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Neither Market Nor Hierarchy: Concurrent Sourcing in Water Public Services

Simon Porcher

Abstract

Analytical frameworks of government service contracting decisions typically focuses on the make-or-buy decision. In concepts, governments can either produce the service itself (make), or outsource production (buy). However, governments make and buy the same public services, a practice that is termed concurrent sourcing. Drawing on transaction cost economics and the resource-based view of the firm, this paper examines empirically local governments' propensities to concurrently source public services. Using a unique dataset on water public services of more than 4,000 French municipalities for four years - 1998, 2001, 2004 and 2008 - we find that low transaction hazards, prior contracting experience and low production capabilities have a positive impact on the level of concurrent sourcing. These findings demonstrate that organizations' characteristics are a significant factor in sourcing decisions and suggest that capabilities and their interactions with transaction hazards deserve heightened attention in the study of public contracting.

Keywords: water trading contracts, transaction costs, capabilities, concurrent sourcing, contracting.

Introduction

Government contracting for the delivery of public services has been a growing practice in the last decades (Greene [1996], Kettl [1993], Levin and Tadelis [2010], Savas

[2000] and Sclar [2000]). Analyses of government contracting decisions typically focus on corner solutions: governments can either directly produce the public service (make), or outsource the production of the public service (buy). In practice, governments both make and buy the same public service, a strategy that is often termed concurrent sourcing. Concurrent sourcing refers to splitting the total volume being sourced across multiple modes. It is different from hybrid governance forms (Williamson [1991]), which refer to sourcing the entire volume of the good from a single governance mode.

Myriad of approaches have been used to study why organizations simultaneously make and buy the same input[1], a phenomenon referred in the literature to variously as partial (Porter [1980]) or tapered integration (Azoulay [2004]), plural (Gulati et al. [2012]), dual (Adelman [1949]), or concurrent sourcing (Parmigiani [2007]) for example. Scholars in public administration, who primarily conceptualized the outsourcing decision as a dichotomous choice (Bel and Fageda [2009]) or a set of choices between direct management, private firms or intergovernmental contracting (Hefetz and Warner [2012]), have also adopted the view of concurrent sourcing to explain the mixed delivery strategy of local governments (Miranda and Lerner [1995], Hefetz et al. [2014]).

This article uses a dataset of more than 4,500 French water public services observed between 1998 and 2008 to explain the determinants of concurrent sourcing and shed light on its impact on performance. In France, as in most industrialized countries, municipalities are responsible for distribution, treatment and storage, and seeking additional water supplies when necessary. The production and distribution of water can be directly managed by the municipality or delegated to a private firm via lease contracts for example ("delegated management contracts"). Whatever the choice made by municipalities to organize the public service, they can sign contracts with other municipalities to trade water ("water trading contracts"). The present

[1] The typical example is the classical work by Monteverde and Teece [1982] in which the authors define "make" as when the firm produces 80 percent or more of its requirements and "buy" as when the firm produces less than this amount.

paper focuses on the latter. While it is probably less frequent in other countries, 66% of the municipalities in our dataset use water trading contracts. The setup of the game is the following. Assume that there are only two municipalities, municipality X, under direct management, and municipality Y, under delegated management. Both municipalities own water public services that are producing and distributing water to the final users. Municipality X can sign a water trading contract to buy, let us say 10% of its annual billed water, from municipality Y which solely uses internal production. This contract does not change the organization of the public service for both municipalities, municipality Y would just have to add an amendment to the lease contract with the private firm. In our terminology, municipality X concurrently sources water (or outsources 10% of its production to municipality Y) while municipality Y produces internally.

Why do then municipalities concurrently source water? At its core, the analysis of concurrent sourcing is not different from the make-or-buy decision; such problem which has been studied for a whole set of public services (Hefetz and Warner [2012], Levin and Tadelis [2010] and Savas [2000] for example). Consistent with transaction costs economics (TCE; Coase [1937], Williamson [1975]), we find that the governance structure of a given transaction is a function of the relative costs of transacting in markets and organizing procurement within the municipality (Brown and Potoski [2003b], Hefetz and Warner [2012], Sclar [2000]). Municipalities experiencing low transaction costs will then rely on concurrent sourcing more intensely than municipalities facing high transaction costs. Following the resource-based view (RBV) of the firm (Barney [1991], Penrose [1959] and Wernerfelt [1984]), another contributing factor is that municipalities' attributes can affect the level of concurrent sourcing. Our results show that municipalities with high production capabilities and high cost-efficiency tend to rely on internal production. Scholars in public administration have also referred directly or indirectly to the RBV to explain contracting performance (Brown and Potoski [2003a,b,c, 2004, 2006], Kelman [2002], Romzek and Johnston [2002] and Yang et al. [2009]). As Brown and Potoski [2003a] state, "contract-management capacity may be important - if not necessary - for successful contract arrangements". Our findings suggest that municipalities that can draw on superior contracting capabilities tend to rely on concurrent sourcing. We finally interact TCE and the RBV (Fabrizio [2012], Hefetz and Warner [2012] and Hefetz et al. [2015]) to assess how interactions between TCE and the RBV can mitigate or increase the level of concurrent sourcing. We find that capabilities have a declining effect when transaction costs are high. These findings suggest evidence that concurrent sourcing is used to mitigate price increases, to increase quality and to ensure service continuity for users.

We then analyze the impact of concurrent sourcing on performance, which complements previous studies on concurrent sourcing. Miranda and Lerner [1995], using data from a large sample of cities in the US, find that mix private or nonprofit sector production with some internal government production are generally cost effective. Arrangements mixing public and private procurement can improve the delivery of public services. Hefetz and Warner [2008] undertake a similar study and show that public managers integrate markets with public delivery in order to balance concerns with efficiency, market management, and citizen satisfaction. Our results show that concurrent sourcing has a significant positive impact on quality performance but results in price premiums, potentially because external procurement demands capabilities to negotiate contracts and to mitigate *ex post* hazards. Such a result is connected to Hefetz et al. [2014] who show that concurrent sourcing in public services is more frequent when local governments want to reduce risks.

