) - b'_{\mathscr{B}}(e_{\mathscr{B}}) \geq 0$. The assumptions $c'_{\mathscr{B}}(e_{\mathscr{B}}) - b'_{\mathscr{B}}(e_{\mathscr{B}}) \geq 0$ and $\beta'_{\mathscr{B}}(i_{\mathscr{B}}) > 0$ say that the quality reduction from a cost innovation for service $\mathscr{B}$ does not offset the quality increase.

An operator's overall *ex ante* costs can therefore be written as follows:

$$\text{For service } \mathscr{A} \quad : \quad C^0_{\mathscr{A}} - c_{\mathscr{A}}(e_{\mathscr{A}}) + e_{\mathscr{A}}$$
$$\text{For service } \mathscr{B} \quad : \quad C^0_{\mathscr{B}} - c_{\mathscr{B}}(e_{\mathscr{B}}) + e_{\mathscr{B}} + i_{\mathscr{B}}$$

2.1.2 Contracts

Following the literature, we further assume that $i_{\mathscr{B}}$, , $b_{\mathscr{B}}$, $\beta_{\mathscr{B}}$, e_s and c_s, with $s \in \{\mathscr{A}, \mathscr{B}\}$, are observable to the contracting parties, but are not verifiable to outsiders (such as a court). Therefore, these variables cannot be part of an enforceable contract. Furthermore, since these variables are not contractible *ex ante*, PA and the private operator(s) may renegotiate the initial contract, once the innovations are discovered. Similar with Hart et al. [1997], we assume that if the parties renegotiate the contract *ex post*, the gains from renegotiation are divided between them according to a Nash bargaining outcome. The timing of the one shot static game is depicted in the following figure.

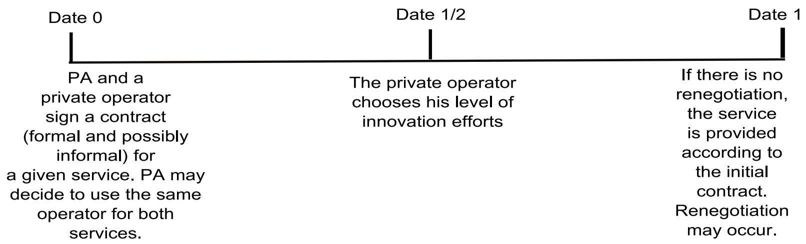


Figure 1: Timing of the game

What is crucial here is that PA may proposes an additional informal contract to the operator to share the gains from innovation that are not contracted on ex ante, thus avoiding *ex post* renegotiations. An informal contract here aims to motivate the operator to achieve first-best levels of investments e_s and i_s, in exchange of a supplementary monetary transfer, denoted T_s from PA to the operator of a given service s. Such a contract, however, may not be enforced by any third party, since innovative efforts are non-verifiable. Consistent with the economic literature, an informal contract is self-enforcing for each party if the payoff stream from cooperation is higher than the payoff stream from deviation (Baker et al. [2002], Baker et al. [2004]). As such the informal contract that we discuss in this paper corresponds to a relational contract. We model such an aspect using a repeated game framework, in which an informal contract is consider to be self-enforcing in the shadow of the future. This issue will be further discussed later on in this paper.

Hence, in our framework, PA is confronted with the decision to whether use a same private operator (horizontal integration) to ensure the provision of both services, or to delegate the provision of both services to two different operators (horizontal disintegration). In other words, PA may choose to bundle the provision of both services or not. We suppose that PA is benevolent, and then will take these decisions to maximize consumers' surplus.[8]

2.2 The first best

First, we will briefly derive the first-best case to serve as a benchmark. In this situation, we assume contractual completeness for e_s and i_s.
As shown by Hart et al. [1997], contracting parties will choose e_s and i_s to maximize total net surplus from their reading relationship, and divide the surplus between themselves using lump-sum transfers. As a consequence, first-best incentives are those maximizing:

$$\max_{e_s, i_s} \quad [-b_s(e_s) + c_s(e_s) + \beta_s(i_s) - e_s - i_s]$$

The first best level of efforts for cost-reducing innovations e_s^{FB} and for quality-enhancing innovations i_s^{FB} for service s are therefore characterized by the following:

$$\begin{aligned} b_s'(e_s^{FB}) - c_s'(e_s^{FB}) &= 1 \\ \beta_s'(i_s^{FB}) &= 1 \end{aligned}$$

[8]As in HSV [1997], the public authority does not maximize the global surplus during renegotiations: its utility function is given by the welfare of the rest of society, excluding the manager M. Indeed, " The political process aligns G's and society's interests (since M has negligible voting power, his interests receive negligible weight). As will become clear, if G placed the same weight on M's utility as on the rest of society, the first-best could be achieved".

This leads to the first-best surplus for each service:

$$S^{FB} = B_s^0 - C_s^0 + \beta_s(i_s^{FB}) + c_s(e_s^{FB}) - b_s(e_s^{FB}) - e_s^{FB} - i_s^{FB}$$

2.3 The one-shot game

As demonstrated by Hart et al. [1997], using Nash bargaining games, private provision leads to the following payoffs for the public authority:

$$U_s^{PA} = B_s^0 - P_s^0 + \frac{1}{2}\beta_s(i_s) - b_s(e_s)$$

and for the private operator: $U_s^{M_s}$ is

$$U_s^{M_s} = P_s^0 - C_s^0 + \frac{1}{2}\beta_s(i_s) + c_s(e_s) - e_s - i_s$$

Maximizing his utility, the private operator of service s chooses e_s^{NB} and i_s^{NB} to satisfy

$$\begin{aligned} c_s'(e_s^{NB}) &= 1 \\ \frac{1}{2}\beta_s'(i_s^{NB}) &= 1 \end{aligned}$$

Hence, if we compare these results to the first-best case, we see that for service $\mathscr{A}$, the efforts devoted to the cost-reducing innovations are optimal. Indeed, as $b_{\mathscr{A}}(e_{\mathscr{A}}) = 0$ and $\beta_{\mathscr{A}}(i) = 0$, then $c'_{\mathscr{A}}(e_{\mathscr{A}}^{NB}) - b'_{\mathscr{A}}(e_{\mathscr{A}}^{NB}) \rightarrow c'_{\mathscr{A}}(e_{\mathscr{A}}^{NB})$. Therefore, incentives to reduce costs achieve optimal levels for service $\mathscr{A}$.

However, for the service $\mathscr{B}$, contractual incompleteness leads to overoptimal incentives for efforts devoted to cost-reducing innovations, and under-provision of efforts devoted to quality-enhancing innovations, as shown by Hart et al. [1997]. This is because the private operator does not internalize sufficiently the negative effect of cost-reducing innovations for society, and his incentives for quality-enhancing innovations are dampened by the fact that he only gets half of the benefits of those innovations at the margin.

