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Abstract

In France, private firms manage the majority of water services but there is still a large part of water services under direct management. Such a diversity of governance forms allows for efficiency and quality benchmarking between direct and delegated management, and raises questions about the determinants of the choice of the local government to manage or delegate, and to switch from a governance model to the other. This paper reviews the literature on these issues in France. Moreover, the paper identifies several hot issues deserving further research such as scale and scope economics, and the implementation of social tariffs or increasing block tariffs.

Keywords

Water, private sector participation, public services, efficiency, increasing block tariffs.

JEL: D82-L33-L95

In France, as in most industrialized countries, municipalities must provide local public services that have natural monopoly characteristics such as water or sanitation. Water public service refers to production and distribution of water while sanitation refers to collection and treatment of used water. A particularity in water and wastewater in France is that service provision is much decentralized: there are more than 14,000 drinking water services producing and distributing water to 64 million inhabitants while in England for example, there are 12 water only companies and 12 water and wastewater companies. This large number of services is due to the fact that France counts more than 36,000 municipalities. Another particularity of France is that local governments monitor prices, control entry and exit of firms into the market, organize competition and ensure uninterrupted service.[1] This is different from England where there is an independent regulatory body responsible for setting service provision conditions for all operators and for monitoring operators' compliance.

Local governments can choose to delegate the management of the water public service to a private firm or directly manage it. Water governance in France is characterized by important private sector participation. Indeed, private firms manage the majority of water services but there is still a large part of water services under direct management. Such a diversity of governance forms allows for benchmarking between direct and delegated management, and raises questions about the determinants of the choice of the local government to manage or delegate. A large literature (see infra) comes with some answers about these two questions. Moreover, because contract length is typically between 8 and 20 years, switches from private management to public management are becoming more and more frequent. Some recent papers (see infra) discuss the reasons motivating governance switches. Finally, an important question is the potential scope economies as France is characterized by a myriad of - rather small - water services. A recent law[2] encourages the grouping of public services to simplify their management and to take advantage of scale economies. The expected effects of such grouping are better efficiency, increased capabilities and more effective regulation.

This paper presents the French institutional context and reviews some of the important results found in the literature. It is organized as follows. Section 1 introduces water regulation in France, by insisting on the various governance forms. Section 2 presents the impact of private sector participation on different measures of performance. Section 3 introduces current issues such as merging services to increase scale economies, remunicipalizations and social tariffs. A brief conclusion follows.

1. Regulation

1.1 Governance: in-house or contracted-out

In France, the responsibility for public services' provision is public but the management can either be public or private. Although some municipalities manage production through direct public management and undertake all operations and investments needed for the provision of the service, the dominating organizational form is private management. In this case, the delegating authority contracts with a private operator for the management of the service. A private operator, independent of the local government, is hired to manage the service and operate facilities through one of the four different private-public arrangements. The most common is the *lease* contract in which the operator manages the service, invests in the network and gets a financial compensation through consumer receipts. Under a *concession contract*, the operator also undertakes construction risk, as it must finance a large part of investments over the duration of the contract. This contractual agreement differs from the lease contract in that operators share risk in exchange for greater decision rights and claims on revenues.

[1] Note that water quality is defined at the national level by the central government, following several European directives (European directive 2000/60 on water).