This paper is of interest for scholars in public administration and policy for at least two reasons. First, the French institutional context and the quality of our data makes such a study very interesting. Contracts between municipalities are interesting to study because they represent, to a certain extent, situations in which a municipality ensures the production of a public service for another municipality, even though the elected municipal council remains responsible for the provision of the public service. Second, water supply is often considered a complex public service[2] and lessons learned from water issues are generalizable to a certain extent to other public services. Water trades between municipalities can be an important means to ensure service continuity, especially in countries experiencing water scarcity such as Spain or the United States. The recent case of Flint[3] in the United States shows the importance of water trading between municipalities. While the focus of the paper is on water trades for drinking water only, the results of the paper are of interests for researchers and professionals working on large water resources transfers. In California, Emerick and Lueck [2014] show that there is a huge market for water reallocations via contracted agreement. For example, the Imperial Irrigation District and San Diego County Water Authority have an agreement involving transferring water from the former to the latter. Water scarcity and the need to transfer resources are also prevalent in developing countries where scarcity can impact social stability. The results of our study can thus be of interest for researchers and professionals working on water trading as a whole and more generally inter-government contracting. Overall, this piece of research adds to our understanding of local governments' sourcing decisions to transactions' conditions and to their own capabilities. Our results offer evidence that sourcing decisions result from the nature of the transaction and contract management capabilities.

The remainder of the paper is organized as follows. The next section presents the theory and hypotheses while the section after introduces the institutional context. An empirical section follows that describes the dataset and the methodology. The results segment present the findings and how these relate to the hypotheses. A final section discusses the results. A brief conclusion follows.

[2] For example Brown and Potoski [2005] ask public managers to assess the transaction cost properties of 64 local government services. Public managers consider water distribution and treatment highly specific with respective scores of 3.94 and 4.12 out of 5. Hefetz and Warner [2012] use a similar survey and finds that contracts in water distribution and treatment are among the most difficult to manage (only electric and gas utilities are more difficult to manage).

[3] Since April 2014, the city of Flint has experienced a drinking water contamination crisis after the change in source from treated Lake Huron water via Detroit to the Flint River. The city used to buy water from Detroit since the 1960s. In 2013, the Flint city council decided to switch from Detroit water to its own internal production.

Theory and Hypotheses

Transaction Costs and Concurrent Sourcing

TCE has been established as a dominant lens to view firm boundary decisions. In this theory, the firm considers the *ex ante* and *ex post* costs as the primary determiner of whether to conduct an activity internally or externally, as these are distinct governance structures. Even if scale economies can be influential in the decision to make rather than buy, TCE stresses that production costs are not sufficient to understand the make-or-buy decision. Because of opportunism and bounded rationality, the key question with respect to the make-or-buy decision is determining when the transaction costs of using the market are larger than those of internal organization. For any transaction, a firm purchases from external suppliers when the cost of the input in the market, added to the transaction costs, is less than the cost of internal production. In the parlance of TCE, transaction costs associated with managing water supply are elevated because contract terms must account for transaction hazards such as service discontinuity (see Brown and Potoski [2003a] for an assessment of transaction costs in different public services) and because there is a chance of substantial risk of incurring costs through maladaptation, i.e. the failure to adapt. Uncertainties about the evolution of water consumption and the inability to foresee the various kinds of contracting hazards such as increased prices or decreased water quality due to bounded rationality[4] are important shifters of transaction costs in water trading markets.

According to Williamson [1996], asset specificity is the main driver of transaction costs. Asset specificity means that an asset's value is reduced substantially if a complementary asset which is contracted for is unable to be secured. The general result from the literature is that hierarchy is likely to dominate temporary contracting when either of two agents in a relationship makes relationship-specific investments (Klein et al. [1978] and Williamson [1979]). If a buyer makes investments in assets which are dedicated to a relationship with a particular seller, an interconnection

[4] It is for example difficult to verify on a daily basis the quality of water bought to the other municipality

between water networks for example, then there is scope for opportunistic behavior in short-term contracts. By the same token, it would be costly and difficult for the buyer to replace the supplier if the contract were to be suddenly terminated. Water public services exemplify these issues as service continuity and consumers' dependency affect asset specificity, bounded rationality, opportunism and thus transaction costs. When transaction costs are high, municipalities will increase the percentage of their own production to the point of internal provision.

A common assumption in public procurement (see Brown and Potoski [2003b] Levin and Tadelis [2010] and Hefetz and Warner [2012]) is that complexity in providing the service is assumed to be linked with contracts harder to write, monitor or adjust. Indeed, contracts that must agree on detailed plans of action to safeguard hold-up problems are more "relational" in a hierarchy (Williamson [1975]). Under hierarchy, there is small room for decision rights and adaptations are more flexible. Regulators or monitors that face complexity in producing their own inputs can decide to "buy" rather than "make" because uncertainty makes the production process more complex. When producing the good is costly, transaction costs to use the market become relatively lower than producing directly, i.e. buying is relatively less expensive that making. We thus expect the complexity of integrated production to have a positive impact on concurrent sourcing.

Hypothesis 1. *The greater a municipality's level of complexity in producing directly the good, the larger the level of concurrent sourcing.*

Capabilities and Concurrent Sourcing

The RBV suggests that organizations with different capabilities and resources have different production costs. Because capabilities are costly to develop and difficult to price and transfer, local governments would tend to directly perform the activities that they are good at. In this sense, the RBV complements TCE: local governments with capabilities to produce at low cost will use hierarchy and supply goods for other local governments which capabilities do not allow to produce at lower cost.

A simple reason motivating outsourcing is differences in retail prices between municipalities that are located in the same area, i.e. the level of concurrent sourcing depends on the level of capabilities of local governments relative to those possessed by local governments around (Demsetz [1988] and Jacobides and Winter [2005]). As Barney [1991] and Jacobides and Winter [2005] noticed, in a market, firms differ in their cost-efficiency or product quality. Behind the market lies another firm that produces a product. In this sense, the market is only an intermediary for buying and selling products and services. In our case, municipalities that decide to use contracts to buy and sell water compare their abilities with those of other municipalities. Concurrent sourcing is an economizing solution occurring when there are gains for trade. Local governments differ in their productive capabilities regardless of scale, and will buy from other suppliers who can carry out the same activity at lower cost. Differences in production costs among municipalities are incentives to trade water for economizing reasons.

