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Does Intermunicipal Cooperation Affect Prices? An Economic Analysis of the French Drinking Water Sector

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Abstract

The provision of drinking water has become a central concern for public authorities due to climate change, prompting policymakers to reevaluate their approach to this semi-renewable resource. In this paper, we assess the effect of inter-municipal cooperation on performance. Using a comprehensive panel dataset comprising all French drinking water providers from 2008 to 2021, we show that organizational forms chosen by municipalities have an effect on prices of drinking water paid by consumers. More precisely, our empirical findings reveal a selection bias in the estimation of price equations and we show that consumer prices are significantly higher on average when municipalities decide to cooperate. Inter-municipal cooperation does not necessarily lead to better performance in the provision of drinking water.

JEL Classification: H11; H77; L11; L95

Keywords: Intermunicipal cooperation, local government, public services, drinking water prices, selection bias

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1 Introduction

Recent decades have been characterized by a growing interest from central governments in enhancing the performance of public services. More specifically, an increasing number of reforms are being embraced with the aim of achieving economies of scale in the provision of certain services such as waste management, drinking water, and gas. A substantial portion of the literature has demonstrated that municipalities can expand their scope of action through intermunicipal cooperation (IMC) (Hulst and Van Montfort, 2007). As a result, IMC has swiftly emerged as an acknowledged means by policymakers to generate economies of scale, enhance the quality of these services and internalize externalities (Dixit, 1973; Ladd, 1992; Garcia, 2003).

The optimal size of organizations providing public services has been a central focus in the literature on local governance (Bel and Mur, 2009; Ferraresi et al., 2018; Aldag et al., 2020). Sharing skills within interorganizational structures is expected to improve performance and reduce production costs, while better maintaining production control.

IMC can be sub-optimal as it requires municipalities to negotiate within the intermunicipal structure. These negotiations are costly and generate transaction costs that can negatively impact performance (Feiock, 2007; Rodrigues et al., 2012). Consequently, IMC may lead to economies of scale, but this outcome is not assured as reductions in production costs may be counterbalanced by the emergence of new transaction costs.

What is the effect of IMC on the performance of the drinking water sector? Does IMC leads to a drop in prices paid by consumers? In this paper, we assess the effect of this organizational choice on performance by using an unbalanced panel dataset of French drinking water services from 2008 to 2021.

The municipalities' decision to cooperate is clearly endogenous. To address this issue, we employ the two-step econometric method proposed by Heckman (1976, 1979). More precisely, we use a switching regressions model and we allow for endogeneity on the decision to cooperate. The results show that prices paid within the framework of intermunicipal management exceed those under municipal management.

Our work aligns with both the analysis of public service performance and the efficiency of contractual choices on prices paid by consumers. We believe that our paper contributes to the literature on the local governance of public services and natural resource management.

This paper is organized as follows. Section 2 provides a literature review of the effect of IMC and the performance of the French drinking water sector. Following this literature review, we present our research hypotheses. This is followed by a presentation of the governance of the French drinking water sector in section 3. Section 4 provides a description of our data and variables used in the study. Then, we present our empirical strategy and results regarding the impact of IMC on performance in section 5. Finally, we discuss our results in section 6 and we conclude in section 7.

2 Related literature

The link between the efficiency of public services and their organizational arrangements has been widely studied in the literature. In their seminal papers, Bish and Ostrom (1973) argue that the effectiveness of public goods provision is associated with service sharing. Their analysis highlighted the critical role of incentives, mutual trust, control mechanisms, and clarity of objectives in promoting effective cooperation in public service management.

Parks and Oakerson (1993) showed that IMC reduces production costs without losing local identity by analyzing public utilies managed by intermunicipal structures in St. Louis, Missouri and Pittsburgh, Pennsylvania. Ultimately, IMC represents an efficient organizational arrangement for correcting negative externalities and achieving economies of scale.

These conclusions have been partially challenged by the transaction cost theory, which come into conflict with the Public Choice school by making a clear distinction between production costs and organizational ones. Williamson (1968, 1976) argue that larger organizations can more effectively absorb the fixed costs associated with transaction execution, resulting in overall cost reduction.

Within the context of IMC, the consolidation of services among multiple municipalities can lead to economies of scale by reducing fixed costs through resource and infrastructure sharing.