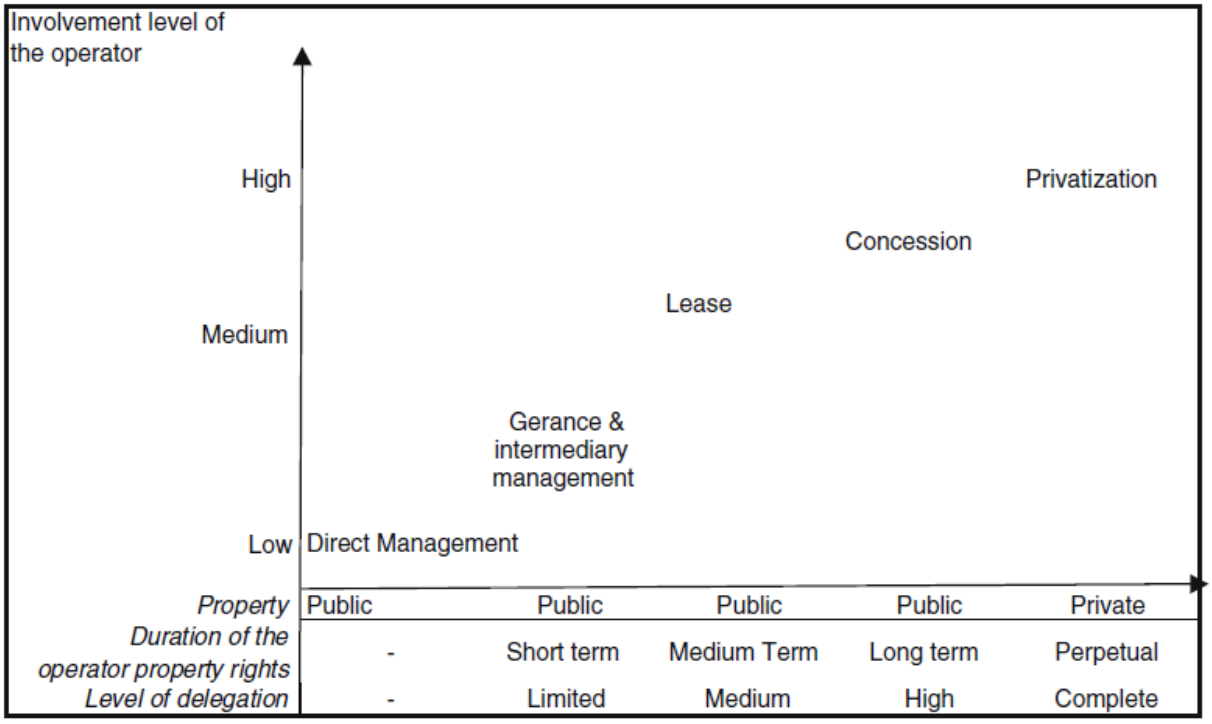
[2] The so-called "Loi NOTRe" (Law of the 7 August, 2015) on the new territorial organization of the Republic.

Other contracts can be chosen by the local authority such as the *gerance* contract in which it pays an operator a fixed fee, or an *intermediary management contract*, i.e. a gerance contract but with a small part of the operator's revenues depending on its performance. Such contracts provide few incentives to reduce costs and transfer no risks and no decision rights to the private operator. According to the Cour des Comptes [2011], the highest financial court in France, 71% of the population is covered by a private operator for water provision and 56% for water sanitation.

Contrary to other industrialized countries, there is no price-cap or rate-of-return regulation for water utilities in France as there is no national regulator. Such regulation has been replaced by a contract in the case the public authority decided to contract out service provision, or a decision of the municipality board in the case of public operation. In the case of delegated management, rules have been defined to ensure that standards are respected during the operation to limit the opportunistic behavior of operators and preserve competition between firms. A first step was the introduction of the "Sapin Law" (1993) which defined a national legislative framework governing the conduct of the bidding process. Under the "Sapin Law", the institutional framework to select the private partner was the following. If the public authority chose a lease or a concession contract, it selected its partners in two steps. First, the public authority launched a classical invitation to tender which was open to all interested private water companies. Second, there was a negotiation phase between the public authority and shortlisted bidders. At the end of the negotiation, the public authority chose its final partner for the duration of the contract. The selection of the private company followed the so-called "*intuitu personae*" principle according to which the municipality or the community set a list of criteria to select the firm considered as the best partner[3]. Following the transposition of three European directives on contract attributions (Directives 2014/23, 2014/24 and 2014/25) in 2016, the selection of the private company does not follow the *intuitu personae* principle anymore. Now the head of the public authority must select the best offer in regards to the "global economic advantage" on the basis of several "objective criteria" and guaranteeing an "effective competition". Service quality and sustainable development are also potential criteria.

[3] However, the number of bidders remained low, around 1.9 for each bidding process (Guérin-Schneider and Lorrain [2003]).