Hypothesis 2. *The greater a municipality's cost-efficiency, the smaller the level of concurrent sourcing.*

From a dynamic point of view, capabilities can be developed, transfered or exchanged on a market Teece et al. [1997]. Municipalities might differ in their ability to write and administer contracts (see Brown and Potoski [2003a], van Slyke [2003] Yang et al. [2009]). Familiarity and experience in contracting are lowering the costs of using contracts for any given service because municipalities might be able to better anticipate possible future contingencies that affect the contractual relationship. Municipalities with capabilities to design contracts will be better at adequately safeguard contractual hazards that can emerge (Mayer and Salomon [2006]). Williamson [1996] himself explained that TCE "maintains that many economic agents have the capacities to learn and to look ahead, perceive hazards, and factor these back into the contractual relation, thereafter to devise responsive institutions. In effect, limited but intentional rationality is translated into incomplete but farsighted contracting." Another factor influencing the level of conflict among contractors is the relation between each transaction and other exchanges, depending on the actual type of transaction (Coase [1937]). The more homogeneous transactions are, the less expensive internal control of similar transactions and the larger the likelihood of contracting out is. This argument is linked to the theory of complementarities developed by Milgrom and Roberts [1990]. Complementarities refer to a situation in which the performance consequences of a choice depend on other choices. For example, the marginal returns to one activity increase as a firm does more of the other activities. In the context of public procurement, complementarity simply refers to the condition in which the marginal benefit of procuring a good from the market depends on the level of internal production, and *vice versa*. In the competitive market, complementarity is divided between incentive complementarity (Porter [1980]) and knowledge complementarity (Dyer and Singh [1998] for example). The former is based on competition between internal production and outsourced production. The idea is that concurrent sourcing gives the municipality the ability to credibly threaten backward integration to their suppliers. The latter is based on collaboration between internal and external suppliers in order to create value for the procuring municipality. As a result, municipalities benefit internal and external suppliers' knowledge improvements in production processes and technologies. A municipality's experience in doing one thing - i.e. making or buying - can have a positive impact on the tendency to take complementary contracts.

Hypothesis 3. *The greater a municipality's contracting capabilities, the larger the level of concurrent sourcing.*

Regardless of conflicts among transactors, there are short-term problems affecting contracting decisions, such as a constraints of production capabilities. Municipalities with high production capabilities tend to internally source the production of the good for at least three reasons. The first one is that their production capabilities risk the hold-up problem as concurrent sourcing might give the other party increased bargaining power resulting in reduced profits for the firm. The second characteristic is that municipalities with shortages in their production capabilities are naturally constrained in their production choices and are thus more likely to concurrently source than municipalities with abundant production capabilities. Third, in natural monopoly such as water, fixed costs take on the form of sunk investments, which make average price decrease and can be interpreted as incentives to produce. We thus expect production capabilities to have a negative impact on outsourcing and concurrent sourcing.

Hypothesis 4. *The greater a municipality's production capabilities, the smaller the level of concurrent sourcing.*

Interactions

In cases where transactions are complex and hazards common, a more capable municipality will establish routines that facilitate *ex post* adaptation and improve the likelihood of mutually agreeable outcomes. Lack of control over the production process or the buying mechanism can increase or mitigate transaction costs such as difficulties in monitoring contracts. Municipalities with superior production capabilities are less impacted when transaction costs increase because they can always revert back to a fully integrated production process. On the contrary, contracting capabilities are more valuable when transaction costs are relatively low. We expect a positive change in transaction costs to decrease the impact of capabilities to contract and increase the impact of capabilities to produce on concurrent sourcing.

Hypothesis 5. *Complexity in producing directly the good strengthens the impact of contracting capabilities on concurrent sourcing.*

Hypothesis 6. *Complexity in producing directly the good strengthens the impact of production capabilities on concurrent sourcing.*

Institutional Context: Water Supply in France

In France, as in most European countries, municipalities must provide local public services that have public good characteristics. Water provision and sewage are two of these public services and can be managed by two different operators. Water provision refers to the production and the distribution of water and sewage implies wastewater collection and treatment. The focus of this paper is water provision. As there is no national regulator, municipalities monitor prices, control entry and exit of firms into the market, organize competition and ensure uninterrupted service. However, if the responsibility for public services' provision is public, its 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. Under these delegated management contracts, the selected operator organizes the public service of water, and thus decides, in partnership with the municipality, of the level of water to be concurrently sourced.

Unlike the abovementioned contracts for the organization of the public service, water trading contracts are usually private-law contracts. These contracts are signed between two administrative authorities, a municipality or a group of municipalities.[5] Under private management, the delegatee will ensure water production and distribution for the municipality but also manage the different contracts signed with other municipalities to trade water.

There are two cases in which municipalities concurrently source water. The first set of reasons is linked to price, scale economies and quality. An obvious reason for buying water is when water production costs more than simply buying it from neighbor municipalities. This is especially true in the case of small municipalities located near large water producers. By buying rather than making, municipalities can benefit from the scale of the economies of the nearby service. Moreover, municipalities can buy from neighbor municipalities that have contracted out with the same operator. It is rather common that private operators spot markets from the same neighbor in order to produce and trade more water, especially when networks are already interconnected[6]. Eventually, municipalities buy water when their raw

[5]In some rare cases, the contracts are considered by the administrative court as being administrative contract. The criterion is that water trades have a direct impact on the organization of the public service of water. Water trades can have a direct impact on the organization of the public service when connecting investments must be undertaken to deliver water to the buyer.

[6]The Competition Authority issued a judgment in 2005 about the lack of competition on water trades when different firms are operating in the same area.

water is of poor quality. In this case, the municipality can buy raw water or treated water from another municipality at lower cost than if it had to directly produce it using its own resource. The second set of reasons is related to water scarcity. Municipalities that are not able to produce large volumes of water necessarily need to buy water to other municipalities. Another case of water scarcity is when there are industries that need large volumes of raw water to function. Large industrial factories can have a proper pipe connecting them to the water production plant. While in some cases concurrent sourcing occurs from necessity rather than option,[7] in some cases the intensity of concurrent sourcing is deeply influenced by transaction costs and capabilities.