IMC can yield more varied outcomes regarding organizational costs, which may increase following the cooperation process, stemming from new negotiations among the partners of the intermunicipal structure (Williamson, 1996). Lowery (2000) and Feiock (2007) highlighted that joining an intermunicipal structure was costly because of the coordination and negotiation among the members of such a collaborative relationship. Alongside these new transaction costs, Rodrigues et al. (2012) defined "political transaction costs" as a consequence of the collaboration of various political parties in an intermunicipal organization, which incurred expenses due to ideological divergences. Moreover, elements such as surveillance and oversight play a central role.

There is no consensus regarding the impact of IMC on costs and performance. More precisely, Bel and Warner (2015) reported that findings on IMC and prices yield diverse outcomes, depending on the country and the area studied. Bel and Costas (2006) found that privatization had no significant effects on costs, while IMC was associated with lower costs in Spain. Clear evidence of cost reductions was also found by Dijkgraaf and Gradus (2013) in Netherlands, Soukopová et al. (2018) in Czechia and Aldag et al. (2020) in the United States.

Alongside these empirical findings in the solid waste sector, Sørensen (2007) and Garrone et al. (2013) identified an increase in costs after local governments decided to join forces through IMC in Norway and Italy. In France, Garcia and Thomas (2001) showed that water providers benefit from significant economies of scale when merging, while Frère et al. (2014) found that IMC had no significant impact on the level of municipal public spending, as pointed by Tricaud (2021). By conducting a difference-in-differences empirical strategy, she showed that performance may be reduced because organizational costs offset reductions in production costs after an IMC.

In the French drinking water sector, previous authors pointed that prices can be influenced by the management mode chosen by water services (Ménard and Saussier, 2003; Carpentier et al., 2006; Le Lannier and Porcher, 2014). Finally, by conducting a difference-in-differences empirical strategy, Tricaud (2021) shows that performance may be reduced because organizational costs offset reductions in production costs after an IMC.

Although the literature presents conflicting perspectives on the effect of IMC on costs, a consensus seems to emerge across scholars. Indeed, recent studies have emphasized that size is a crucial factor in analyzing the impact of IMC on performance (Gori et al., 2023; Blåka et al., 2021). These empirical findings align with the results identified by Garcia (2003), who pinpointed an effective size of IMC beyond which achieving economies of scale becomes impractical.

3 Governance of the French drinking water sector

The French drinking water market is a local natural monopoly with high fixed costs (80 to 95%). Historically, municipalities have been responsible for providing this resource to the population. However, this responsibility has evolved over years, making the governance of drinking water a significant issue for policymakers at local and global levels.

The law of March 22, 1890 introduced IMC as an organizational form to municipalities, to pool their resources and expertise in managing drinking water. The primary objective of this shared competence is to reduce production costs and achieve economies of scale.

Central governments have encouraged municipalities to merge into these intermunicipal structures by enacting three major laws in 1992, 1999 and 2015 (see Pezon (2009) for a detailed historical overview). Despite these incentives, IMC remains a relatively unpopular organizational mode. As illustrated in Figure 1, only 25% of drinking water providers in France were communities in 2021. Guelmamen et al. (2024) show that IMC in France is predominantly adopted by providers seeking improved economic performance.

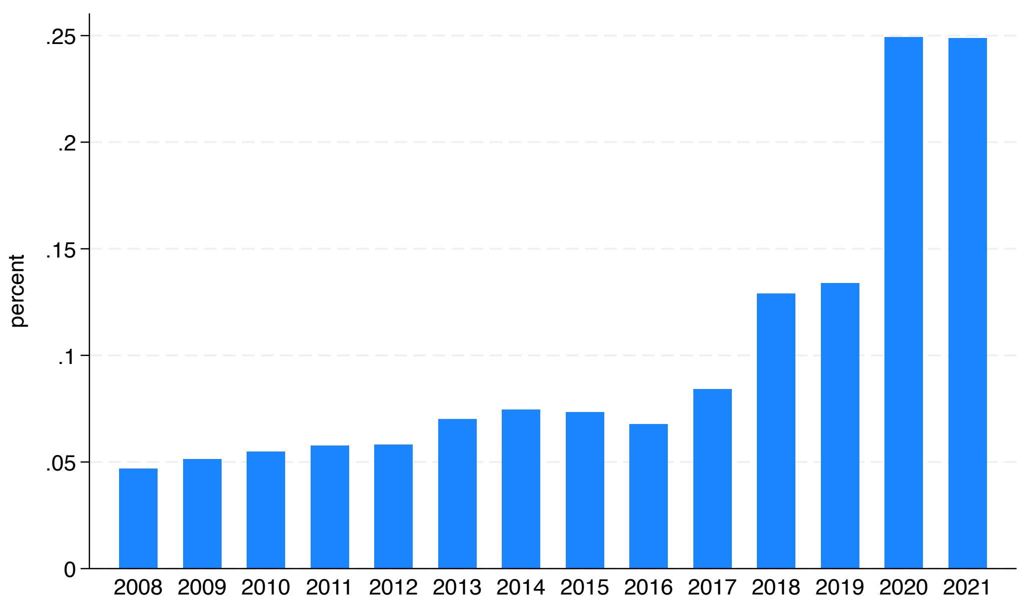
French municipalities are predominantly opposed to IMC due to concerns about operational costs. Indeed, a loss of local public services may occur following IMC, especially in rural municipalities. However, other costs can be reduced, and tax revenues can increase (Tricaud, 2021).