Figure 1: Contractual options for public services in France (Chong et al. [2006])



1.2 Quality

Since the "Barnier Law" (1995) private operators have to produce every year an *Annual Report on Price and Service Quality* ("*Rapport prix et qualité du service*" in French). These reports include yearly indicators on water public services such as detailed prices for a standard bill, leak ratio, water production and water quality[4] among other indicators. It is thus possible to see follow and compare the evolution of quality and price in France. For example, water quality is relevant for more than 99% of the tests run (Porcher [2012]) and the leak ratio slightly decreases every year because of the amount of investments made to prevent leaks (CGDD [2010]).

Furthermore, rules have been defined to ensure that standards are respected during the operation to limit the potential opportunistic behavior of operators. These rules support water quality, duration of contracts and information about management and provision quality. In the case of water quality, a precise definition of more than 60 verifiable quality parameters has been set by the 1992 Water Act to ensure that water services, would they be private or public, respect quality standards. Consequently, water quality is respected and is rarely below a 95% score of conformity to the standards of the microbiological analysis. Moreover, limits on duration have been implemented and management and provision information is now required to be publicly reported. To ensure competition among operators, the "Barnier Law" (1995) limits the duration of contracts and includes an automatic renegotiation of the contract every five years. To struggle against information asymmetries, the executive power passed a decree in 2007 to force municipalities and communities to provide 14 performance indicators in the mayor's *Annual Report on Prices and Service Quality*. These

[4] Water quality is measured as the % of compliance to the microbiological / physic-chemicals indicators.

performance indicators and other data about water and sewerage services have been collected from 2009 on by the *French National Observatory of Water and Aquatic Environments* ("*Observatoire national de l'eau et des milieux aquatiques*" or ONEMA in French) to give users and citizens information about their water services. However, the data collection appears as being a failure so far as there is a lack of incentives for public authorities to fulfill the data on a regular basis

1.3 Price Settings

In the case of delegated management, public authorities face the classic regulatory problem: they find themselves in an information asymmetry position and have few tools to carry out their essential tasks. However, rules have been implemented to limit opportunistic behavior by private operators. For example, in renegotiating prices, operators are constrained by the fact that in administrative contracts, all renegotiations that change the value of the initial contract by more than 5% trigger a new selection process of the private operator. Even if this safeguard is rarely used, it provides a credible power to local authorities in order to prevent opportunistic behavior from an operator.

Price setting is different whether the local community has chosen to delegate the service to a private firm or not. Under direct public management, the municipality council designs prices in order to generate revenues that allow the utility to cover its costs. European legislation (Directive 2000/60) requires the water utility budget to be balanced following the so-called "full-cost recovery" principle. Prices are thus set to cover operating and capital costs.[5] Administrative accounting rules are framed so that municipalities hold two separate accounts for the water utility budget. The first account is an operating budget and the second is an investment budget. Net revenues from the operating budget are automatically transferred to the investment budget in order to limit operating costs. This is usually the case if the municipality undertakes a multi-year investment program. While the "full-cost recovery" principle usually implies a zero-margin cost structure, margins are however possible but the way they are used is highly controlled by administrative rules.

Under private management, the price structure is determined by projecting financial accounts provided by the operator over the duration of the contract. The contract includes periodic revisions of water tariffs using a price index adjusting formula. The relationship between the local municipality and the firm is formalized by means of a contract that specifies a price structure, a formula of price revision and negotiated clauses allowing for exceptional conditions. Since the bargaining power is often considered to be favorable to firms, the price structure is likely to reflect a monopolistic behavior rather than social welfare maximization.

1.4 Water taxation

In France, negative externalities and resource protection are considered in the water tariff structure, namely to internalize externalities, as the polluter-pays and user-pays principles are clearly stated in the law. Two taxes have been implemented to finance the six Water Agencies, implemented at the River Basin-level, for the purpose of subsidizing projects to address pollution and protect resources. The product of taxes is collected by the utilities and transferred to the Basin Agencies.