Concurrent sourcing in the water market is interesting to study for several reasons. First, despite differences in raw water quality, concurrent sourcing in the public water service is made on an equivalent good. Even if water is not produced exactly with the same technology (treatments and plant quality can differ), distributed water is a good that is relatively homogeneous in quality and in its inherent characteristics. Second, trade frequency is important. Every year, 4 billion cubic meters of water are billed in France. Even if there are no clear statistics on global water trades between municipalities in France, the size and the level of the interconnections of the market increase the probability of concurrent sourcing. In our dataset, 56% of interconnected municipalities use concurrent sourcing and 66% of municipalities are involved in water trading. Third, various structural characteristics such as production capabilities make buying and selling capabilities rather exogenous to TCE and RBV. For these reasons, a significant impact of TCE and RBV on concurrent sourcing is particularly robust.

[7] This is analogous to the scissor effect described by Marques [2008].

Data and Empirical Identification

Datasets and Measures

The unique and fine-grained dataset we use in this study merges three sources. The data comes from the French Environment Institute (IFEN-SOeS), the French Health Ministry (DGS) and the French National Institute for Economics and Statistics (INSEE). The unit of observation is a municipality. We observe a set of municipalities in France during four years: 1998, 2001, 2004 and 2008. These municipalities are withdrawn from a representative set of municipalities. The final dataset is made of an ubalanced set of 14,884 observations, grouping 4,651 municipalities. Mean covariates and standard deviation are presented in Table 1 for the whole sample.

The IFEN-SOeS, collected by the French Environment Institute and the Environment Ministry, is a nationally-representative municipal survey of the public service of water. This sample is representative of the total French population and the local public authorities from where they are living: all sizes of local authorities are proportionally represented and municipalities with more than 5,000 inhabitants are all represented. The IFEN-SOeS database provides detailed information about water public services and municipalities' characteristics. There have been four data collections in the last ten years. The data collection proceeds as follows. Municipalities fill in the database, then the data is checked by the Environment Ministry. The IFEN-SOeS is the only representative national dataset on water public services. The database includes a lot of information about water supply at the municipal level - e.g. billed water in thousands, water sources, treatments and municipalities' characteristics that can influence water consumption. It also includes some data coming from the census made by INSEE. This provides information concerning incomes, regions and information about structural characteristics of the municipalities for example.

Dependent variable. Concurrent Sourcing is measured as the ratio between water bought to another municipality and water bought plus water production of a given municipality i at year t. This measure is consistent with prior works (Parmigiani [2007]). This variable takes values between 0 and 100, 100 meaning that 100% of the production of water is outsourced. This measure is better than a simple dummy variable equal to 1 if a municipality concurrently sources because it captures variations in municipalities' concurrent sourcing patterns.

Independent variables. The independent variables are our proxies to measure the level of transaction costs and capabilities. As abovementioned, municipalities with high production costs usually deal with relatively low transaction costs in contracting with other municipalities to buy water, because the costs of producing internally are likely to be higher than the costs of buying water. Complexity in producing water is mainly linked to the type of water and to the type of treatment needed to make the water drinkable. For example, ground water is usually associated with higher treatment complexity, i.e. needing more chemicals, because it is more polluted than underground water. Under mixed sources of water, costs might be higher than for ground or underfoot sources as the utility might need a treatment plant for each type of water. From the IFEN-SOES dataset, we know whether raw water comes from ground, underground or mixed sources. We used a dummy that equals 1 when raw water comes from *ground* or *mixed* sources and 0 otherwise. Water treatment does not only approximate the complexity of service provision but also the level of specific investments needed to operate the service. Treatments are sixfold and coded between 1 and 6 in the IFEN-SOeS dataset. Treatments 1 to 3 are pretty standard, treatments 4 and 5 are used when raw water needs a heavy disinfection treatment plus extra-controls. Treatment 6 refers to cases in which water needs mixed treatments, for example treatments of types 1 and 4, which is standard when water sources are mixed. A dummy that is equal to 1 when treatments 4, 5 or 6 are used and 0 either captures the complexity of the public service.

We built several variables that account for the RBV. *Selling Capabilities* are measured as the ratio between water exports and exports plus billed water for a given municipality i in time t. As *Concurrent Sourcing*, this variable goes from 0 to 100 and gives a good account of contracting capabilities. This measure is a good proxy for contracting capabilities because it captures effectively the experience of municipalities in writing and administrating water trading contracts. Moreover, there are no other reasons, either than contracting capabilities, explaining why municipalities selling water would buy water as well as they have apparently production capabilities. Contracting capabilities can be measured with the propensity to contract for other services than water trades. We used a dummies equal to 1 and 0 either if the city leases the water and sanitation public service. We expect these variables to have a positive impact on concurrent sourcing.

Production Capabilities are measured as the ratio between water produced and billed water for a city i in year t. Production capabilities capture the potential scale economies from internal production. We also include a proxy for *Cost Efficiency* that is the ratio between the marginal price of a given city i and the average marginal price of municipalities in the same administrative region as a municipality tends to buy water from other municipalities around. The intuition is that relative prices can motivate exchange, especially concurrent sourcing when the local price of water is high.

Controls. Several controls are included in the model. Population and incomes are important controls, because they can impact the city's resources. Including such controls purges effects that can be linked to the size or the economic conditions of the city. A dummy for touristic areas is taken into account because touristic municipalities face larger levels of consumption and need to increase their production capabilities during some periods of the year. We borrowed from INSEE a dummy that takes 1 when the municipality is located in a touristic area and 0 otherwise. We used variables computed by the French Ministry of Environment to distinguish urban, semi-urban and rural areas. This is an important control because we would expect rural areas to have more agricultural production that can increase the need for concurrent sourcing. Pipes' length are also an important control because it correlates to the level of water trades. Indeed, similar municipalities can differ in the size of the network because one integrally produces internally while the other uses concurrent sourcing and thus need larger connexions to the other municipalities around. Year and local fixed-effects are considered in all models such as regional and time fixed effects. This accounts for norms, rules and market structure that can influence contract hazards associated with TCE. These controls are also important because there can be some unobservable characteristics that can impact the outsourcing decision such as competition or the political agenda.