The pricing of drinking water in France operates based on two principles: the "water pays for water" principle and the prohibition of cross-subsidies. The first principle, established in 1992, mandates a strict separation of accounts between the water budget and the general budget. This ensures that revenues from water bills are exclusively used to cover costs associated with the production, distribution, and treatment of drinking water, preventing their diversion for other purposes.

The prohibition of cross-subsidies is designed to maintain fair competition in the water market. It prevents municipalities from financing one service using revenues generated by another, thereby avoiding any distortion of competition. This prohibition ensures that prices paid by consumers reflect costs of managing the provision of drinking water (Mayol and Saussier, 2023).

Within the framework of these principles, local authorities are bound by the principle of equality before public service, which holds constitutional value in France. This principle guarantees that all citizens have equal access to public services and contribute equally to their funding. Thus, the determination of drinking water prices is a collaborative process and prices paid by consumers must be uniform for all members of a community.

Figure 1: Share of communities responsible for drinking water provision in France



4 Data and sample

4.1 Data description

We use a dataset provided by the French Biodiversity Office, which directly reports to the French Ministry of Ecological Transition. This dataset covers French drinking water services from 2008 to 2021[1].

The data are collected annually and involve 23,376 drinking water providers. In France, it is mandatory for all drinking water providers to disclose financial and organizational information, particularly regarding water quality and network conditions. The dataset includes information on drinking water prices, water quality, network quality, population, and volumes (water abstracted, imported, exported, produced, and non-domestic). However, some services may not report complete information, resulting in occasional missing data.

There is no information available on production factor expenses or local government investments in the drinking water network. Therefore, constructing a structural model of drinking water prices is beyond the scope of this study. The unit of observation is a French drinking water provider (municipality or community) between 2008 and 2021. Using such an observation unit makes it difficult to gather additional information.

The panel is unbalanced because a municipality joining a community disappears from the dataset the following year. Furthermore, sanitation providers are distinct from drinking water ones. Municipalities or communities responsible for drinking water provision may differ from those responsible for sanitation. Additionally, cross-subsidies are prohibited in France, so variables related to sanitation are not included in our study due to their unavailability.

From this dataset, we compiled a panel dataset covering French drinking water services from 2008 to 2021. Table 1 summarizes the variables used in this study.

[1] Data are publicly accessible at this link: https://www.services.eaufrance.fr/pro/telechargement

Table 1: Summary of variables

Variables	**Description**
Price_{it} (constant 2015 euros)	Prices paid by consumers for 120 cubic metres of drinking water in year t
Community_{it}	Dummy variable that takes a value of 1 if a community is responsible for water provision and 0 if the provision is under a municipal management
Public_{it}	Dummy variable that takes a value of 1 if water provision is under public management and 0 otherwise
Return_{it} (%)	Ratio between the volume of domestic water and exported water, and the sum of produced water and imported water
Nondomestic share_{it}	Share of total water consumption by nondomestic users of provider i in year t: $\frac{\text{Nondomestic Volume}}{\text{Consumed Volume}}$
Microbiological Conformity_{it} (%)	Compliance rate of water regarding microbiological parameters
Physicochemical Conformity_{it} (%)	Compliance rate of water regarding physico-chemical parameters such as pesticides, nitrates, chromium, and bromate
Population_{it}	Number of inhabitants served by water provider i in year t
Water Factories_{it}	Number of stations needed to distribute water in year t
Revenues_{it} (Euros)	Annual revenue generated by provider i in year t.