The total surplus for contract $\mathscr{A}$ is in this case:

$$S_{\mathscr{A}}^{NB} = B_{\mathscr{A}}^0 - C_{\mathscr{A}}^0 + c_{\mathscr{A}}(e_{\mathscr{A}}^{NB}) - e_{\mathscr{A}}^{NB}$$

as $\beta_{\mathscr{A}}(i_{\mathscr{A}}) = 0$ and $b_{\mathscr{A}}(e_{\mathscr{A}}) = 0$.

and for contract $\mathscr{B}$:

$$S_{\mathscr{B}}^{NB} = B_{\mathscr{B}}^0 - C_{\mathscr{B}}^0 + c_{\mathscr{B}}(e_{\mathscr{B}}^{NB}) + \beta_{\mathscr{B}}(i_{\mathscr{B}}^{NB}) - b_{\mathscr{B}}(e_{\mathscr{B}}^{NB}) - e_{\mathscr{B}}^{NB} - i_{\mathscr{B}}^{NB}$$

Granting both contracts to the same operator has *a priori* no effect. Indeed, in such a case, PA's utility function is written

$$U_{\mathscr{A}+\mathscr{B}}^{PA} = [B_{\mathscr{A}}^0 - P_{\mathscr{A}}^0] + [B_{\mathscr{B}}^0 - P_{\mathscr{B}}^0 + \frac{1}{2}\beta_{\mathscr{B}}(e_{\mathscr{B}}) - b_{\mathscr{A}}(e_{\mathscr{A}})]$$

and operator M's utility function is:

$$U_{\mathscr{A}+\mathscr{B}}^{M} = [P_{\mathscr{A}}^0 - C_{\mathscr{A}}^0 + c_{\mathscr{A}}(e_{\mathscr{A}}) - e_{\mathscr{A}}] + [P_{\mathscr{B}}^0 - C_{\mathscr{B}}^0 + \frac{1}{2}\beta_{\mathscr{B}}(i_{\mathscr{B}}) + c_{\mathscr{B}}(e_{\mathscr{B}}) - e_{\mathscr{B}} - i_{\mathscr{B}}]$$

A utility-maximizing operator M will choose $e_{\mathscr{A}}^{FC,B}$, $e_{\mathscr{B}}^{FC,B}$ and $i_{\mathscr{B}^{FC,B}}$ to satisfy the following first order conditions

$$\begin{aligned} c'_{\mathscr{A}}(e_{\mathscr{A}}^{FC,B}) &= 1 \\ c'_{\mathscr{B}}(e_{\mathscr{B}}^{FC,B}) &= 1 \\ \frac{1}{2}\beta'_{\mathscr{B}}(i_{\mathscr{B}}^{FC,B}) &= 1 \end{aligned}$$

All this is resumed in the following proposition.

Proposition 1 *Under a static game, with two services, one with and the other without adverse effects on quality when reducing costs, it is irrelevant for a* *public authority to consider granting contracts to a same operator or to different operators.*

The proposition above is rather straightforward, given our assumption that the services are not related in any way.

3 The repeated game framework

When the agents are in a long term relationship and care about the future, the lack of incentives to invest in i and the over-optimal incentive to invest in e should not be so severe. Such an intuition is based on recent developments on "relational contracts" (Baker et al. [2002], Baker et al. [2004]), *i.e.* informal agreements about observable but non verifiable parameters sustained by the value of future relationships.[9] These works demonstrate that incentives derived from various allocations of ownership may change when concerns for future are taken into account. To this end, the authors use repeated-game models, and show how incentives vary, and how the underpinning informal dealings become self-enforced.

We will follow here such an approach by appealing to the grim trigger strategies framework developed by Friedman [1971]. A period in our framework is considered as a contract's duration. As a consequence, at each period, the public authority can choose to pursuit or to stop the relationship. The discount factor is denoted $0 \leq \delta \leq 1$. Following Halonen [2002], we suppose that parties implicitly agree to make efficient investments, and to share total ex post surplus.

For service $\mathscr{A}$, the first-best is reached even in a static game as shown in the

[9] Bull [1987] and Klein [1988] also suggest that reputation effects can limit holdup problems.

previous section. Therefore, there is no need of a relational contract to achieve optimal levels of efforts devoted to innovation. However, this is not the case for service $\mathscr{B}$, where private provision leads to over-optimal incentives to reduce costs, as the adverse effect is not internalized by the private manager, and to under-optimal incentives for quality-enhancing investments.

For this service, we therefore suppose that the private manager implicitly agrees to make the first best levels of efforts devoted to innovation e^{FB} and i^{FB}, *i.e.* levels of efforts that maximizes total surplus, but do not maximizes his own utility. As a result, the PA's utility is increased, as the adverse effect from cost-reducing innovations is internalized. Let us denote $U_{\mathscr{B}}^{M,FB}$ and $U_{\mathscr{B}}^{PA,FB}$ the utilities of the operator for service $\mathscr{B}$ and of the PA when first-best investments are made during the management of service $\mathscr{B}$. To compensate the decrease in utility of the private operator, the PA gives him a transfer $T_{\mathscr{B}}$ that is paid at the end of each period, *i.e.* when levels of efforts become observable by parties. In case of relational contracting, final payoffs of each party are then:

$$\begin{aligned} U_{\mathscr{B}}^{M,R} &= U_{\mathscr{B}}^{M,FB} + T_{\mathscr{B}} \\ U_{\mathscr{B}}^{PA,R} &= U_{\mathscr{B}}^{PA,FB} - T_{\mathscr{B}} \end{aligned}$$

Note that the only relevant information about the previous period is whether there was or not deviation. It then remains to determine what kind of transfer $T_{\mathscr{B}}$ (*i.e.* sharing of the surplus) allows such a relational contract to be respected by both contracting partners.[10] To this end, let us first precise what the trigger strategy means here:

- Either each partner accepts the relational agreement, *i.e.* the private manager makes optimal levels of investments. He receives a transfer

[10]Such a transfer can correspond to a price increase during the execution of the contract.

from the public authority. There is no reason for the relationship to be stopped as first-best is achieved.

- Else, one of the partners reneges. If the private operator cheats, he prefers to invest to maximize his own utility, *i.e.* he prefers to have $U_{\mathscr{B}}^{M,NB}$ than $U_{\mathscr{B}}^{M,R}$. However, from this point, he is no longer considered as trustworthy. This means that the PA will select him again for the subsequent periods with a probability $0 \leq p \leq 1$, and will refuse to contract with him with a probability $(1-p)$.[11]

- If the public authority reneges, *i.e.* refuses to give the transfer while the private manager has made first-best incentives, then the latter applies nash bargaining rules for the rest of the game. If he is chosen for the following periods, he will not accept any informal dealing, and returns to the non-cooperative solution.

As in the static game, $P_{\mathscr{B}}^0$ represents the (*ex ante*) price paid by the public authority to the private manager to provide the service. As $T_{\mathscr{B}}$ is the *ex post* transfer given to the private manager, the total price paid by the public authority when relational contracting is honored on both sides is $P_{\mathscr{B}}^0 + T_{\mathscr{B}}$ for service $\mathscr{B}$.

First best will be supported in equilibrium only if the discounted payoff stream from efficient behavior exceeds the payoff stream from the deviation path for both agents. We will show that when two contracts - one with and the other without adverse effect - are signed by the same partners, the level of transfer

[11]What happens in case of reneging is that the public authority is free to decide to stop the game with the private manager (and then turn to public provision or choose another private manager), or to continue the relationship, *i.e.* to select him again but without informal dealings, as the private manager is now considered as not trustworthy. For instance, we can suppose that the market is oligopolistic, and there is no other alternative than this private manager, or the costs to go back to the public provision are too high. To model such an alternative, there is a probability that affects reversion to Nash equilibrium of the static game as "punishment". Hence, the parameter $(1-p)$ allows us to capture outside options available to PA should he decide to change for another operator at the end of the contract.

$T_{\mathscr{B}}$ is lower than when only one contract is delegated. As a consequence, the total price is lower in case of "horizontal integration" than in case of "horizontal disintegration".

3.1 Horizontal disintegration: A different operator for each service

3.1.1 Share of the uncontractible surplus

Suppose that the public authority has chosen a different operator for each service. For the service $\mathscr{A}$, there is no relational agreement to implement to achieve first-best, as incentives of the private manager correspond to the optimal levels, even in the one-shot game. The total price paid by the public authority is then $P^0_{\mathscr{A}}$, as described in the previous part.