Empirical Identification

We use two different models to compute the impact of TCE and RBV on concurrent sourcing. As municipalities are not always interconnected, the decision to concurrently source might not be exogenous, i.e. municipalities must be interconnected to trade water. To control for this potential selection effect, we apply a simple Heckman [1979] selection model. In the first stage, we use a Probit model of the probability for a municipality of being interconnected as a function of explaining variables. The selection equation is:

$$V_i = \beta_0 + \beta Z_i + \eta_i \quad (1)$$

where V_i is a latent variable equal to one if the city is interconnected with other municipalities, β the vector of coefficients for the selection equation, Z_i the vector of covariates for city i and η_i the random disturbance for a given city i. The vector of covariates includes dummies for the urban, semi-urban or rural status, a dummy equal to 1 if the city is located in a touristic area, a dummy equal to 1 if water consumption is limited in the city and regional fixed-effects. From this equation, we compute the inverse Mills ratio that is added as a variable in the second-stage equation in order to account for the potential selection effect.

The first model uses an OLS regressor and takes concurrent sourcing as the dependent variable. In this case, we expect concurrent sourcing to be impacted by proxies for TCE and RBV. High transaction costs and production capabilities should have a negative impact on concurrent sourcing while contracting capabilities should have a positive impact. The equation takes the following form:

$$ConcurrentSourcing_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Y_{it} + \beta_3 \cdot X_{it} \cdot Y_{it} + \alpha\theta_{it} + \epsilon_{it} \qquad (2)$$

with X_{it} a set of variables capturing TCE characteristics, Y_{it} a set of variables capturing RBV characteristics and θ_{it} a set of controls in municipality i in year t.

We finally test the impact of the make-and-buy decision on various performance indicators such as price, water quality and network performance, controlling for regional and year fixed-effects and including all controls. The following OLS model is tested:

$$Performance_{it} = \gamma_0 + \gamma_1 ConcurrentSourcing_{it} + \tau\phi_{it} + \epsilon_{it} \qquad (3)$$

with ϕ_{it} a set of controls and fixed effects. To avoid any selection effect, the model is run on municipalities with interconnected networks. This model is useful to assess the impact of concurrent sourcing on performance.

Descriptive Statistics

Table 1 includes four panels regarding whether there is a make and buy decision. Panels (A), (B) and (C) respectively show the TCE, RBV variables and the other controls. The table is divided between public services that only make and use concurrent sourcing. Descriptive statistics provide an initial indication of the direction of the impact of transaction costs and capabilities on concurrent sourcing. In Panel (A), complexity is higher for services that make and buy, meaning that transaction costs to use the market as a governance mode are relatively lower for these municipalities. Panel (B) shows that municipalities with higher contracting capabilities are also more often concurrently sourcing. Moreover, municipalities using concurrent

Table 1: Descriptive Statistics

Variable	Definition	Make	St. Dev.	Conc. sourcing	St. Dev.
Dependent Variable					
Concurrent Sourcing	Ratio of Imports and Billed Units plus Imports, in %	0	-	24.577	(29.853)
Panel A: Transaction Costs Economics Variables					
Complex Treatment	Dummy equal to 1 if treatment is heavy or a mixture of treatments	0.207	(0.405)	0.421	(0.494)
Complex Water	Dummy equal to 1 if water comes from a ground source or a mixture of ground and underground sources	0.234	(0.423)	0.434	(0.496)
Panel B: Resource Based View Variables					
Selling Capabilities	Ratio of Exports and Billed Units plus Exports, in %	5.65	(11.701)	7.971	(13.330)
Contract in Sanitation	Dummy equal to 1 if the public sanitation service is contracted out	0.56	(0.496)	0.545	(0.498)
Private Management	Dummy equal to 1 if the water service is managed by a private firm	0.627	(0.484)	0.705	(0.454)
Cost Efficiency	Ratio of city i's marginal price and the average marginal price in city i's region and	0.986	(0.282)	1.014	(0.245)
Production Capabilities	Ratio of water Production on Billed Units	1.504	(1.027)	1.161	(0.682)
Panel C: Controls					
Group of Cities	Dummy equal to 1 if the municipality is part of a group of cities to provide public services	0.630	(0.482)	0.780	(0.415)
Population	City population, logged	7.694	(1.586)	8.121	(1.506)
Relative Income	Ratio of the median income of city i and the lowest median income in t	2.982	(1.101)	3.085	(1.222)
Pipes	Pipes Length in kilometers, logged	3.437	(1.123)	3.798	(1.028)
Touristic Area	Dummy equal to 1 if city is touristic	0.123	(0.328)	0.137	(0.344)
Semi-Urban Area	Dummy equal to 1 if the city is located in a semi-urban area	0.411	(0.492)	0.368	(0.482)
Urban Area	Dummy equal to 1 if the city is located in an urban area	0.184	(0.388)	0.207	(0.405)
Limitation	Dummy equal to 1 if water consumption is limited in the city	0.062	(0.240)	0.057	(0.232)

Note: Panel (A) describes variables used as proxies for the TCE. Panel (B) presents data corresponding to the RBV. Panel (C) gives descriptive statistics for the other controls. Panel (D) describes the variables used in the selection equation.

sourcing have lower cost-efficiency and production capabilities than municipalities only making. Descriptive statistics are thus consistent with our hypotheses.

Finally, Panel (C) shows that population, income, the probability of being in a touristic or an urban area are on average higher in utilities that use concurrent sourcing. These variables are important to understand the demographics of municipalities which are important shifters of demand that can explain concurrent sourcing.