The per-unit rates of these taxes, set-up by the Basin Agencies, depend on the geological characteristics of the Basin. These characteristics include the origin of water and the condition of the sources, for the resource protection fee, and pollution intensity for the pollution fee. On average, the pollution fee is a 0.21 euro tax per cubic meter while the resource protection rate is a 0.52 euro tax per

[5] There is little historical evidence of the application of this principle. However as large cities' accounts are now published every year, there is strong evidence of the application of this principle in recent years. The highest financial court in France, the Cour des Comptes [2011], notified several municipalities that their prices were too high, therefore using municipal budgets to fund non-water spendings, or too low, i.e. subsidized by another municipal budget.

cubic meter (Porcher [2017]). The level of taxes is computed using a simple formula at the municipal level: inhabitants are added to seasonal visitors (weighted by a coefficient of 0.4) and multiplied by an agglomeration coefficient going from 0.5 to 1.4 depending on the size of the city. A pre-determined cost of pollution per capita which is differentiated from city to city is then multiplied by the artificially computed number of inhabitants. The result is the corresponding amount of pollution charges that is to be paid by the municipality to the water agency. It is then divided by the billed units to determine the level of tax per unit. The total amount of water taxes is equivalent to 2 billion euros per year. To the best of our knowledge, France has been the first country to implement such water taxes (in the 1960s) but similar taxes exist in the Netherlands (since the 1970s), Germany (1981) and Denmark (1997). These taxes are also designed as incentives to consume less water, especially in water-stressed regions.

1.5 Datasets

An important feature of water governance is the availability of datasets enabling comparisons between water public services. There are two main datasets in France. As abovementioned, there is no national regulator in France. There is however the abovementioned *National Observatory of Water and Aquatic Environments* (ONEMA in French) which gathers data on the different regulatory indicators of water in France since 2009. The dataset, named SISPEA, is publicly available. Data on water services characteristics can be found, such as the governance form, the length of the network, and the regulatory indicators, such as the rate of complaints, the index of resource protection, etc. A complete list is reported in appendix A1. It is in principle compulsory for local governments to fulfill every year the values of the different indicators.

The data collection of the ONEMA follows the work that was performed since the beginning of the 1990s by the *French Institute for the Environment* (IFEN in French). IFEN collected data every three years on a representative subsample of 5,000 French municipalities. Datasets were available for 1998, 2001, 2004 and 2008, and some early datasets were collected in the beginning of the 1990s. The IFEN dataset is the dataset used in most of the studies reviewed in the following sections. Note that the IFEN dataset is a city-level dataset while the SISPEA dataset is a service-level dataset. A service can be managed by a single city or by a group of cities. IFEN dataset is thus disaggregated at the city-level when a service includes several cities.

1.6 Overall distribution of regulatory functions

The above sections on governance forms, price setting, quality indicators, water taxes and collection of data, show that France is characterized by a rather complex organization of regulatory functions and powers (Salvetti and Canneva [2016]). For example, quality standards are supervised by the Health Ministry, the incentives for the efficient use of water resources are managed by water agencies, tariff regulation or governance forms are managed by the service (see table A2 in appendix). The same applies for regulatory powers, where a various set of local and national actors audit, fine or enforce compliance with regulation (see table A3 in appendix). Overall, the regulation functions and powers are very fragmented in the French water sector. Numerous stakeholders are involved, at different scale, and in different regulation areas. Nevertheless, this multi-level governance is observed in many OECD countries (OECD [2015]) and results from the conception of water sector regulation as being domain specific. For example, the Environment Ministry sets up the water treatment standards in order to respect the environment while the Health Ministry is in charge of setting the compulsory quality standards for drinking water. A myriad of actors might however reveal a coordination problem, especially in a context of highly decentralized water services as in France. The issue of grouping or merging local governments to enforce them becomes then central in order to rationalize the number of providers and to make regulation more effective.

2. Private sector participation and performance

2.1 Private sector participation and Price

Many papers study the relationship between private sector participation and price in France. Early studies by Ménard and Saussier [2003], Glachant and Miessner [2003] and Boyer and Garcia [2004] show that municipalities with complex services tend to use private management rather than public management. Carpentier, Nauges, Reynaud, and Thomas [2006] use treatment effects on a large dataset of French municipalities for 1998 and find that private management copy with harder operating environments. Accounting for the complexity of services explains a large part of the price difference between public and private operators. When there is complexity, municipalities thus prefer to pay higher prices rather than directly manage water services. The average difference, *ceteris paribus*, is rather small (5% per cubic meter in 1998) and the difference is not statistically significant for large municipalities.