For service $\mathscr{B}$, first-best levels of incentives are achieved if the relational contract described above is implemented. Beyond the formal contract signed *ex ante* for a price $P^0_{\mathscr{B}}$, an informal dealing is agreed on by the partners. Let us denote $T_{\mathscr{B}}$ the transfer of the public authority to the private manager in such a case. We try to determine the level of such a transfer.[12] As just mentioned, first-best will be supported in equilibrium if, for both partners, the discounted payoff stream is higher under relational contracting than under the deviation path, *i.e.* :

- for the private manager:

[12] One could argue that the threat of the sanction is strong enough to dissuade the private operator from reneging. This is true when $p \to 0$, i.e. the public authority can get rid of the private manager forever. But, when $p \to 1$, as discussed in the previous footnote, then the threat is not strong enough and a bonus is needed. Comparative statistics on results of the following subsection will show that $\frac{dT}{dp} > 0$, then the higher p is, the highest T has to be.

$$\frac{U_{\mathscr{B}}^{M,FB} + T_{\mathscr{B}}}{1-\delta} \geq U_{\mathscr{B}}^{M,NB} + \frac{\delta p U_{\mathscr{B}}^{M,NB}}{1-\delta} \tag{1}$$

Indeed, the private manager obtains $U_{\mathscr{B}}^{M,NB}$ when he deviates, and then receives $\frac{\delta p U_{\mathscr{B}}^{M,NB}}{1-\delta}$ (See appendix for demonstration).

- for the public authority:

$$\frac{U_{\mathscr{B}}^{PA,FB} - T_{\mathscr{B}}}{1-\delta} \geq U_{\mathscr{B}}^{PA,FB} + \frac{\delta p U_{\mathscr{B}}^{PA,NB}}{1-\delta} + \frac{\delta(1-p) U_{\mathscr{B}}^{PA,oo}}{1-\delta} \tag{2}$$

where $U_{\mathscr{B}}^{PA,00}$ represents the utility of the public authority derived from her outside option, *i.e.* either public provision or the selection of another private manager for the next periods (with or without informal dealings). Gain from deviation for the public authority is $U_{\mathscr{B}}^{PA,FB}$, as he chooses not to give the transfer to the private manager the bonus and benefits from the optimal investments. It follows that the private manager will no longer trust the PA if he is selected again (with probability p) for the next periods.

Equation 1 leads to:

$$\begin{aligned} \frac{U_{\mathscr{B}}^{M,FB} + T_{\mathscr{B}}}{1-\delta} &\geq U_{\mathscr{B}}^{M,NB} + \frac{\delta p U_{\mathscr{B}}^{M,NB}}{1-\delta} \\ U_{\mathscr{B}}^{M,FB} + T_{\mathscr{B}} &\geq U_{\mathscr{B}}^{M,NB}(1-\delta) + \delta p U_{\mathscr{B}}^{M,NB} \end{aligned}$$

$$T_{\mathscr{B}} \geq \delta(p-1) U_{\mathscr{B}}^{M,NB} + U_{\mathscr{B}}^{M,NB} - U_{\mathscr{B}}^{M,FB} \tag{3}$$

As a result, when $T_{\mathscr{B}}$, *i.e.* the bonus paid by the public authority to the private manager when the relational contract is honored, is at least equal to $\delta(p-1)U_{\mathscr{B}}^{M,NB} + U_{\mathscr{B}}^{M,NB} - U_{\mathscr{B}}^{M,FB}$, the relational contract is self-enforced for the private manager.[13] Then, equation 3 is the incentive compatibility for the private manager.

Let us note that the lower the transfer is, the lower temptations to deviate are for the party that gives the transfer. Moreover, since PA only cares about consumers' surplus, she will have an interest to pay the lowest possible transfer.[14] Therefore, $T^*_{\mathscr{B}}$ is such as 3 is just satisfied, *i.e.* :

$$T^*_{\mathscr{B}} = [\delta(p-1)]U^{M,NB}_{\mathscr{B}} + U^{M,NB}_{\mathscr{B}} - U^{M,FB}_{\mathscr{B}}$$

3.1.2 Total cost for the public authority

The total total cost for PA to provide both services is then:

- $P^0_{\mathscr{A}}$ for the service $\mathscr{A}$
- $P^0_{\mathscr{B}} + T^*_{\mathscr{B}}$, *i.e.* the *ex ante* price $P^0_{\mathscr{B}}$ and the *ex post* surplus, for service $\mathscr{B}$

Denoting P^D, the total cost for both services, we have $P^D = P^0_{\mathscr{A}} + P^0_{\mathscr{B}} + T^*_{\mathscr{B}}$.

3.2 Horizontal integration: A same private operator

3.2.1 Share of the uncontractible surplus

Suppose now that both services are bundled, *i.e.* a same private operator is managing them. Let us determine the sharing rule $T_{\mathscr{A}+\mathscr{B}}$ of the surplus that

[13]Note that in this case, $U^{M,R}_{\mathscr{B}} = U^{M,FB}_{\mathscr{B}} + T_{\mathscr{B}}$, *i.e.* $U^{M,R}_{\mathscr{B}} = \delta(p-1)U^{M,NB}_{\mathscr{B}} + U^{M,NB}_{\mathscr{B}}$

[14]Indeed, we may think that benefits from the optimal management of public services dedicated to public interest is sufficiently high that PA would have adequate incentives to respect her end of the dealing, *i.e.* to pay the minimum amount of bonus necessary to provide the private operator with incentives to undertake the investment efforts. This can be seen from the fact that the PA's outside option cannot enable her to achieve the first-best situation if she does not honor the informal contract. However, we are aware that this assumption may be too restrictive, and we intend to explore this issue in more details in the near future.

allows to make relational contract self-enforced.

In a similar way to the previous case, the private manager either accepts the sharing rule $T_{\mathscr{A}+\mathscr{B}}$, or deviates and prefers Nash bargaining rules. As a consequence, the public authority will select him again for each service with a probability $0 \leq p \leq 1$. Yet, contrary to the case of horizontal disintegration, punishment is here applied to both contracts: when the private partner deviate, the public authority applies his sanction, *i.e.* the probability p to be chosen again at subsequent periods, on contracts for both service $\mathscr{A}$ and $\mathscr{B}$.

As a consequence, when the informal dealing is respected, the private manager's utility $U^{M,R}_{\mathscr{A}+\mathscr{B}}$ is:

- The utility derived from the contract for service $\mathscr{A}$, *i.e.* $U^{M,FB}_{\mathscr{A}} = U^{M,NB}_{\mathscr{A}}$, as first-best is achieved through Nash bargaining
- And the utility of the second contract with first-best investments plus the bonus, *i.e.* $U^{M,FB}_{\mathscr{B}} + T_{\mathscr{A}+\mathscr{B}}$

As a consequence, $U^{M,R}_{\mathscr{A}+\mathscr{B}} = U^{M,NB}_{\mathscr{A}} + U^{M,FB}_{\mathscr{B}} + T_{\mathscr{A}+\mathscr{B}}$.