Results

Concurrent Sourcing

Table 7 reports the results of equation (2) with concurrent sourcing as a dependent variable. Models (1) to (4) are OLS regressions. Models (1) and (3) test hypotheses 1 to 4. Models (2) and (4) test hypotheses 5 and 6. In all models, concurrent sourcing depends on TCE and RBV characteristics but models (2) and (4) include crossed variables to measure the moderation effect of the degree of complexity on contract and production capabilities. Models (1) and (2) use regional and year fixed effects while models (3) and (4) use the interacted year and region fixed effects. All models include the inverse Mills ratio to control for the potential selection effect (results from Equation (1) are presented in appendix).

We first comment on the main impacts observed in models (1) to (4). Complexity, measured as *complex treatment*, has a significant positive impact on concurrent sourcing in all models, which supports hypothesis 1; *complex water* has a positive but non-significant impact in models (1) and (2) but become positive and significant as expected when we change the nature of fixed effects. When complexity to produce is high, transaction costs to use the market become relatively lower than bureaucratic costs and the market will be selected as a sourcing mode rather than internal production. In all models, contracting capabilities at the utility-level, measured by *selling capabilities*, have a significant positive impact on concurrent sourcing. Experience in subcontracting to sell water fosters buying from other municipalities as hypothesis 3 stands. The main impact of *production capabilities* is significantly negative in both models and strongly supports hypothesis 4. We include another proxy for production capabilities that is the relative marginal price of a unit of production. The lower the relative price is, the more competitive the production capability of the city is and the less it will concurrently source water. We thus expected a positive relationship between the relative price and the level of concurrent sourcing, confirming hypothesis 2.

Table 2: Concurrent Sourcing as a Function of Transaction Costs and Capabilities

	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Variables	Concurrent Sourcing			
Complex Water (=1)	1.128	0.994	3.183***	2.998***
	(0.767)	(0.742)	(0.716)	(0.695)
Complex Treatment (=1)	4.19***	13.16***	4.456***	13.77***
	(0.675)	(5.039)	(0.677)	(5.105)
Selling Capabilities	0.198***	0.162***	0.240***	0.186***
	(0.037)	(0.037)	(0.036)	(0.037)
Production Capabilities	-9.736***	-7.589***	-10.05***	-7.706***
	(1.607)	(1.506)	(1.626)	(1.508)
Selling Capabilities·Complex Treatment		0.120		0.165***
		(0.083)		(0.082)
Production Capabilities·Complex Treatment		-7.516*		-8.107***
		(4.344)		(4.479)
Relative Price	5.960***	6.014***	5.283***	5.349***
	(0.992)	(0.974)	(0.981)	(0.958)
Private Management for Water (=1)	0.835	0.763	1.233**	1.085*
	(0.604)	(0.604)	(0.589)	(0.605)
Private Management for Sanitation (=1)	0.747	0.776	0.952*	0.979*
	(0.554)	(0.546)	(0.549)	(0.541)
Inverse Mills Ratio	-16.84***	-18.31**	-13.82***	-13.28***
	(7.620)	(7.356)	(1.646)	(1.773)
Constant	28.2***	26.1***	26.95***	24.89***
	(3.99)	(3.852)	(3.37)	(3.17)
All Other Controls	Yes	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	No	No
Regional fixed-effects	Yes	Yes	No	No
Year·Regional fixed-effects	No	No	Yes	Yes
Observations	14,884	14,884	14,884	14,884
R-squared	0.247	0.262	0.217	0.235

Note: Robust standard errors in parentheses with *p<0.10, **p<0.05, ***p<0.01. All other controls include all other variables presented in Table 1 that are not reported in this table.

Models (2) and (4) account for the interaction of complexity with capabilities.

Interaction terms show how transaction costs can mitigate or accelerate the impact of capabilities on concurrent sourcing. Consistent with hypotheses 5 and 6, we expect complexity, i.e. the costs of hierarchy, to strengthen the impact of capabilities on concurrent sourcing. In models (2) and (4), the interaction term between complexity and contracting capabilities has a positive impact on concurrent sourcing, thus showing that increased complexity renders transaction costs relatively lower and stimulates the use of the market to source the good. The negative impact of production capabilities on concurrent sourcing is reinforced by complexity as supports hypothesis 6. Lower transaction costs reinforce the impact of contracting capabilities and decreases even more the impact of production capabilities.

In Table 7, in appendix, we provide the results of models (1) and (2) but we add a dummy equal to 1 if the mayor is politically affiliated to a right-wing party and 0 if the mayor is affiliated to a left-wing party. The information is available for an unbalanced subset of 1,227 municipalities with more than 5,000 inhabitants. Political affiliation might influence contracting decisions of municipalities. Conventional wisdom would suggest that, ceteris paribus, right wing governments are more pro-market than left-wing governments. Our results show that political persuasion has no impact on concurrent sourcing and does not significantly alter the impact of the independent variables of interest.

In summary, both theories assisted in explaining the level of concurrent sourcing. TCE logic is supported as municipalities are more likely to buy if complexity for directly sourcing is high. The capabilities view is supported as greater contracting capabilities positively impact the level of concurrent sourcing, competitive capabilities decrease the level of concurrent sourcing while production capabilities decrease the level of concurrent sourcing. Overall, the results show that concurrent sourcing is a governance mode *per se* that can be explained by the traditional theories of the firm.

Discussion and Limitations

Discussion

Our results are consistent with TCE and RBV theoretical predictions. Intuitively, we would expect capabilities to be strengthened in environments with high levels of transaction hazards. Our intuition is confirmed by the empirical analysis. Results demonstrate systematic patterns in the heterogeneity of municipalities to organize the sourcing of water. However, the results show also that capabilities impact differently municipalities that have different levels of transaction costs and capabilities.

Municipalities with prior experience in designing and operating complex and incomplete contracts may find such contracts less costly to write, be more skilled at enforcing their requirements and be more accustomed to *ex post* adaptation. This contracting experience has a substantial and significant effect on organizational choices. However, because transaction costs differ from a municipality to another, contracting experience will have a declining effect when hold-up risks are more important. The same effect is observed for production capabilities. Production capabilities foster internal production and hierarchy rather than external sourcing via the market. The effect is stronger when transaction costs decrease.