4.2 Dependent variables

In the first stage of our empirical strategy, we estimate a probit model of IMC. To achieve this, we built a $\textit{Community}_{it}$ dummy variable, to indicate whether drinking water service is managed by a community or a municipality. When the provider is a community, the variable equals 1. If the service is managed by a standalone municipality, it equals 0.

The performance of the French drinking water sector can be gauged through the annual price paid by consumers for 120 cubic metres of water because this variable is indicative of the costs borne by the entity responsible for providing drinking water. We adjusted the variable for inflation, and it is expressed in constant 2015 euros.

Prices are set by the municipality or the community responsible for water provision and depend on multiple factors, such as the quality of the network and geographical constraints. The French legislation requires prices to perfectly represent costs incurred by the local authority following the “water pays water” principle.

The responsible government (municipality or community) has the ability to delegate water provision to a private company. In this case, public authorities face information asymmetry framework, and the private company may engage in opportunistic behaviours.

To limit this, the French legislation implemented rules so that delegation contracts specify a price structure and private companies are allowed to renegotiate it only under exceptional conditions. As in the public case, prices are set to perfectly represent the costs incurred by the needed investments when the provision is managed by a private company.

Figure 2 shows the evolution of prices paid by consumers between 2008 and 2021. The blue line represents the price under municipal management and the red line represents the prices under a community management. All prices are expressed in constant 2015 euros. The gap between IMC and municipal management remained almost the same after 2011.

Figure 2: Price evolution under IMC and municipal management

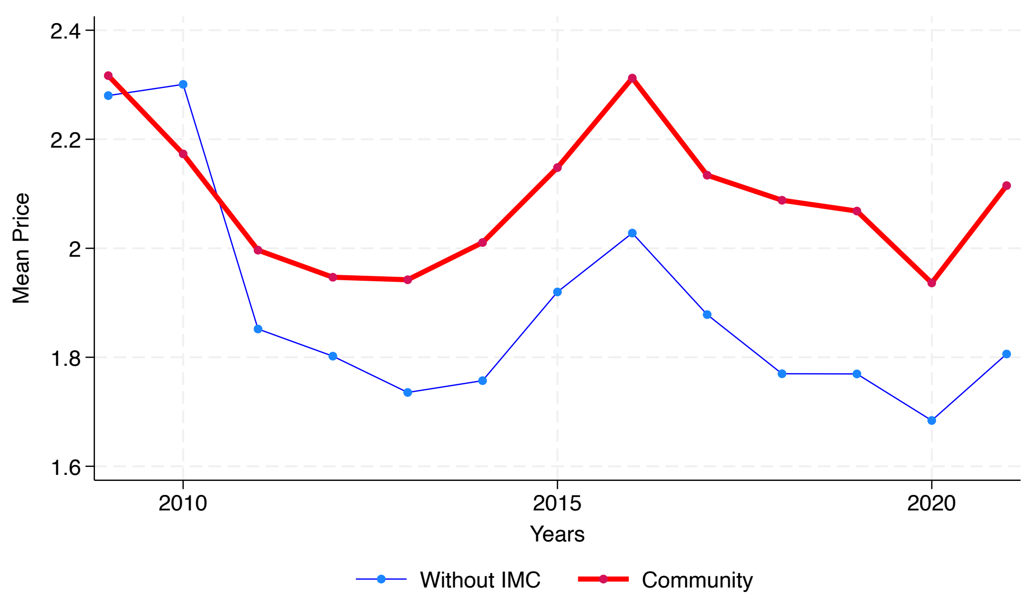


Table 2 shows more detailed information on the price paid by consumers. Standalone municipalities appear to exhibit better performance, as evidenced by lower prices. However, it seems that the governance mode (public or private) chosen by municipalities and communities affects the gap in performance. While the price discrepancy stands at 8.12% for communities and municipalities overseeing public water management, it decreases to a mere 1.37% when service provision is delegated to a private company.

Table 2: Average price paid by consumers for 120 cubic metres of water (2008-2021)

Water Providers	**Average Price**	**Std. Dev.**	**Min.**	**Max.**	**Observations**
All services	1.868	0.522	0.519	4.876	23,179
Cooperation					
Without IMC	1.859	0.520	0.538	4.978	22,195
Community	2.032	0.476	0.615	4.753	2,539
Community/Without IMC Gap	*+9.31%*				
Public Management					
Without IMC	1.773	0.481	0.538	4.962	17,127
Community	1.917	0.432	0.835	4.154	1,144
Community/Without IMC Gap	*+8.12%*				
Private Management					
Without IMC	2.145	0.543	0.557	4.978	5,068
Community	2.116	0.490	0.615	4.753	1,395
Community/Without IMC Gap	*+1.37%*				

Note: Calculations from the authors. “Std. Dev.” stands for the standard deviation.
Prices are corrected for inflation and expressed in constant 2015 euros.
“Community/Without IMC Gap” represents the percentage difference between services under a community management and independent services.