In case of deviation, he gains on the contract for service $\mathscr{B}$[15], *i.e.* $U^{M,NB}_{\mathscr{B}}$, but would be selected again for the other periods with a probability p, for both contracts. As a result, the private manager honors his informal agreement when:

[15] Recall that for service $\mathscr{A}$, the Nash solution for the operator corresponds to the first-best, so there is no possible deviation.

$$\begin{aligned}
\frac{U_{\mathscr{A}}^{M,NB}+UM_{\mathscr{B}}^{M,FB}+T_{\mathscr{A}+\mathscr{B}}}{1-\delta} &\geq (U_{\mathscr{A}}^{M,NB}+U_{\mathscr{B}}^{M,NB})+\frac{p\delta(U_{\mathscr{A}}^{M,NB}+U_{\mathscr{B}}^{M,NB})}{1-\delta} \\
U_{\mathscr{A}}^{M,NB}+UM_{\mathscr{B}}^{M,FB}+T_{\mathscr{A}+\mathscr{B}} &\geq (U_{\mathscr{A}}^{M,NB}+U_{\mathscr{B}}^{M,NB})(1-\delta)+p\delta(U_{\mathscr{A}}^{M,NB}+U_{\mathscr{B}}^{M,NB}) \\
T_{\mathscr{A}+\mathscr{B}} &\geq (U_{\mathscr{A}}^{M,NB}+U_{\mathscr{B}}^{M,NB})\delta(p-1)+(U_{\mathscr{B}}^{M,NB}-UM_{\mathscr{B}}^{M,FB})
\end{aligned}$$

In the same way as our discussion above, PA will want to choose the lowest possible amount of transfer in order to maximize consumers' surplus. Furthermore, the lower the transfer is, the lower temptations to deviate are for the public authority that has to give the amount of transfer. As a consequence, when both contracts are bundled:

$$T_{\mathscr{A}+\mathscr{B}}^{*}=(U_{\mathscr{A}}^{M,NB}+U_{\mathscr{B}}^{M,NB})\delta(p-1)+(U_{\mathscr{B}}^{M,NB}-UM_{\mathscr{B}}^{M,FB})$$

Let us now compare horizontal integration and disintegration.

3.2.2 Total cost for the public authority

In case of horizontal integration, the total cost for PA is therefore:

- $P_{\mathscr{A}}^{0}$ for the service $\mathscr{A}$
- $P_{\mathscr{B}}^{0}+T_{\mathscr{A}+\mathscr{B}}$, *i.e.* the *ex ante* price $P_{\mathscr{B}}^{0}$ and the *ex post* surplus, for the service $\mathscr{B}$

Denoting P^{I} such a cost, we have $P^{I}=P_{\mathscr{A}}^{0}+P_{\mathscr{B}}^{0}+T_{\mathscr{A}+\mathscr{B}}$.

3.3 Cost comparison and proposition

Let us now compare the total cost in each cases:

- In case of horizontal disintegration, the total cost paid by the public authority is $P^D = P^0_{\mathscr{A}} + P^0_{\mathscr{B}} + T^*_{\mathscr{B}}$, *i.e.*

$$P^D = P^0_{\mathscr{A}} + P^0_{\mathscr{B}} + \delta(p-1)U_{\mathscr{B}}^{M,NB} + U_{\mathscr{B}}^{M,NB} - U_{\mathscr{B}}^{M,FB}$$

- In case of horizontal integration, the total cost paid by the public authority is $P^I = P^0_{\mathscr{A}} + P^0_{\mathscr{B}} + T_{\mathscr{A}+\mathscr{B}}$, *i.e.*

$$P^I = P^0_{\mathscr{A}} + P^0_{\mathscr{B}} + \delta(p-1)(U_{\mathscr{A}}^{M,NB} + U_{\mathscr{B}}^{M,NB}) + (U_{\mathscr{B}}^{M,NB} - UM_{\mathscr{B}}^{M,FB})$$

Parameters defining P^I and P^D are the same ex ante prices $P^0_{\mathscr{A}} + P^0_{\mathscr{B}}$, and the same final terms $U_{\mathscr{B}}^{M,NB} - UM_{\mathscr{B}}^{M,FB}$. Differences are then the first terms on the right of the equation $(U_{\mathscr{A}}^{M,NB} + U_{\mathscr{B}}^{M,NB})\delta(p-1)$ and $\delta(p-1)U_{\mathscr{B}}^{M_{\mathscr{B}},NB}$.

With $0 \leq p \leq 1$, $(U_{\mathscr{A}}^{M,NB} + U_{\mathscr{B}}^{M,NB})\delta(p-1) \leq \delta(p-1)U_{\mathscr{B}}^{M,NB}$, then $P^I \leq P^D$.

Proposition 2 *When two services - one with and another without adverse effect- are concentrated in the hands of one single operator, it may lead to lower prices to pay, compared to the situation where both services are contracted out to different private firms.*

In the following section, we propose an empirical analysis to see whether this result is consistent with what can be observed in some data about water sector.

4 An empirical analysis of horizontal concentration in the French water sector

4.1 Putting the Model to the test

Before turning to the empirical analysis, we address some preliminary issues of interpretation. Our baseline model focus on two types of services, one with and the other without adverse effect on quality in case of uncontractible cost reduction. It points out that horizontal integration, *i.e.* the provision of both services by the same private operator, facilitates the enforcement of relational contracts.

Putting our theory to the test implies to find at least one service whose uncontractible cost-reducing investments do not impact on quality. This is a very strong empirical challenge, as it implies some "limited" contractual incompleteness: cost-reducing investments could not be contracted on ex ante, but would never damage quality. It seems difficult to find a service with such characteristics. Nevertheless, it is straightforward to see that our results can be extended to the case of two services, one whose uncontractible cost reductions are likely to entail strong adverse effects on quality, while the other is likely to generate weak adverse effects. Matching our theory to the data therefore requires us to consider two services - one with *high* and the other with *low* adverse effects on quality in case of uncontractible cost reduction. In such case our model suggests, and this is the main proposition we will test, that prices paid by public authority are likely to be lower in case of horizontal integration than in case of horizontal disintegration. To evaluate the empirical relevance of such a proposition, we draw our attention to the French water sector.

Water sector appears particularly interesting in order to test our proposition because there are two types of water services that a municipality has to provide to consumers: drinking water services and waste water (or sanitation) services.

The provision of the former service involves producing and distributing drinking water to the population, while the latter involves collecting used water and treating it in an adequate way. Moreover, we observe that generally, firms that provide one of these services can provide the other service.

What is crucial is that quality is a more sensible topic of concern for drinking water than for waste water services. Sanitary risks exist in both cases but because of public safety dimensions related to drinking water, the population is more able to observe quality in this service than in waste water service. As a consequence, municipalities may be more concerned with providing adequate incentives to ensure the quality of drinking water provided to the population, in contrast with the quality of treatment for waste water, especially regarding their willingness to comply with citizen's complaints in order to be reelected. Difference between both services may also be highlighted by looking at the number of norms that regulate the quality of drinking water and the quality of waste water. For instance, in Europe, the European Council Directive 98/83/EC (Official Journal OJ L 330 of 05.12.1998) of 3 November 1998 on the quality of water intended for human consumption defines a number of about 53 norms that drinking water is subjected to. In contrast, the European Council Directive 91/271/EEC of 21 May 1991 concerning urban waste water treatment defines only about 5 norms for waste water treatment. This may also suggests that control for quality in drinking water can be costly and more complicated than for waste water. We may therefore think that adverse quality effects may be more limited in waste water services than drinking water services. As such, the industry is close to the theoretical case which we studied in our theoretical part.

The French case is also interesting because of the "*intuitu personae*" principle that regulates PPP contracts. Indeed, while a municipality has to organize a call for tender if she wishes to attribute a contract to an external operator, she is not legally obliged to publish any objective or subjective criteria for selecting the winning tender (Auby [1997]). Hence municipalities have a greater latitude in selecting a private partner, making it easier for them to use the same operator for the provision of various services and to propose a relational contract scheme.