The contribution of the paper to theory is that transaction costs do not only vary from a transaction to another but also from a production unit to another even in similar institutional environment. This means that studying government contracting should not be focused on the nature of the transaction but also on local governments' characteristics and their capabilities that can evolve across time.

The results also complement the RBV by specifying the transaction conditions under which municipalities make more or buy more a good and how the mix varies. Under high transaction costs, municipalities with high levels of production capabilities will predictably make more and buy less than municipalities with similar resources but operating on transactions with lower asset specificity. Perhaps, one of the most important insights to arise from a consideration of concurrent sourcing is the value of systemic local government-level analysis coupled with transaction-level analysis.

We finally assess the relative performance of municipalities using concurrent sourcing rather than internal production. We simply test the impact of concurrent sourcing on several performance indicators like price for a standard bill, marginal price, water quality and network performance. Prices are measured in euros. Water quality and network performance are expressed in percentage. Water quality is measured as the percentage of succeeded sanitary tests in regards to certain standards while network performance is measured as the ratio of water losses to the total volume distributed. Results are reported in Table 3. All four models are OLS regressions including year and region fixed effects. Because of missing data, the number of observations varies from a model to another. We observe that concurrent sourcing is associated with higher price level as depicted in models (1) and (2) but stronger quality standards as illustrated models (3) and (4) show. This raises a puzzle as the sourcing production unit would be expected to do so when its suppliers' production costs are lower. There can be various explanations to this trend. The first one is that for a given complexity making internally is always cheaper. This is especially true for water production as - contrary to other goods - there is no competitive advantage from external procurement in terms of knowledge or innovative competition. Moreover, the price charged to the sourcing municipality may be higher than those in internal procurement, due to the risk borne by having transaction costs in implementing contracts and uncertainty in the transferred volume. In this case, securing supply flows is a sufficient reason to source both internally and externally and the price premium is comparable to an insurance premium. To avoid disruptions in supply, municipalities would use concurrent sourcing as a means to assure the continuity of water public services. The slight increase in price would then be the price to pay to use alternative sourcing modes, rather than relying on the single use of internal production. Hefetz et al. [2014] find that concurrent sourcing is lower with inter-municipal contracts. They attribute this to more common goals between municipal partners and thus less risk and less need for concurrent sourcing. Our dataset does not allow us to track the characteristics of partners in the sourcing decisions.

We believe that this piece of research sheds light on the cost of this insurance premium, already highlighted in Hefetz et al. [2014]. The final reason is that in water markets, as in many commercial transactions, supply markets are relatively thin due to some specific investment or capabilities required to manage contracts and thus local governments have few potential external suppliers. This raises the trade-off between specific investments required for concurrently source a good and capabilities to negotiate with limited suppliers that we approximated with the model of concurrent sourcing. Higher quality standards under concurrent sourcing can result from higher market complementarity, improved performance from personnel that would fear competition from the other sourcing units or higher monitoring resources from local governments use to concurrently source. More investigation, using detailed contract-level data, could be undertaken to deepen these points.

Table 3: The Efficacy of Concurrent Sourcing

Variables	(1) OLS Price	(2) OLS Marginal Price	(3) OLS Water Quality	(4) OLS Network Performance
Concurrent Sourcing	0.119***	0.001***	0.005	0.017***
	(0.022)	(0.0001)	(0.006)	(0.005)
All Other Controls	Yes	Yes	Yes	Yes
Observations	12,738	12,738	7,682	12,487
R-squared	0.256	0.259	0.127	0.212

Note: Robust standard errors in parentheses with *p<0.10, **p<0.05, ***p<0.01. For ease in reading, all other controls include all variables used in previous regressions, except interactions. The number of observations falls as we do not have always complete information on performance.

As our dataset provides no access to contracts to exchange water, we collected annual reports on 139 bigger water utilities for 2009 that both make and buy water. All the observations include at least one city with 15,000 inhabitants. We could get information on the subcontracts with other municipalities for a subsample of 62 public services. Descriptive statistics are reported in Table 4. From this subsample, we find no evidence that trades are organized between municipalities managed by the same operators. In most cases, the motivation reported to trade with other municipalities comes from the need for service continuity and the existence of contracts to trade water with municipalities around. These exchanges can be negotiated through long-term contracts but usually the trade is organized using a short-term contract of one year that is renewed every year with an adaptation of the volume sold.

Table 4: Contracts to Trade Water

Variable	Mean	Standard Deviation	Min	Max
Billed Units	5102.25	6671.26	681.358	40298
Imports	1302.13	2003.60	0.48	9835
Average Number of Partners	1.94	1.41	1	7
Contracting with the Same Operator	0.23	0.42	0	1
Concurrent sourcing and selling	0.26	0.44	0	1

Note: Billed Units and Imports in thousands cubic meter for 2009. The average number of partners is the average number of contracts for municipalities using concurrent sourcing. The two last lines report the share of municipalities contracting with at least one city managed by the same operator and the number of municipalities which make, buy and sell water.

The transaction hazards and the framework studied in this paper are specific to the residential water industry. Nevertheless, the theoretical implications can be however expanded to other public services or to any contracting decisions.

Conclusion

This paper integrates TCE with the RBV to examine how transaction hazards and capabilities influence local governments' propensities to use concurrent sourcing in water public services. Using a unique dataset on water public services of more than 4,000 French municipalities for four years - 1998, 2001, 2004 and 2008 - we find that low transaction hazards, prior contracting experience and low production capabilities have a positive impact on the level of concurrent sourcing. These findings suggest that organizations' heterogeneity is a significant factor in governance decisions and that capabilities and their interactions with transaction hazards demand superior consideration in the study of contracting choices in public services. This paper also shows that concurrent sourcing is associated with higher price and quality, which we respectively interpret as a risk premium - to ensure the service continuity - and the result of a better monitoring of suppliers.

This paper has several implications for managers. When considering their sourcing options, public managers should not only be aware of the level of transaction hazards but also of their capabilities to manage contracts and to directly source the public service. Capabilities in contracting can be very important to mitigate hazards such as *ex post* renegotiation and this might be the reason why the results show that municipalities with high capabilities in contracting tend to concurrently source more than municipalities with low level of contracting capabilities. Local governments with superior capabilities in contracting can thus adopt concurrent sourcing to have a better monitoring of the sourcing process, benefiting from other local governments production capabilities and increasing incentives for their own services.