4.3 Explanatory variables

We select a set of independent variables to estimate how organizational choices affect performance. We mainly use the same variables than Chong et al. (2006) and Mayol and Saussier (2021).

Governance. As noted above, the drinking water provision can be delegated by a provider to a private company. Therefore, we add the $Public_{it}$ variable, which equals 1 if the water service is under public management and 0 if the service is under private management.

Quality. The European Union and the French government set high-quality standards for drinking water. The French Health Ministry conducts inspections and collects information on the microbiological and physico-chemical compliance of drinking water. The variables $\textit{Physico-chemical Conformity}_{it}$ and $\textit{Microbiological Conformity}_{it}$ represent the proportion of tests conducted that meet microbiological and physico-chemical standards.

The costs associated with complying with quality standards are often considered fixed costs for water suppliers. These costs are related to the necessary infrastructure and water treatment technologies and do not vary directly with the price charged to consumers.

Another quality indicator is the ratio between the volume of water consumed by users and the volume introduced in the network. We define the $Return_{it}$ variable as:

$$Return_{it} = \frac{(Volume\ of\ domestic\ water_{it} + Volume\ of\ exported\ water_{it})}{(Volume\ of\ produced\ water_{it} + Volume\ of\ imported\ water_{it})} \times 100$$

Previous authors consider water network losses as an environmental indicator and a proxy of the quality of the infrastructure (Le Lannier and Porcher, 2014). Leakage incurs costs for the municipality because customers are billed solely for the water they consume, and any private water provider compensates the municipal government only for the water purchased by customers.

Consistent with prior research (Chong et al., 2006), we run several additional regressions to ensure that quality variables don't show endogeneity issues. We regressed quality variables on prices and on the choice of cooperating. We find no evidence of endogeneity.

Control variables. We include a set of variables to control for specific characteristics of the drinking water providers.

To control for the size of municipalities and communities, we include the variable $Population_{it}$. The presence of economies of scale in production would be indicated by a negative correlation between this variable and the price.

We add the $Nondomestic\ share_{it}$ variable which refers to the share of produced water used for purposes other than domestic use. Nondomestic uses typically include water utilization in industry and agriculture. Local authorities and regulatory bodies monitor this outcome to implement effective water management policies.

The variable $Water\ Factories_{it}$ refers to the total number of technical installations used for capturing, storing, and channeling water from a resource for a primary use.

These facilities are developed and maintained by local governments to perform significant water extractions. It controls for a municipality's reliance on water from its own jurisdiction.

Our empirical strategy is based on the two-stage model developed by Heckman (1976, 1979). In the selection equation, we include all previously mentioned explanatory variables, but require an instrumental variable that will not be included in the price equation. We introduce the variable $Revenues_{it}$, representing the annual revenue generated by provider i in year t.

Annual revenues are considered by drinking water providers in the decision-making process regarding cooperation. By capturing the annual revenue generated by each provider in a given year, it offers insights into financial capacities and strategic motivations that may influence cooperative behaviors.

Finally, we include fixed effects for "Water Agencies" to address spatial effects, given that each provider operates under the oversight of a Public Water Agency[2] within specific geographical jurisdictions. This approach allows us to control for heterogeneity that may not have been fully captured by our previous explanatory variables.

The descriptive statistics of the variables for our samples are presented in Table 3. As discussed above, the price paid by consumers is greater when drinking water is provided by communities. Moreover, communities appear to be more inclined towards private management rather than public management.

This is surprising, considering that within an intermunicipal structure, reaching a consensus on a delegation contract seems challenging.

The compliance of drinking water with physico-chemical and microbiological standards is higher for communities. Pooling expertise in managing drinking water could be seen as a means to implement water treatment processes that may be challenging for individual municipalities to undertake alone.

[2] In France, a water agency is a public administrative institution involved in water management. Its primary mission is to promote sustainable water resource use and protect aquatic environments.