4.2 The Data

In order to test our main proposition, pointing out the fact that drinking water services should be lower when the same operator is being used to provide for both types of water services, 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 1998 and 2001.[16] This sample is representative of 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 choose different organizational choices for water production and distribution, so we restrict our sample 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. We then restrict our database to the public private partnerships observations (1866 observations) excluding local authorities organizing themselves their water services. The unit of observation is a municipality. The following table (table 2) provides definitions of all variables used in the empirical model along with descriptive statistics

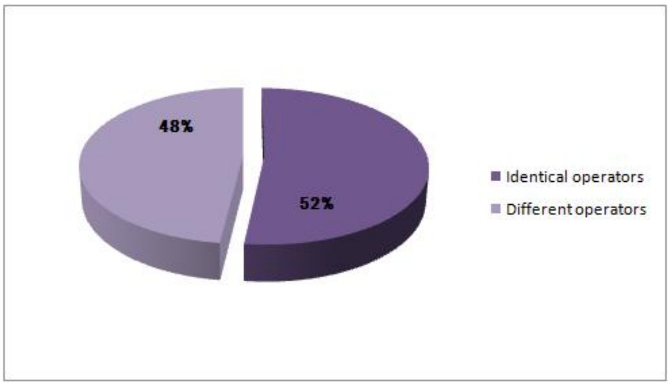
[16] All data comes from the IFEN and SCEES, with the exception of data concerning the type of treatment used for water before it is distributed, which comes from the DGS (Direction Générale de la Santé).

Table 2: Description of our variables

VARIABLES	DESCRIPTION	MEAN	MIN	MAX	N
PRICE 2001	Price in euros, for the production and distribution of water, taking into account fixed fee but not taxes. These are the prices in force in 2001, but contracts may have been signed before 2001	154,02	43,54	378,70	1866
IDENT	Takes value 1 if the local authority chose the same operator to operate distribution and sanitation of water	0,52	0	1	1866
PAST TIME	Number of year since the contract is signed	9,87	0	78	1569
TREATA2	Takes value 1 when raw water needs a desinfection treatment	0,15	0	1	1866
TREATA3	Takes value 1 when raw water needs a heavy desinfection treatment	0,17	0	1	1866
TREATMIXA2	Takes value 1 when raw water needs mix kind of treatment (A1 and A2 because water comes from different sites)	0,06	0	1	1866
TREATMIXA3	Takes value 1 when raw water needs a heavy desinfection treatment (A1 or A2 and A3 because water comes from different sites)	0,05	0	1	1866
UNDERGROUND WATER	Takes value 1 when water origin is underground	0,69	0	1	1866
TOURISTIC AREA	Takes value 1 when the area where water is distributed is a touristic area	0,13	0	1	1866
EXTENSION	Number of Km of network developed to extend the network	0,50	0	51	1866
INVST PROGRAM	Takes value 1 when the contract specifies an investment program	0,62	0	1	1866
REPLACEMENT	Number of Km of network developed to replace the network	0,49	0	23	1866
LEAKRATIO	Volume of lost water / size of the network	0,26	0,00	0,94	1866
INTERAUTHORITY	Takes value 1 if the local authority is organizing the distribution of water in cooperation with other local authorities	0,67	0	1	1866
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	1866
INDEPENDENCE RATIO	Total volume distributed / (total volume distributed + imported volume)	0,89	0,23	1	1866
INHABITANTS	Number of inhabitants concerned by the contract / 10 000	0,73	0,0031	22,54	1866
INHABITANTS2	Square (Number of inhabitants concerned by the contract) / 1000 000	253,00	961,00	50800	1866
DENSITY	Number of Km of network / Number of Inhabitants	22,52	0,31	1 438	1866

What we are interested in is the impact for local authorities from choosing the same operator in order to operate both distribution and sanitation of water. Before looking at descriptive statistics on this issue, let us first have a look at the data, to see whether contracts for both types of services are concentrated in the hands of the same operator in the French water sector. The following figure (figure 2) shows that 52% of the municipalities in our sample uses the same operator for the provision of drinking water services and sanitation services. As a crude approximation, and assuming that there are only 3 operators available and that choices are randomly distributed, we should only observe that about 33% of municipalities use the same operator for both contracts.[17]

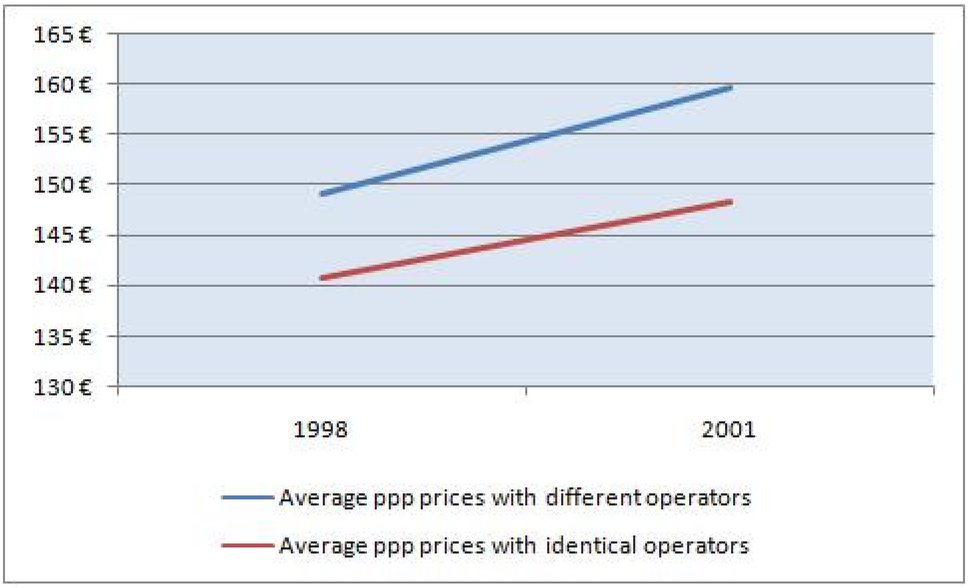
Figure 2: Share of French municipalities using the same operator for the provision of drinking water services and sanitation services.



A first look at the data permits us to suspect that this choice is not neutral and randomly chosen. As showed in the following graph (figure 3), at first glance, this choice impacts on both the price level and their evolution through time.

[17] Each of the three major player has a probability of 0.33 to be chosen for a service, hence the probability that the same operator is chosen for both services is $0.33 \times 0.33 \times 3 \approx 0.33$.

Figure 3: Average prices per 120m^3 of drinking water in 1998 and 2001 for PPPs, according to whether a same operator is used or not.



4.3 Empirical methodology

To go a step further, we must take into account the fact that each local authority is unique. Each water service is characterized by a specific environment that may also impact on prices and their evolution (e.g. characteristics of the networks, size of the population, ...).

We begin by estimating a least squares regression of price on a set of exogenous factors that may impact on the production costs of the service and then on the price of distributed water:

$$p = D\delta + X\beta + T\eta + u \qquad \text{with } u \rightsquigarrow (0, \Sigma)$$

where p is price, D contains indicators of the relational level for each contract, X is a set of exogenous factors characterizing each service, T is a set of exogenous controls, and u is the (heteroskedastic) stochastic error. We are interested in the coefficients, δ, which measure the average shift in price across different relationship types ranging from relational to non-relational contracts.

An econometric problem arises, however, from the fact that a local public authority's choice of relationship 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 relationship choice and performance. In this case, $\mathbb{E}[Du|X] \neq 0$. Least Squares estimates of the specification above will be biased and inconsistent.

While a full structural model of the determination of relationship choice is beyond the scope of this paper, we separately estimate a probit model of the decision to choose the same operator to operate both services as a function of X and T, and Z a set of variables that should affect relationship choices but not prices. We find that indeed there is non-random sorting of local public authorities across relationship choices.