Some unobserved factors would deserve more attention, among them, the possibility that past governance choices provide learning and capabilities that are dynamic and can in turn influence future governance decisions, especially in local governments operating in an environment with a lot of transactional hazards. Organizational capacity is an important factor explaining the success of concurrent sourcing or mixed delivery (Hefetz and Warner [2008]). Further research should focus on collecting data on contracts in public services with high degree of concurrent sourcing to analyze the impact on the market structure of the make-and-buy decision.

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Appendix: Results from the selection equation

Table 5: The Determinants of Interconnections between Municipalities

Variables	(1) Probit Interconnected (=1)
Limitation (=1)	-0.015
	(0.053)
Touristic Area (=1)	-0.200***
	(0.068)
Regional, Urban status and Year Fixed Effects	Yes
Observations	19,454
Pseudo R-squared	0.15

Note: Robust standard errors in parentheses with *p<0.10, **p<0.05, ***p<0.01.

Table 6: Concurrent Sourcing as a Function of Transaction Costs and Capabilities, Including Controls in the Table

	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Variables		Concurrent Sourcing		
Complex Water (=1)	1.128	0.994	3.183***	2.998***
	(0.767)	(0.742)	(0.716)	(0.695)
Complex Treatment (=1)	4.19***	13.16***	4.456***	13.77***
	(0.675)	(5.039)	(0.677)	(5.105)
Selling Capabilities	0.198***	0.162***	0.240***	0.186***
	(0.037)	(0.037)	(0.036)	(0.037)
Production Capabilities	-9.736***	-7.589***	-10.05***	-7.706***
	(1.607)	(1.506)	(1.626)	(1.508)
Selling Capabilities·Complex Treatment		0.120		0.165***
		(0.083)		(0.082)
Production Capabilities·Complex Treatment		-7.516*		-8.107***
		(4.344)		(4.479)
Relative Price	5.960***	6.014***	5.283***	5.349***
	(0.992)	(0.974)	(0.981)	(0.958)
Private Management for Water (=1)	0.835	0.763	1.233**	1.085*
	(0.604)	(0.604)	(0.589)	(0.605)
Private Management for Sanitation (=1)	0.747	0.776	0.952*	0.979*
	(0.554)	(0.546)	(0.549)	(0.541)
Pipe		1.347***	1.307***	1.811***
	(0.583)	(0.561)	(0.522)	(0.501)
Population	-1.484***	-1.509***	-1.850***	-1.897***
	(0.495)	(0.486)	(0.445)	(0.438)
Touristic Area (=1)	3.114**	3.278***	4.567***	4.523***
	(1.036)	(1.006)	(0.803)	(0.867)
Limitation (=1)	-0.0603	-0.229	0.934	0.686
	(0.753)	(0.728)	(0.752)	(0.725)
Relative Income	1.629***	1.514***	1.823***	1.685***
	(0.37)	(0.37)	(0.303)	(0.314)
Group of cities	-2.181***	-2.060***	-2.614***	-2.513***
	(0.620)	(0.606)	(0.500)	(0.503)
Semi-Urban	-0.835	-0.818	-0.846	-0.681
	(0.928)	(0.898)	(0.718)	(0.712)
Urban	-5.123***	-5.144***	-4.794***	-4.428***
	(1.930)	(1.860)	(1.131)	(1.127)
Inverse Mills Ratio	-16.84***	-18.31**	-13.82***	-13.28***
	(7.620)	(7.356)	(1.646)	(1.773)
Constant	28.2***	26.1***	26.95***	24.89***
	(3.99)	(3.852)	(3.37)	(3.17)
All Other Controls	Yes	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	No	No
Regional fixed-effects	Yes	Yes	No	No
Year·Regional fixed-effects	No	No	Yes	Yes
Observations	14,884	14,884	14,884	14,884
R-squared	0.247	0.262	0.217	0.235

Note: Robust standard errors in parentheses with *p<0.10, **p<0.05, ***p<0.01. All other controls include all other variables presented in Table 1 that are not reported in this table.

Table 7: Concurrent Sourcing as a Function of Transaction Costs, Capabilities and Mayors' Political Persuasion

Variables	(1) OLS Concurrent	(2) OLS Sourcing
Right-Wing Mayor (=1)	0.140	0.198
	(0.717)	(0.680)
Complex Water (=1)	-2.350**	-2.430**
	(1.001)	(0.944)
Complex Treatment (=1)	3.954***	20.17
	(1.065)	(13.00)
Selling Capabilities	0.365***	0.283***
	(0.102)	(0.0650)
Production Capabilities	-24.86***	-18.43***
	(5.269)	(3.765)
Selling Capabilities·Complex Treatment		0.150
		(0.204)
Production Capabilities·Complex Treatment		-13.09
		(11.39)
Relative Price	1.928	1.995
	(1.716)	(1.680)
Private Management for Water (=1)	-1.230	-1.129
	(1.071)	(1.028)
Private Management for Sanitation (=1)	1.320	1.405*
	(0.875)	(0.832)
Pipe	2.201**	2.017**
	(0.870)	(0.819)
Population	-3.126***	-2.925***
	(0.904)	(0.876)
Touristic Area (=1)	2.442	2.645*
	(1.510)	(1.433)
Limitation (=1)	0.619	0.479
	(1.195)	(1.182)
Relative Income	0.0722	0.0410
	(0.476)	(0.481)
Group of Cities (=1)	-3.269***	-2.940***
	(1.106)	(1.024)
Inverse Mills Ratio	7.143	5.017
	(6.894)	(6.518)
Constant	61.96***	51.53***
	(8.774)	(8.347)
All Other Controls	Yes	Yes
Year fixed-effects	Yes	Yes
Regional fixed-effects	Yes	Yes
Observations	4,179	4,179
R-squared	0.399	0.421

Note: Robust standard errors in parentheses with *p<0.10, **p<0.05, ***p<0.01. All other controls include all other variables presented in Table 1 that are not reported in this table.