Table 3: Descriptive statistics of the samples

Variables	**Communities**					**Standalone municipalities**				
	Mean	**Std. Dev.**	**Min.**	**Max.**	**Obs.**	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**Obs.**
Price	2.031	0.476	0.615	4.753	2,539	1.859	0.520	0.520	4.978	22,195
Public	0.450	0.498	0	1	2,539	0.772	0.419	0	1	22,195
Return	77.401	12.099	21	100	2,539	76.255	15.324	0	100	22,195
Physico conformity	98.933	4.61	13.725	100	2,539	96.531	9.419	0	100	22,195
Microbio conformity	95.931	12.73	0	100	2,539	95.590	15.343	0	100	22,195
Nondomestic share	0.045	0.103	0	1	2,539	0.065	0.151	0	1	22,195
Water factories	5.451	11.477	0	142	2,539	2.263	3.439	0	179	22,195
Population	17,022.29	35,442.9	0	284,234	2,539	1,843.536	15,644.55	0	2,243,739	22,195
Revenues	2,145,432	4,298,603	0	6,620,070	2,539	193,867.4	446,755.1	0	6,550,338	22,195

Note: Calculations from the authors. "Std. Dev." stands for the standard deviation.
Prices are corrected for inflation and expressed in constant 2015 euros.

5 Empirical strategy

We aim to identify the impact of inter-municipal cooperation on the performance of the drinking water sector in France. Performance is assessed through consumer prices across a panel of French providers. A simple least squares regression of price on the decision to cooperate and exogenous variables is inadequate because provider organizational choices are endogenous. Least squares estimation would be biased and inconsistent.

Estimating a structural model is challenging due to significant missing data on production factors and costs. The study's focus is not on identifying determinants of drinking water prices, but rather on examining the effect of organizational choices on performance.

5.1 Estimation procedure

Previous scholars have shown that estimations of the impact of organizational choices on subjective performance will be biased if selection bias issues are not addressed. Therefore, simply comparing average prices for different organizational modes or regressing prices on organizational choices cannot be considered a satisfactory methodology.

We build a two-step econometric strategy inspired by Heckman (1976, 1979). First, we estimate a probit model of the decision to join a community versus remaining independent as a function of time-varying variables X_{it} and time-invariant variables Z_i to treat the selection bias. We subsequently regress prices on the determinants of the decision to cooperate or not and on the inverse Mills ratios (IMRs), calculated after estimating the probit model in the first stage. Using these estimations, we calculate the average effect of IMC on prices paid by consumers.

The first-stage probit model is estimated using a Correlated Random Effects (CRE) framework, developed by Mundlak (1978) and extended to probit models and unbalanced panels by Wooldridge (2010, 2019). This methodology addresses issues related to heteroscedasticity, serial correlation, and correlation between time-varying variables and individual effects by incorporating the individual mean of time-varying variables ($\overline{X}_i$) and the individual mean of year dummies in the probit model.

Like Carpentier et al. (2006), we employ the revenues of water providers ($Revenues_{it}$) as an instrument in the first-stage probit model. This amount corresponds to all annual revenues from the service. This decision stems from the fact that revenues influence the binary selection variable in the first stage but do not affect consumer prices. The probit models employed in our analysis are as follows:

$$P(\text{Community}_{it} = 1 | X_{it}, \text{Revenues}_{it}, Z_i, \overline{X}_i, \overline{\text{Revenues}}_i) = \Phi(\Psi) \tag{1}$$

with

$$\Psi = \psi_1 + \beta_1 X_{it} + \delta_1 \text{Revenues}_{it} + \theta_1 \overline{X}_i + \kappa_1 \overline{\text{Revenues}}_i + \gamma_1 Z_i \tag{2}$$

and

$$P(\text{Community}_{it} = 0 | X_{it}, \text{Revenues}_{it}, Z_i, \overline{X}_i, \overline{\text{Revenues}}_i) = 1 - \Phi(\Psi) \tag{3}$$

where Φ is the standard normal cumulative distribution function and X_{it} contains time dummies.

The second step involves estimating price equations conditional on the organizational choice of the municipality (cooperation or remaining alone). To address the selection bias, the inverse Mills ratios $\frac{-\phi(\Psi)}{\Phi(\Psi)}$ and $\frac{\phi(\Psi)}{1-\Phi(\Psi)}$ are incorporated into the following regime equations ('0' : standalone municipality management, '1' : community management):

$$Price_{it}^0 = \beta_2^0 X_{it}^0 + \gamma_2^0 Z_i^0 + \rho^0 \left(\frac{\phi(\Psi)}{1 - \Phi(\Psi)} \right) + \mu_i^0 + e_{it}^0 \quad (4)$$

$$Price_{it}^1 = \beta_2^1 X_{it}^1 + \gamma_2^1 Z_i^1 + \rho^1 \left(\frac{-\phi(\Psi)}{\Phi(\Psi)} \right) + \mu_i^1 + e_{it}^1 \quad (5)$$

where ϕ denotes the standard normal density function. μ_i^0 and μ_i^1 are the unobserved individual heterogeneity for standalone municipality management and community management. If either of the coefficients ρ^0 or ρ^1 is significantly different from zero, this implies a statistically significant difference between the price under municipal (community) management and what it would have been under community (municipal) management.