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

$$\begin{array}{rcl} p & = & D\delta + X\beta + T\eta + u \\ D^* & = & X\alpha + T\lambda + Z\gamma + v \\ D & = & \left\{ \begin{array}{ll} 1 & \text{if} \quad X\alpha + T\lambda + Z\gamma \geq v \\ 0 & \text{if} \quad X\alpha + T\lambda + Z\gamma < v \end{array} \right. \end{array}$$

Here D is an indicator that takes the value one when local authorities choose the same operator for both distribution and sanitation of water and zero elsewhere. The D equation is normalized by the standard deviation of v, and we assume that $(p \;\, D)$ is distributed bivariate normal with mean zero and variance-covariance:

$$\Gamma = \left[\begin{array}{cc} \sigma_u^2 & \sigma_{uv} \\ \sigma_{uv} & 1 \end{array} \right]$$

This procedure accounts for endogeneity in the choice, D, and yields unbiased estimates of δ, the unconditional mean premium or discount paid by consumers in a municipality that has chosen only one operator for both services.[18]

We will now discuss our variables. A first set of control that we used in our estimations concerns the characteristics of providing drinking water services, X. In this set for variables, we attempt to account for factors that may have an impact on prices for drinking water. Such characteristics include the complexity of the technology needed to treat raw water (the variables TreatA2, TreatA3, TreatMixA12 and TreatMixA3), the source of raw water (the variable Underground Water), the abundance of raw water in a municipality (the variables Independence Ratio and Limitation of Water Volume), and the characteristics of the water distribution network (the variables Density, Leak Ratio, Replacement and Extension). In this set of variables, we have also included some characteristics of the contractual relation such as the elapsed time since the beginning of the contract (the variable Past Time) and whether an investment program is specified in the contract (Invst Program). We also attempt to account for the fact that a municipality may organize the provision of drinking water services by associating itself with other municipalities nearby (the variable Interauthority).

In addition with these controls, we include several variables that attempt to capture the characteristics of a municipality which may have consequences on prices for drinking water. These variables include the level of population in a

[18]Applying conditional normal theory and change of variables yields the individual contribution to the likelihood:

$$\begin{aligned} f(p_1, D_i) &= \frac{1}{\sqrt{\sigma_u^2}}\phi\left(\frac{u_i}{\sqrt{\sigma_u^2}}\right)\left[1-\Phi\left(\frac{(-x_i\beta - z_i\gamma - v_i)/\sqrt{\sigma_u^2}}{\sqrt{1-\rho^2}}\right)\right]^{D_i} \\ &\quad \left[\Phi\left(\frac{(-x_i\beta - z_i\gamma - v_i)/\sqrt{\sigma_u^2}}{\sqrt{1-\rho^2}}\right)\right]^{1-D_i} \end{aligned}$$

In our switching regressions model, the β are not separately identifiable because the X enter both the p and D equations, however our initial Least Squares estimation is sufficient for predictive purposes, and allows us to interpret the estimated β.

municipality (and its square), and whether the municipality is a tourist area.

Finally, in our switching regression model, we use a set of dummies for French "Régions" in our Z variables. A "Région" is the most important political entity in which a local public authority is situated.

A more complete discussion on the rationale of using these variables as control for water prices can be found in Chong et al. [2006].

We are interested in whether, after controlling for the influences of these variables, the fact of using the same operator for drinking water services and sanitation services does indeed lead to lower water prices.

4.4 Estimation results

We will now discuss the results of our estimations. The results from our OLS regressions are presented in table 3, and those from our switching regressions are presented in table 4. We run these regressions both for prices in 2001, and for the first difference of prices for drinking water between 1998 and 2001.

Table 3: Results of our OLS regressions

	Price in 2001				Price increase between 1998 & 2001			
	model1 OLS	model2 OLS	model3 OLS	model4 OLS	model5 OLS	model6 OLS	model7 OLS	model8 OLS
Ident		-4.588*	-4.206*	-3.670+		-2.674*	-3.280**	-2.223*
		(1.909)	(2.054)	(2.051)		(1.064)	(1.164)	(1.113)
TreatA2	13.933***	14.071***	11.279***	8.871**	0.521	0.601	1.357	-0.591
	(2.999)	(2.994)	(3.228)	(3.081)	(1.711)	(1.704)	(1.940)	(1.938)
TreatA3	5.612+	5.542+	8.530**	6.165+	-1.371	-1.411	-1.870	-3.260
	(2.895)	(2.892)	(3.114)	(3.295)	(1.786)	(1.778)	(1.905)	(1.989)
TreatMix	-0.884	-0.890	8.430	3.458	-4.656+	-4.659+	-4.790	-4.471
A12	(4.759)	(4.752)	(5.144)	(4.720)	(2.520)	(2.510)	(3.015)	(3.139)
TreatMix	3.051	2.588	6.113	1.614	2.489	2.219	2.389	0.450
A3	(5.167)	(5.186)	(5.261)	(5.225)	(3.226)	(3.224)	(3.267)	(3.295)
Underground	-18.487***	-18.479***	-21.216***	-14.318***	0.285	0.290	-0.508	0.033
Water	(2.674)	(2.666)	(2.863)	(2.964)	(1.814)	(1.811)	(1.967)	(1.952)
Independence	-14.234**	-13.705**	-9.134+	-2.224	1.865	2.174	0.385	-1.453
Ratio	(4.395)	(4.400)	(4.701)	(4.484)	(2.279)	(2.289)	(2.476)	(2.532)
Tourist	-0.663	-1.224	-2.476	0.492	1.231	0.904	1.449	0.275
Area	(3.026)	(3.017)	(3.263)	(3.198)	(1.640)	(1.643)	(1.790)	(1.765)
Invst	0.388	0.630	-0.493	-2.938	0.902	1.043	1.652	1.624
Program	(1.916)	(1.912)	(2.047)	(2.063)	(1.572)	(1.572)	(1.699)	(1.640)
Extension	-0.341	-0.288	-0.035	0.081	1.167	1.198	1.058	0.899
	(0.579)	(0.560)	(0.543)	(0.505)	(0.831)	(0.849)	(0.805)	(0.749)
Replacement	1.540	1.552	-0.209	-0.442	2.080	2.087	3.074	3.185
	(1.060)	(1.063)	(0.912)	(0.905)	(2.463)	(2.468)	(3.025)	(2.801)
Leak	-1.517	-1.373	9.232	26.576**	12.308**	12.392**	15.878**	9.216+
Ratio	(7.874)	(7.878)	(8.943)	(9.071)	(4.733)	(4.719)	(5.321)	(5.476)
Interauthority	19.543***	18.745***	19.328***	18.782***	-6.315***	-6.780***	-8.304***	-5.459***
	(2.238)	(2.210)	(2.395)	(2.354)	(1.312)	(1.316)	(1.483)	(1.445)
Limit.	14.769*	14.748*	-1.811	-16.883+	1.227	1.215	7.173	-6.135
Water Vol.	(6.063)	(6.115)	(5.944)	(9.866)	(5.388)	(5.396)	(5.158)	(4.670)
Density	0.160+	0.155+	0.150+	0.140+	0.007	0.004	0.002	0.013
	(0.088)	(0.086)	(0.081)	(0.074)	(0.010)	(0.009)	(0.009)	(0.014)
Inhabitants2	0.004***	0.004***	0.006***	0.005***	0.001*	0.001*	0.001*	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Inhabitants	-8.801***	-8.665***	-11.554***	-9.646***	-2.413*	-2.334*	-2.890*	-2.978*
	(1.399)	(1.367)	(1.395)	(1.334)	(1.188)	(1.186)	(1.370)	(1.279)
Past			0.362***	0.361***			-0.074	-0.031
Time			(0.101)	(0.101)			(0.053)	(0.054)
Département Dummies				Yes***				Yes***
Intercept	164.427***	167.204***	162.369***	137.355***	6.666*	8.284*	10.505**	32.209**
	(6.083)	(6.213)	(6.677)	(13.539)	(3.251)	(3.278)	(3.601)	(11.744)
R2	0,2	0,21	0,25	0,33	0.050	0.053	0.079	0.149
N	1866	1866	1569	1569	1866	1866	1569	1569

*Note: Robust standard errors are presented in parentheses. Fixed effects jointly significant where included. *** denotes significance at 0.1% level, **denotes significance at 1 % level, * denotes significance at 5% level, + denotes significance at 10% level.*

The estimations of our control variables are on the overall consistent across our various OLS regressions on prices in 2001, and across our OLS regressions on the first difference in prices between 1998 and 2001.