Chong et al. [2006] use a dataset of 5,000 French municipalities' in 2001 and find *ceteris paribus* an 11-euros premium of private management relative to the direct public management on baseline bills of 120 cubic meter consumption per year. This 11-euros premium is lower to what simple descriptive comparison would find (30 euros on average). They also find that local governments are keener to contract out the management of water public services if they are more technically difficult to provide. A recent paper by Chong et al. [2015] studies the impact of contracting out on price using a large panel of 3,700 municipalities and shows that over the 1998-2008 period, contracting out increases price. However, the impact narrows or disappears when one considers cities with more than 10,000 inhabitants, as they have probably more capabilities to negotiate contracts with private operators.

There are several reasons that can be used to explain the gap between public and private performance. A first reason is that margins are expected to be higher in private management, in comparison with public management. Such a margin could create efficiency costs, because marginal prices would be set higher than marginal costs. A study of margins in France (Porcher [2014]) on a subset of utilities in 2008 shows that margins seem to be higher in services directly managed – around 15 cents of euros per cubic meter - than in services managed by a private operator – around 12 cents of euros per cubic meter. The remaining difference in price between public and private management cannot be related to differences in margins. The price gap between public and private operators might best be explained by some differences in transaction costs, less competition or less effort to decrease costs and thus prices by private operators, especially in small services; or by differences in debts.

A second argument is that debt of the public service can be used to fund investment instead of using the "full recovery" principle. Indeed, in France, public services such as water, waste and public transport, have their own budget ("supplementary budget" or "*budget annexe*" in French) which is appended to the budget of the municipality. Such a supplementary budget means that all the costs of the water industry must be covered by the price paid by consumers. This suggests that if the price does not cover the costs, the supplementary budget is in deficit, creating a debt for the public service, which cannot be refunded by increasing local taxes or using the surpluses of some other supplementary budgets (such as sanitation or transportation). Directly managed public services are typically expected to have lower prices than contracted-out services but higher debt of the supplementary budget because city councils are reluctant to increase prices in the short-term. On the contrary, under *lease* contracts, private firms would tend to have higher prices than directly managed public services but lower debt of the supplementary budget. A recent study by Porcher [2017] uses an original dataset of 116 water utilities in 2009 serving more than 9 million inhabitants in France. The study shows that debt per customer is respectively on average 319 euros and 133 euros under public and private management. In Porcher [2017], debts of the supplementary budget of water are assumed to be refundable immediately, in 5 years or 10 years under a 2% interest rate. Prices are then recomputed to consider debt refunding using the different assumptions. Under an immediate debt refunding hypothesis, there

is an average difference of 150.81 euros for an annual bill between public and private management. The difference decreases to 5.57 euros for an annual bill in favor of private management under a 5-year debt refunding hypothesis and it becomes 13 euros in favor of public management under a 10-year debt refunding hypothesis. It thus shows that by using a period of debt-refunding longer than the standard contracts with private operators, municipalities succeed in decreasing price in the long run despite important levels of debt.

A final argument, explained in Chong et al. [2006] and Chong et al. [2015], is that transaction costs or capabilities might explain the performance gap between public and private management. Indeed, as the gap narrows with the size of the city, even controlling for scale economies, it seems that the level of transaction costs or capabilities differs depending on the size of the city. Most probably, the lack of information and measurement about transaction costs or capabilities in these studies make these interpretations prospective; moreover, a good measure of transaction costs should be compare with a good counterfactual allowing the computation of bureaucratic costs.

2.2 Private sector participation and cost-efficiency

In countries like Germany or the UK, the availability of data on costs and revenues enable researchers to work on better measures of performance, such as cost-efficiency, i.e. the level of costs related to the scale characteristics of the service, such as population, billed units and length of the network. In France, such data is not directly available but can be retrieved in some of the mayor's *Annual Report on Prices and Service Quality*. Le Lannier and Porcher [2014] collected information on costs and revenues in these reports to provide a benchmarking of big water services in France.