The major advantage of this empirical strategy is that it enables the calculation of the price paid by consumers if a provider had chosen the alternative organizational mode. Consequently, we can compute the price paid by consumers if a municipality had opted for inter-municipal management, and vice versa. As shown by Boyer and Garcia (2008), when prices are observed, estimated prices are calculated as follows:

$$E(Price_{it}^0 | Community = 0) = \beta_2^0 X_{it}^0 + \gamma_2^0 Z_i^0 + \rho^0 \left(\frac{\phi(\Psi)}{1 - \Phi(\Psi)} \right)$$

$$E(Price_{it}^1 | Community = 1) = \beta_2^1 X_{it}^1 + \gamma_2^1 Z_i^1 + \rho^1 \left(\frac{-\phi(\Psi)}{\Phi(\Psi)} \right)$$

If the drinking water provider has not opted for the alternative organizational choice, then prices are not observed. Therefore, prices are estimated based on the calculation of the conditional mean of prices under the regime that could have been chosen:

$$E(Price_{it}^0 | Community = 1) = \beta_2^1 X_{it}^0 + \gamma_2^1 Z_i^0 + \rho^1 \left(\frac{-\phi(\Psi)}{\Phi(\Psi)} \right)$$

$$E(Price_{it}^1 | Community = 0) = \beta_2^0 X_{it}^1 + \gamma_2^0 Z_i^1 + \rho^0 \left(\frac{\phi(\Psi)}{1 - \Phi(\Psi)} \right)$$

Finally, we computed a panel bootstrap estimation with 10,000 replications to correct standard errors for heteroscedasticity and serial correlation. Combining the two-step Heckman method with the CRE framework allows us to address endogeneity in the choice and in the price.

5.2 Results

We present our results in Table 4. The first column contains the robust estimation (standard errors are corrected for heteroscedasticity) of the Probit model 1. This probit model is used as a selection equation in our empirical strategy. We include a set of time-varying explanatory variables X_{it}, time-invariant variables Z_i, $Revenues_{it}$ as an instrument and their individual means $\overline{X}_{it}$, $\overline{Z}_i$, and $\overline{\text{Revenues}}_{it}$.

Table 4: Prices and IMC

Method	CRE Probit	Switching Regression	
Regime	-	0	1
Dependent Variable	Community	Price	Price
Public	0.687*	-0.368***	-0.166***
	(0.359)	(0.019)	(0.035)
Return	-0.005***	-0.0005	-0.002*
	(0.002)	(0.0004)	(0.001)
Microbio conformity	-0.004***	-0.0001	0.001
	(0.001)	(0.0003)	(0.001)
Physico conformity	0.002	0.0017***	-0.004
	(0.003)	(0.0005)	(0.003)
Nondomestic share	-0.614**	-0.246***	-0.119
	(0.259)	(0.042)	(0.129)
Water factories	-0.009	-0.003*	0.0007
	(0.029)	(0.002)	(0.001)
Pop $<$ 5k	ref	ref	ref
Pop 5k-10k	2.019*	0.254***	0.239***
	(1.206)	(0.063)	(0.054)
Pop 10k-15k	2.308*	0.113*	0.065
	(1.198)	(0.064)	(0.059)
Pop $>$ 15k	1.121	-0.002	0.046
	(1.265)	(0.081)	(0.070)
Revenues	1.24e-06***		
	(1.59e-07)		
IMRs		0.035	0.099***
		(0.022)	(0.030)
Intercept	-2.829***	1.040***	3.003***
	(0.865)	(0.231)	(0.371)
Water Agency FE	Yes	Yes	Yes
Years FE	Yes	Yes	Yes
Observations	23,376	22,195	2,539
Pseudo R^2/R^2	0.347	0.164	0.189
Wald χ^2	1139.53		
Prob $> \chi^2$	0.00	0.00	0.00
Log pseudolikelihood	-3813.43		

Note: Significance levels: $*** : p < 0.01, ** : p < 0.05, * : p < 0.10$. The probit model includes time averages and time averages of year indicators and standard errors are clustered at the drinking water provider level. All regressions include indicators for each number of time-observations. Standard errors in parentheses are from 10,000 cluster-bootstrap repetitions for the prices estimations.