Notice also that the impact of choosing the same operator for both water services results are in line with our proposition (Model 1 to Model 4). Even when we include variables taking into account specificities of each local authority water service, results suggest that there still exist a significant impact of variable IDENT on observed prices. This impact is negative, suggesting that using the same private operator for operating both distribution and sanitation of water reduces prices paid by consumers.

Results also suggest that prices increase through time after contracts are signed. This may be the result of repeated contract renegotiations. Indeed, another interesting variable in these regressions is the time elapsed since the contract for drinking water services is signed. This variable is positive in our regressions. This means that prices tend on the average to be higher when a contract has been signed a long time ago. This may be due to the fact that for contracts that are signed long ago, there is relatively more frequent renegotiation to modify prices, and resulting in higher prices. Therefore this result may show that renegotiations do actually occur.

The price increase estimates are also suggesting an impact of choosing the same operator to operate the both service (model 5 to model 8).

Table 4: Results of our switching regressions

	Ident	Price 2001	Price Increase between 98 & 01
	model9 Probit	model10 OLS	model11 OLS
IDENT		-4.873*	-3.475*
		(2.165)	(1.475)
TreatA2	0.087	9.679***	0.775
	(0.114)	(2.789)	(1.859)
TreatA3	0.235+	4.644	-2.777
	(0.137)	(3.328)	(2.218)
TreatMix	0.087	-5.150	-4.110
A12	(0.172)	(4.319)	(2.878)
TreatMix	-0.275	-0.408	1.090
A3	(0.180)	(4.455)	(2.970)
Independence	0.180	-8.148+	2.014
Ratio	(0.175)	(4.234)	(2.822)
Underground	-0.045	-7.306*	1.602
Water	(0.121)	(2.959)	(1.972)
Tourist	-0.308**	-2.807	-1.157
Area	(0.118)	(2.714)	(1.809)
Invst	0.177*	0.679	0.946
Program	(0.074)	(1.802)	(1.201)
Extension	0.032	-0.452	1.093**
	(0.027)	(0.519)	(0.604)
Replacement	0.011	1.652+	2.040***
	(0.042)	(0.853)	(0.568)
Leak	0.070	12.694+	8.629+
Ratio	(0.297)	(6.911)	(4.606)
Interauthority	-0.456***	18.432***	-5.283***
	(0.085)	(2.055)	(1.371)
Limit.	0.245	-4.539	-6.630+
Water Vol.	(0.235)	(5.762)	(3.841)
Density	-0.006*	0.110***	0.011
	(0.003)	(0.020)	(0.013)
Inhabitants2	-0.000+	0.004***	0.001*
	(0.000)	(0.001)	(0.001)
Inhabitants	0.103+	-8.614***	-2.505**
	(0.060)	(1.244)	(0.829)
Departement Dummies		Yes***	Yes***
Regional Dummies	Yes***		
Intercept	-0.017	151.629***	3.495***
	(0.602)	(24.211)	(0.017)
Rho		0.135*	0.004
		(0.061)	(0.064)
R2			0.053
N	1813	1813	1813

*Note: Standard errors are presented in parentheses. Fixed effects jointly significant where included. *** denotes significance at 0.1% level, **denotes significance at 1 % level, * denotes significance at 5% level, + denotes significance at 10% level.*

We could see from the results of these switching regressions that the negative effects of using a same operator on water prices in 2001 and the first difference between prices in 1998 and 2001 remains significant, even after accounting for the possible endogeneity in such a choice. These results also show that one should account for such a dimension in OLS regressions on water prices in 2001, since the inter-equation correlation ρ is significant. This points out that factors influencing the decision to use a unique operator for both services that are unobserved to the econometrician also influence the observed water prices in level. However, the impact on prices is low, and this correlation is not significant when the explained variable is the first difference of water prices. In this latter case, OLS estimates can be considered to be consistent.

In conclusion, these estimations show that when a same operator is used to provide for drinking water services and waste water services, prices for drinking water services are significantly lower for consumers, and the price increase between 1998 and 2001 is also lower. This empirical result is consistent with the predictions of our theoretical model.

4.5 Alternative explanation

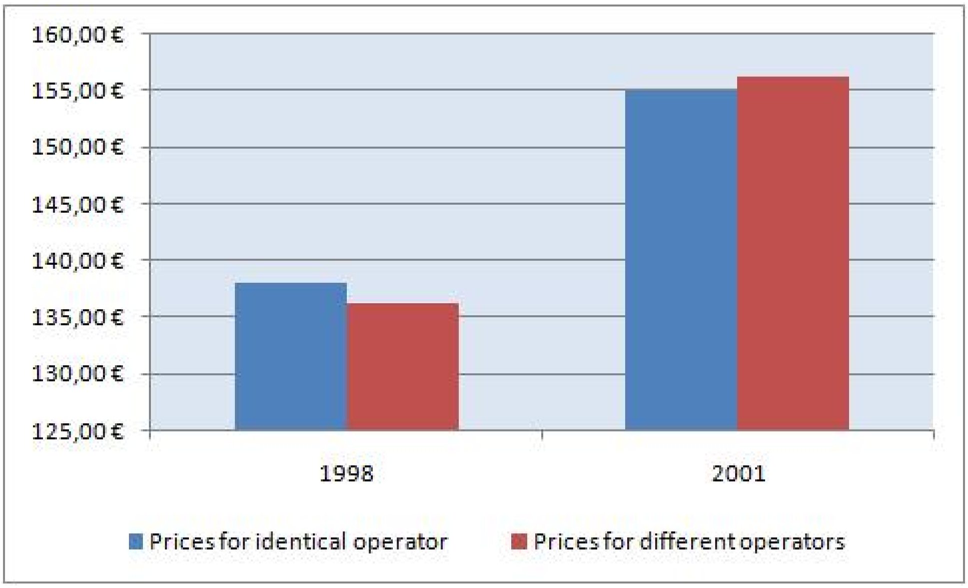
Before concluding, we would like to consider alternative stories that might fit with our empirical findings.

One may rightfully wonder whether the lower price for water observed in figure 3 when an identical operator is in charge of the provision of both services might stem from reasons pertaining to economies of scale and/or of scope. Indeed, if there are economies of scale and/or scope between water production and waste water services, an operator in charge of both services may exploit the synergies between the two activities. Hence, he may charge a lower price when a public authority designate him to be in charge of both services.

Nevertheless, there seem to be little synergy between both types of activity. A report submitted to the UK water regulator, the OFWAT, shows some empirical evidence on this issue for the English and Welsh water industry (Stone and Webster Consultants [2004]). Using data from the English and Welsh water sector between 1992-93 and 2002-03, the report found no evidence of economies of scale nor economies of scope between drinking water services and sewage services. Using data from water utilities in Wiscousin, Garcia et al. [2007] found no evidence for economies of vertical integration even between production and distribution of drinking water. However, this latter study does not attempt to assess scale or scope economies for drinking water services and waste water services.

Another indication of potential scale and scope economies might be found in the value of the contract according to the private operator, depending on the fact that he bids on one service or on both of them. If such economies exist, this should reflect in lower (initial) prices for contracts when the private operator already manages sewage. We do not observe lower bid when only one operator manage both services. The initial prices per 120 m^3 of water for contracts signed in 1998 and 2001 is shown in figure 4.