Using a dataset made of 177 water services serving more than 20,000 inhabitants in 2009, the authors compare the efficiency of private and public management. To measure efficiency, the authors use a mixture of Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) to obtain efficiency scores ranging between 0 (the less efficient) and 1 (the more efficient). An interesting contribution of the article is that the methodology allows controlling for the heterogeneity in the environment of the water services. Some environmental variables relative to the service itself - such as the type of water (ground or underground) or treatment (simple or complex) - or to the geographic area - touristic area, density, etc. – are added to the model. The reader can thus check the evolution of the efficiency scores for each water services, before and after integrating the environmental variables. The results show that water services under private management are on average more complex to manage. Accounting for environmental variables increases efficiency by 0.1 under private management while it only lifts up efficiency by 0.059 for public management. However, even after having taken environment variables and statistical noise into account, private management remains on average less efficient than public management. Public management has an efficiency score of 0.883 against 0.823 for private management. As a summary, even if the technical efficiency gap is narrowing after correcting for structural differences, it remains significantly positive. This gap partly results from a widespread technical efficiency of water services under private management.

2.3 Private sector participation and quality

A few papers use quality as a performance indicator for at least two reasons. First, apart water quality and the leak ratio, most of the regulatory quality indicators are either not collected (this is the case in the IFEN dataset) or not well fulfilled (this is the case in the SISPEA dataset). A good measure of service quality such as the rate of complaints, to capture the feeling of the user, is not available. Second, water quality is largely uniformed in France, with small disparities between services and governance forms.

There is however three studies which could be mentioned on water quality in France, even if their focus is not quality per se. The first one is Ménard and Saussier [2000] who links governance choice

with quality parameters, using a dataset of 2,000 observations for 1995. Their measure of quality is a dummy variable equal to 1 if a water service has been identified as failing to meet quality parameters at least once in the year and 0 otherwise. They show that there are no significant differences between public and private management. Another paper by Porcher [2012] uses a dataset of more than 2,200 French municipalities observed between 1998 and 2008. The paper shows that private management is associated with higher water quality, measured as the percentage of tests passing the required microbiological standards. The impact is nevertheless rather low, around 1 point of percentage.

Finally, another way to approach quality is to focus on the leak ratio rather than water quality. The leak ratio can be used as a proxy of the care of the manager to reduce water losses. It is measured as the ratio of losses and production. In a recent paper, Chabrost et al. [2018] compute the overleak for French services, in order to see if this variable is a determinant of remunicipalizations. The overleak is the difference between the leak ratio under a given governance model and the predicted leak ratio if the service had the other governance model. For example, for services directly managed, the overleak variable is computed as the ratio of the difference between the observed leak ratio in a given period and the econometrically predicted leak ratio that would exist if the service was managed by a private company in numerator and the observed leak ratio in denominator. For directly managed services, the overleak is positive, i.e. the computations show that direct management is associated with higher leak ratios.

To conclude, the literature shows that private sector participation is associated with small but higher water quality and better network performance, i.e. lower leak ratios.

3. Some other issues: scale and scope economies, remunicipalizations and social tariffs?

3.1 Scale and scope economies

The so-called "loi NOTRe"(2015), focused on territorial reform, is trying to enforce municipalities and inter-municipal bodies to group together to reach a more relevant scale for water provision and management. The expected result is that the overall water policy framework will be rationalised in order to ensure better regulation, efficiency, effectiveness and accountability of water policy and water utilities. There are however several papers computing the potential scale economies of reducing the number of water services. Each water service would then increase in production together with an increase in the number of customers, reducing the average variable cost of production. Garcia and Thomas [2001] show that municipalities have an interest in merging and forming a single water utility up to a certain scale. Communities of 2 to 5 municipalities tend to have the higher degree of scale economies. Creating a water district seems to be more profitable for local communities with high population density.

Some other pieces of research compute the scope economies of bundling the management of water and sanitation services in the hands of a single operator. Chong et al. [2013] use the IFEN dataset from 1998 to 2004 and show that local governments regularly select the same governance mode (and operators) for water and sanitation services. Their results show that using the same operator for both water production and sanitation leads to a significant price reduction for consumers, between 8 and 11 euros for an annual standard bill per household. Scope economies thus seem to exist and could significantly improve the efficiency of water services.

