

# The Political Economy of Utility Privatization: Structural and Political Determinants

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## **Abstract**

In the developed and developing world alike, seemingly small decisions over how to organize utilities can significantly impact the lives of average citizens. Whether a given utility is publicly or privately controlled may affect firm capabilities and objectives, which explains the not infrequent headlines and controversy surrounding decisions to privatize essential utilities. At the same time, privatization is often defended as a solution to public sector inefficiency or indebtedness. Nonetheless, little is known about what factors actually drive sector organization decisions. This paper develops a model of local government decisions over utilities ownership that depends on long-term regulatory and administrative costs, consumer sensitivity to product quality, and the political costs associated with acting contrary to the desires of interest groups and voters. In order to test the implications of the model in a way that controls for unobserved heterogeneity, this paper undertakes a firm-level analysis of one particular utility: water. Using a unique panel dataset covering all community water utilities in the United States over the period 1997-2003, we shed light on two questions: First, what factors account for the present-day distribution of ownership types in the U.S., where water utilities are almost evenly divided between public and private ownership? Second, what factors induce local authorities in control of publicly-owned systems to undertake privatization? As expected, local conditions that increase the costs of administrating and regulating private utilities make private ownership less likely. However, there is also strong evidence that utility ownership decisions are a function of the political interests of the median voter as well as organized labor, and that increased voter sensitivity to water service quality makes public ownership more likely.

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# 1 Introduction

The privatization of government-owned utilities is controversial. While private ownership is often motivated by the argument that profit-motivated private firms are inherently more efficient, others argue that the positive externalities of universal, affordable service—and the implied subsidies and cross-subsidies that this may entail—are most easily achieved under government ownership. A consumer welfare issue is at the heart of the privatization debate, but it is not clear how governments actually go about weighing the efficiency of private firms against the associated regulatory costs and against the potentially greater ability of public firms to prioritize cross-subsidies and product quality. What factors ultimately determine a policymaker’s choice over public versus private ownership of utilities? Answering this question in the context of the democratic, developed world can shed light on the politics of network industries in such countries. It also provides a useful baseline from which to understand the politics of network industries in the developing world. Where factors shown to impact ownership decisions are absent in developing countries, utility ownership decisions may be driven by only a subset of the factors that a responsive government might take into account.

A careful, firm-level study of one of the most essential utilities for human well-being—piped drinking water—provides a concrete way to explore these questions. For data reasons, our focus is the United States. In the U.S., just under half of water utilities are publicly-owned.<sup>1</sup> Water utility ownership decisions are generally under the jurisdiction of local governments, but little is known about the factors actually motivating these decisions. In particular, how are ownership decisions impacted by region- and utility-specific factors that impact the inherent costs of monitoring and regulating a private firm? What role does potentially variable consumer sensitivity to water and customer service quality play? Finally, can features of the political and institutional environment impact the type of ownership arrangement chosen? Answers to these questions can be sought in two domains: First, what

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<sup>1</sup>Although, interestingly, around 80% of those served by community water utilities in the U.S. get water from a public utility, as larger utilities tend to be publicly-owned.

factors can account for the present-day distribution of water utility ownership types in the U.S.? In particular, why are water utilities almost evenly split between private and public ownership? Second, what factors induce local authorities to make infrequent but occasional changes to the existing ownership structure? In particular, what motivates policymakers to privatize publicly-owned utilities?

Despite recent trends toward privatization in network industries throughout the world, little is known about the drivers of ownership decisions. Much of the literature on “privatization” relates to government decisions regarding whether to provide services in house or contract them out to private parties (López-de-Silanes *et al.* 1997; Levin and Tadelis 2007), generally ignoring what would motivate the drastic decision of giving away ownership rights entirely. Furthermore, most existing papers focus on rough cross-sectional equilibria instead of rigorously analyzing changes to the ownership structure of a given utility over time. The literature that does treat ownership privatization tends to focus on large-scale privatizations that may differ substantially from typically small utilities privatizations (see, for example, Clarke and Cull 1998; Opper 2004). Indeed, Opper (2004) notes that her main findings on the motivations of large-scale privatizations during the transition in Eastern Europe did not apply in the case of some smaller-scale privatizations that she explored. Additionally, most empirical work—with the exception of Levin and Tadelis (2007), who discuss this shortcoming in the literature—does not test any specific theoretical model, and simply aims to simultaneously test the implications of various theories and intuitions. This paper contributes to the existing literature by explicitly examining ownership changes instead of only contracting decisions, performing both cross-sectional as well as panel data analysis, examining small and moderate-sized firms—which are more intimately related to day-to-day local public policy—instead of only large firms or entire industries, and doing so within the confines of an explicit theoretical model with testable empirical predictions.

Large datasets on the ownership of small and medium-sized utilities and other firms—and especially on changes to that ownership structure over time—are scant, which has hindered research in this area. Fortunately, owing to the help of the Environmental Protection

Agency, we were able to obtain firm-level data on the universe of community water utilities in the United States over the period 1997-2003. Using this unique panel dataset, we empirically test a theoretical model of utility ownership decisions by local government policymakers. The model is largely adapted from a model of government contracting decisions in Levin and Tadelis (2007), although the model is augmented to incorporate the very relevant political costs and benefits of ownership decisions. The model yields several fairly sharp predictions regarding the physical, political, and institutional factors influencing ownership decisions. As expected, local conditions that increase the costs of administering and regulating private utilities make private ownership less likely. However, there is also strong evidence that utility ownership decisions are a function of the political interests of the median voter as well as organized labor, and that increased voter sensitivity to water service quality makes public ownership more likely. While all of these factors explain the rough equilibrium distribution in ownership types, quality-sensitivity and political concerns appear to be the most important factors accounting for privatization on the margins. From a development perspective, we interestingly find that civic involvement via participation in elections decrease the likelihood of private ownership and privatization. This has interesting implications in the developing world, where privatization of water and other industries is becoming increasingly frequent and is often protested.