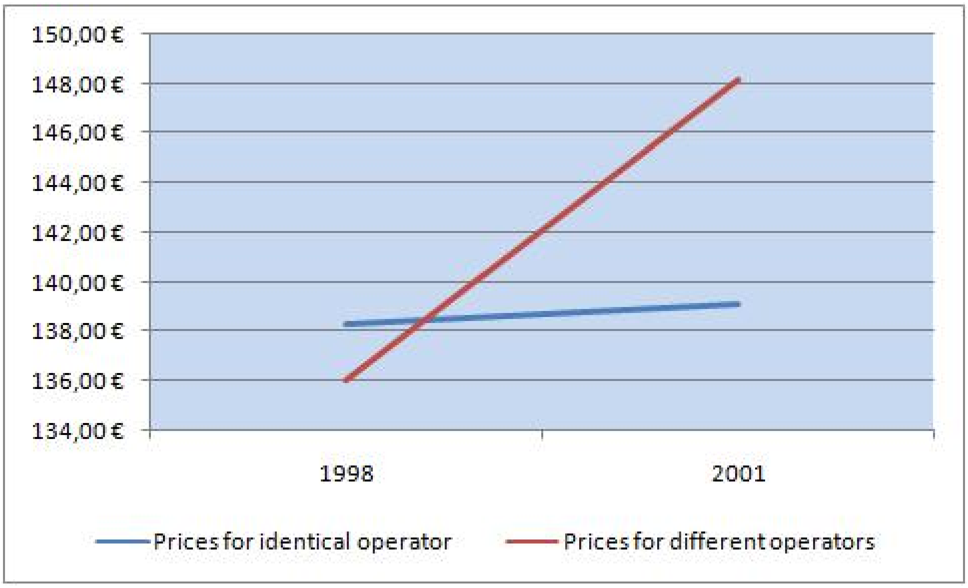
Figure 4: Average initial prices per $120m^3$ of drinking water for contracts signed in 1998 and 2001, according to whether both services are granted to an identical operator or not.



As one may see from figure 4, average initial prices do not seem to be that different when contracts for sewage services and drinking water services are granted to an identical operator or not.

What is even more interesting is to look at price evolution of contracts signed in 1998 depending on the fact that both services are managed by the same operator or not. The following graph (based on 32 contracts signed in 1998) suggests clearly that when the same operator manages both services, prices might be more stable through time.

Figure 5: Evolution of average prices per $120m^3$ of drinking water for contracts signed in 1998, according to whether both services are granted to an identical operator or not (N=32).



This is consistent with our model and might be explained by the fact that such contracts are more protected against renegotiation initiated by the operator once the contract is signed.[19]

In order to ensure that relational contracts are the main reason why water prices may be lower when both services are run by a same operator, and not because of reasons pertaining to scale and scope economies, we have also chosen to run our OLS regressions using the first difference in observed water prices between 2001 and 1998 as our explained variable. Indeed, one may expect that possible scale and scope economies remain constant over time. Hence, benefits from any possible scale and scope economies that may arise in the event of

[19] Guasch [2004] found that water contracts are more exposed to renegotiation compared to other industries. More than 75% of water contracts in his database are renegotiated less than two years after contract signature. We are not able to check in our database if prices increases are coming from renegotiations. Nevertheless, because public authorities decide unilaterally of contractual provisions, this could not be explained by ex ante operators' strategies in negotiating contractual terms depending on the fact they or they do not manage both services.

horizontal integration on observed prices should not be reflected in the first difference of water prices between 2001 and 1998.

Given these observations, we feel confident in the fact that the observed lower water prices when a unique operator is charged of both services are not due to economies of scale and/or scope.

5 Conclusion

In this article, we seek to understand why local public authorities tend to concentrate the provision of various services in the hands of a single operator, which seems to be disconnected with the current trend to promote competition in the organization of public services. We suggest that such horizontal concentration may be desirable because it enhances the efficiency of relational contracts between local public authorities and private operators. To show this, we proposed a model based on the incomplete contract literature. We then show that under some conditions, horizontal integration leads to better performance at lower cost for the public authority. We suggest taht this is explained by the fact that relational contracts are more easily sustained in the latter case, as deviations from the relational contracts can be more severely punished.
We then look at the empirical relevance of our findings using data from the French water sector. In particular, our regressions show that drinking water prices are significantly lower when a same operator is in charge of providing waste water services, *ceteris paribus*. This empirical result is robust to several specifications and consistent with our story on relational contracts.

On the whole, our study suggests that informal dealings, and relational contracts are important dimensions in contracting choices, especially in PPPs, in a world where it is impossible for contracting parties to anticipate contingencies that may arise throughout a contract's lifetime. Hence, these aspects should be accounted for when one ponders on the use of PPPs for the provision of public services.

Appendix A

Once the manager has reneged on his informal commitment, he is chosen at subsequent periods with a probability $p \in [0;1]$. This implies that at each period, his expected gain is pU_s^{NB} where s denotes the service $\mathscr{B}$ in case of horizontal disintegration, and denotes the services $\mathscr{A}$ and $\mathscr{B}$ in case of horizontal integration.

Let us note that such a probability is applied at each contract renewal, whether he has been chosen at previous period or not.

$U_{t,s}^{M,E}$ represents the expected payoff stream of the manager at period t, once he has cheated in period $(t-1)$. We may define $U_{t,s}^{M,E}$ as:

$$U_{t,s}^{M,E} = p[U_{t,s}^{M,NB} + \delta U_{t+1,s}^{M,E}] + (1-p)[0 + \delta U_{t+1,s}^{M,E}]$$

It then comes:

$$\begin{aligned}
U_{t,s}^{M,E} &= pU_{t,s}^{M,NB} + \delta p U_{t+1,s}^{M,E} + (1-p)\delta U_{t+1,s}^{M,E} \\
U_{t,s}^{M,E} &= pU_{t,s}^{M,NB} + \delta p U_{t+1,s}^{M,E} \\
U_{t,s}^{M,E} &= pU_{t,s}^{M,NB} + \delta p[U_{t+1,s}^{M,NB} + \delta U_{t+2,s}^{M,E}] \\
U_{t,s}^{M,E} &= pU_{t,s}^{M,NB} + \delta p[U_{t+1,s}^{M,NB} + \delta U_{t+2,s}^{M,E}] \\
U_{t,s}^{M,E} &= pU_{t,s}^{M,NB} + \delta p U_{t+1,s}^{M,NB} + \delta^2[U_{t+2,s}^{M,E} + \delta^2 U_{t+3,s}^{M,E}] \\
U_{t,s}^{M,E} &= pU_{t,s}^{M,NB} + \delta p U_{t+1,s}^{M,NB} + \delta^2 U_{t+2,s}^{M,NB} + \delta^3 U_{t+3,s}^{M,E}
\end{aligned}$$

By recurrence, we deduce that:

$$U_{t,s}^{M,E} = \sum_{i=0}^{i=\infty} [\delta^i p U_{t+i,s}^{M,NB}]$$

At each period i $U_{t+i,s}^{M,NB} = U_s^{M,NB}$, then

$$U_{t,s}^{M,E} = \sum_{i=0}^{i=\infty} [\delta^i p U_s^{M,NB}]$$

$$U_{t,s}^{M,E} = \frac{pU_s^{M,NB}}{1-\delta}$$

Therefore, if the manager cheats in period $t-1$, his expected gain is $U_s^{M,NB}$ in this period as he chooses the levels of investments that maximizes his own present payoff, instead of first best level. For the next periods, he expects a discounted gain $U_{t,s}^{M,E}$. This can be write as follows:

$$\begin{aligned} U_s^{M,E} &= [U_s^{M,NB}] + \delta U_{t,s}^{M,E} \\ &= U_s^{M,NB} + \frac{\delta p U_s^{M,NB}}{1-\delta} \end{aligned}$$

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