3.2 Remunicipalizations

In a report for a NGO, Kishimoto, Lobina and Petitjean [2015] compute that nearly 50% of remunicipalizations worldwide take place in France. While delegated management for water services has been used for a long time, it is interesting to investigate what the main drivers of

remunicipalizations are. Indeed, there were several cases of remunicipalizations in France, including Paris in 2009, while the option of remunicipalization has been discussed in major cities such as Bordeaux, Marseille or Nice. In a recent paper, Chabrost et al. [2017] discuss the main drivers of remunicipalizations. The authors believe that the main determinants might be dissatisfaction with private management performances. A good proxy for underperformance of water services can be computed as excessive prices or underinvestment. Besides these efficiency concerns, other matters might be part of the explanation, especially political concerns such as ideology, willingness to be re-elected by politicians or mimetic behaviors between local governments. The intuition for the latter is that small local authorities might not have the capabilities to benchmark their performance relative to other local governments. As a result, the number of observed remunicipalizations around might be an incentive to remunicipalize itself.

The authors compute two different variables to measure performance. The first variable, *overprice*, is the ratio of the difference between the price in a given service and the price that would be observed if the service was run in the alternative governance form and the price in the service. For example, for a water service directly managed, overprice is the ratio of the difference between the current price and the price that would be observed under private management and the current price. The numerator is a "predicted price" using an endogenous regression switching model. In our case, a positive overprice means that switching from public to private management would decrease the price. On the contrary, a negative overprice means that current price is lower than what it would be under private management.

The second variable, overleak, is similarly computed, using leak ratios instead of prices. A positive overleak means that the observed leak ratio is higher than the predicted leak ratio under the other governance form. In this case, a switch to the other governance form could decrease the leak ratio.

Chabrost et al. [2018] link overprice and overleak to the probability of remunicipalizing. They find that overprice and overleak are influencing positively the probability of remunicipalization. The results show that cities paying more and experiencing more leaks under private management that what they would have had under public management are more likely to remunicipalize. The finding suggests that the observed remunicipalizations can be explained by the municipalities' willingness to increase water services efficiency.

3.3 Social tariffs

In France, the so-called "Brottes Law" (2013) promotes the experimentation of discriminative pricing based on income, e.g. the implementation of social tariffs for the poor. As mentioned above, in France, water tariffs have two parts, a fixed part covering fixed costs, and a variable part, covering the variable costs of production. The "Brottes Law" (2013) allows local governments to experiment multi-tiered pricing based on the level of income. Mayol and Porcher [2017] use a unique dataset from Dunkerque, a city in the North of France, to study the impact of tariff change on consumption and to compute consumers' price elasticities.

The case study of the city of Dunkerque is particularly interesting. The city has implemented a three-part tariff and a social tariff. The three-part tariff works in the following way: a "vital consumption" tier below 75 cubic meter per household per year, a "useful consumption" tier between 75 and 200 cubic meters per household per year and a "comfort" tier above 200 cubic meters. The marginal price, exclusive of taxes, is respectively 0.84, 1.56 and 2.07 euros per cubic meter. The social tariff consists in a large rebate on the first tier for consumers eligible to the universal health insurance, a social benefit for the poor in France. Consumers eligible to the universal health insurance would pay 0.32 euro per cubic meter for the first tier. Mayol and Porcher [2017] show that the change in the tariff structure increases consumption for consumers in the first tier and largely decreases consumption in the second and the third tier. Interestingly, the results show also a tendency of consumers to bunch around kink points. The authors do not discuss the efficiency costs of such measures, which are

probably high, as consumer elasticities are negative and significantly different from 0 while marginal prices differ from the marginal cost of production.

Social tariffs are an interesting policy instrument to study because they raise the question of equity and efficiency. While social tariffs seem to clearly favor equity in use, they also distort prices and create efficiency costs. An alternative social policy to social tariffs is to set marginal price equal to marginal cost and to use water coupons for the poor funded by a small increase in fixed-part tariffs for the other consumers; or to use fixed-part tariffs exemptions for the poor (Porcher, [2014]). The struggle against water poverty is an interesting issue which demands further research.

Conclusion

This chapter gave a thorough outline of water regulation in France. Water regulation in France is highly decentralized, with different governance forms observed for water and sanitation. The use of private firms to manage water and sanitation is rather common. Contracting out increases price and quality overall. The questions of scale and scope economies, remunicipalizations and social tariffs have been hot topics in the recent years. However, the overall expected impact of these three phenomena on the sector's efficiency is still to be assessed and discussed.