The estimation of this model indicates that municipalities do not decide to cooperate randomly. Indeed, it appears that the decision to cooperate is influenced by efficiency considerations[3]. The coefficients associated with the variables *Returnit* and *Microbio conformityit* are negative and significant, suggesting that a provider with a lower-quality distribution network and water is more likely to engage in cooperation.

The pseudo R^2 associated with our estimation is 35%, which is deemed satisfactory given the panel specification of our database.

Finally, we present the estimation results for equations 4 (column 2) and 5 (column 3). For the sample of municipally managed providers, the coefficient associated with the selection variable (IMRs) is not significant. In contrast, this coefficient is significant (at the 1% level) for the sample of providers under intermunicipal management. This indicates the presence of selection bias when the decision to cooperate is not accounted for in the estimation of the price paid by consumers.

The positive sign of the selection bias in intermunicipal management indicates that the price paid by consumers is higher than it would have been if the provider had been under a municipal management. This suggests that unobserved factors lead municipalities to cooperate in the provision of drinking water and affect prices paid by consumers.

These estimation results are directly used to calculate the average prices for each mode of organization, as well as the hypothetical prices if the providers had chosen the alternative mode of organization.

Providers that have chosen municipal management show superior performance (measured by the price paid by consumers) compared to if they had opted for intermunicipal management. These results are shown in table 5.

On the other hand, these indicate that providers under intermunicipal management perform less effectively than if they had opted for a municipal management.

Table 5: Estimated average prices for each governance choice

	Municipal observations (N=22,195)	**IMC observations (N=2,539)**
Estimated mean prices		
Providers through municipal management	1.859	1.752
Providers through IMC	1.968	2.032

[3]See Guelmamen et al. (2024) for a detailed analysis of the determinants of IMC, which is not the focus of this paper.

6 Discussion

Our results reveal that ignoring selection bias leads to skewed results. By addressing this endogeneity issue, we find that intermunicipal management is less effective than municipal management.

This finding is consistent with the transaction cost literature, which suggests that inter-municipal management can generate organizational costs. These additional costs negatively affect performance, as measured by price. As shown by Williamson (1999), transaction costs are crucial in the delivery of public services and in the decision-making process of municipalities (remaining independent or cooperate). Monitoring and control among members complicate collective management.

Camões et al. (2021) also points out that the collective management of public services faces the diverse interests of its members (ideological, economic, social interests). Consequently, the organizational framework of inter-municipal structures tends to create negotiation and coordination costs.

This is exacerbated by the limited power of community members to sanction a third party exhibiting opportunistic behavior. French intermunicipal structures are particularly affected by this issue, as the General Code of Territorial Collectivities imposes significant process in dissolving cooperation or allowing a member to withdraw.

We show that IMC does not necessarily enhance the economic performance of the drinking water sector. The lack of coordination among members could be a contributing factor. Our data provides organizational and financial information about water providers in France. Including geographical characteristics could yield more precise results. Specifically, such data would help clarify the heterogeneity of situations based on proximity to water extraction points or altitude.

7 Conclusion

The efficiency of public services is a significant concern for policymakers. In particular, the provision of drinking water has become a central issue due to climate change, which increases the frequency of droughts. This study identifies the effect of IMC on the performance of the French potable water sector, as measured by the price paid by consumers.

Our results show that, all else being equal, drinking water providers under inter-municipal management perform worse than those under municipal management. The presence of a selection bias in our price estimation equations indicates that unobserved factors also contribute to this price differential. This selection bias is corrected with the two-step selection model introduced by Heckman (1979) and generalised by Wooldridge (2019).

This study contributes to the literature of public services performance and transaction costs. It suggests interesting research perspectives. Initially, collective management of public services (like drinking water - considered a common good in the sense of Ostrom (1990)), may not always be the most efficient form of management. However, climate change makes collective management inevitable. What organizational forms would enable effective management of drinking water while mitigating coordination problems and opportunism among members?

It is also crucial to consider other performance variables such as drinking water quality or network reliability in future studies. Finally, a promising direction for further research could involve expanding this framework to investigate how ideology and political affiliation specifically impact performance.

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