A final question that remains open is whether the French model of water regulation provides better results than the British model of water regulation. It seems that sunshine regulation can be informative for local governments and give them more capabilities in negotiating contracts with private operators. Nevertheless, the implementation of a single centralized regulator is a disregarded option at the moment, as French local governments are keen on keeping their prerogatives in managing water and sanitation public services. Moreover, the current quality of the SISPEA dataset does not allow doing a proper benchmarking of a representative set of water services. Efforts should be made in order to collect data of good quality to be able to increase the quality of water services' benchmarking.

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APPENDIX

Table A.1. Variables of the datasets

Variable	Definition	Datasets
Population	Population connected to the water service.	SISPEA, IFEN
Price of water for a standard bill or a cubic meter	Price, inclusive of all taxes, for a standard bill of 120 cubic meters; price divided per 120 cubic meters.	SISPEA, IFEN
Tax-exclusive price and taxes	Price, exclusive of taxes, and decomposition of taxes in the tax-inclusive price.	IFEN
Water Quality	% of tests passing the compliance to the microbiological / physic-chemicals indicators.	SISPEA
Index of knowledge of the network	Index from 0 to 120, based on a marking system.	SISPEA
Network Performance	Ratio of consumed units to production.	SISPEA, IFEN
Average rate of network renewal	Average rate of network renewal – measure as the percentage of new pipes on all pipes - on the last five years.	SISPEA, IFEN
Amount of debt waivers and transfers to solidarity funds	Amount of debt waivers and transfers to solidarity funds in euros per cubic meter.	SISPEA
Unexpected rate of water interruptions	Number of water interruptions for 1,000 customers.	SISPEA
Duration of debt extinguishment	Number of years to refund the debt of the water service.	SISPEA
Rate of unpaid bills	Ratio of unpaid bills to total bills.	SISPEA
Rate of complaints	Complaints for 1,000 customers.	SISPEA

Table A2. Distribution of Regulation Functions in the French Water Sector (adapted from Salvetti and Canneva [2016])

Regulation Functions	French organisation bearing the function	Level
Quality standards for wastewater treatment	Environment Ministry	National
Quality standards for drinking water	Health Ministry	National
Supervising utilities' financing activities	Accounting chambers	Regional
Supervision of contracts with private sectors	Service (municipal or inter-municipal body)	Local
Carrying management audits on utilities	Service (municipal or inter-municipal body) / Accounting court	Local / National
Promotion of innovative technologies	Water Agencies	River basin
Defining public services obligations	Central government	National
Promoting demand management	Central government / Service (municipal or inter-municipal body)	National / Local
Incentive for efficient use of water resources	Water Agencies / Central government	River basin / National
Defining technical and service standards	Central government	National
Customer engagement	Service (municipal or inter-municipal body)	Local
Incentive for efficient investment	Water Agencies	River basin
Consumer protection and dispute resolution	Rights Defender	National
Uniform systems of accounts	Finance Ministry	National
Information and data gathering	Onema	National
Analysing utilities' investments/business plans	Service (municipal or inter-municipal body)	Local
Monitoring of service delivery performance	Onema	National
Tariff regulation	Service (municipal or inter-municipal body)	Local

Table A.3. Distribution of Regulator Powers in the French Water Sector (adapted from Salvetti and Canneva [2016])

Regulator Powers	French organisation bearing the power	Level
Compulsory collection of information	Onema	National
Mediate to resolve dispute	Administrative courts	Local
Enforce compliance with regulation	Water police for discharge / Regional health agencies for drinking water quality standards	Local / Regional
Investigate cases of breaches	Administrative courts	Local
Issue guidelines and code of conduct	Central government / Onema	National
Impose fines/financial sanctions	Administrative courts, criminal courts, Local authorities	Local
Audit water utilities	Accounting chambers	Regional
Review or approve contract terms	Service (municipal or inter-municipal body) / Local representatives of Central government	Local
Control profits and dividends	Accounting chambers	Regional
Veto utilities investment plans	Service (municipal or inter-municipal body)	Local
Impose or ban a particular technology	Health Ministry	National

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