The paper is organized as follows: Section 2 offers background information on water utilities in the United States and reviews the literature on public-private decisions. Section 3 develops a theoretical model of local government officials' utility ownership decisions and presents the testable implications. Section 4 describes the dataset and the empirical approach. Section 5 presents a cross-sectional analysis examining factors that can account for the present-day "rough equilibrium" distribution of ownership types. Section 6 presents a panel data analysis of the factors affecting privatization. Finally, section 7 concludes.

## 2 Background

### 2.1 The Impacts of Private Ownership

Does ownership (public or private) matter for consumer outcomes? On the whole, the answer seems to be “it depends.” Existing empirical studies of the effects of water privatization—many of them from the developing world—are mixed. Some suggest that privatization is not detrimental to efficiency *or* measures of consumer welfare (see, for example, Byrnes, *et al.* 1986; Feigenbaum and Teeple 1983; Teeple and Glyer 1987; Estache and Rossi 2002; Renzetti 2003; Clarke *et al.* 2004; and Wallsten and Kosec 2007).<sup>2</sup> Still others suggest that privatization has added to efficiency or consumer welfare when compared with public ownership (Estache and Kouassi 2002; Bitran and Valenzuela 2003; Galiani *et al.* 2003). Bhattacharyya *et al.* (1995) find that private (public) operators tend to be more efficient among small (large) systems (i.e. utilities). There is clearly not a consensus, and location-specific factors and policy goals may play an important role in determining the ideal form of ownership from the perspective of a benevolent social planner. One interpretation of these mixed results is that private ownership may be more efficient, but private firms may be costly to regulate in a way that prevents them from harming some consumers. For example, government firms may operate at a loss or engage in heavy cross-subsidization in an effort to achieve particular policy goals, whereas private firms are driven by the profit motive. Privatization, then, may imply a larger pie with a completely different distribution scheme in place.

### 2.2 Literature Review: Private or Public?

On a political level—and perhaps in part as a result of the lack of consensus in empirical work—the question of whether water systems should be owned by governments or by private firms is controversial. Proponents of private ownership argue that firms can deliver water and sewerage services more efficiently than can governments. Governments have diverse, and

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<sup>2</sup>Consumer welfare, loosely and broadly defined, refers to access to water, human health, and expenditure on water, among other things.

often contradictory, objectives that may lead to a misallocation of resources. For example, politicians may feel pressure to provide jobs in the utility to constituents rather than investing in the infrastructure. In addition, public ownership may make the government both the regulator and the regulated firm, with potentially incompatible incentives. Opponents argue that private ownership is both difficult and impractical given the large externalities of most network industries, and the limited scope for competition. Many also worry that a private firm's profit-maximization objective will make it less likely to serve the public interest than a similar, public firm. Some of the groups least likely to receive high-quality water service at affordable prices are those with less ability to pay: minorities, the poor, and populations that are more expensive to serve, such as those in rural areas. Many governments provide affordable public services to such groups through elaborate cross-subsidization initiatives. Such initiatives may be harder to negotiate and offer under private ownership arrangements, leading vulnerable groups to call for public ownership.

Theoretically speaking, in a world of complete contracting, government ownership is unnecessary to control firm behavior. Provided that contracts are sufficiently detailed, public and private firms have the same incentives (Sappington and Stiglitz 1987; Hart 2003; Martimort *et al.* 2005; Martimort 2006). In practice, however, contracts are incomplete. As a result, a case can be made for either private or public ownership, depending on the nature of the contracting difficulties and the externalities involved. Mitigating factors also come into play. For example, if the political benefits of a particular type of ownership are high enough, they may be able to outweigh any relevant inefficiencies or contracting costs.

Given incomplete contracting, several theory papers examine the factors affecting private ownership. Martimort (2006) finds that private ownership reflects a pro-firm bias of politicians, and is specifically undertaken to commit the locality to a decision that is not easily reversed.<sup>3</sup> Shleifer and Vishny (1994) find that politicians use public firms to obtain political benefits. Such firms—which typically employ 20-30% more people than similarly productive private firms—are used to offer excess jobs and wages to political supporters

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<sup>3</sup>Martimort (2006) notes that the difficulty of overturning private ownership is particularly acute in developed countries, where property rights are often secured so as to make municipalization without grounds complicated.

(especially when the firm is large), and to control prices for political ends. In the model, private ownership is selected when politicians determine that the benefits of lower taxes (more feasible under private ownership) outweigh the political benefits of public ownership. Accordingly, the authors note that privatization should occur when conservative governments replace leftists. Finally, Debande and Friebel (2004) find that privatization has the benefit of potentially inducing efficiency-generating restructuring, but the drawback of giving control rights to a private firm that may later demand a costly bailout. The ideal ownership type depends on whether the private firm restructures or shirks, with shirking being more likely when the firm is unprofitable. Thus, privatization is more desirable from a policy perspective when firms are quite profitable.

Several empirical papers have also examined factors affecting privatization. Clarke and Cull (1998) found that bank privatizations in Argentina in the 1990s were more likely following fiscal and economic crises, when the province's governor belonged to a fiscally conservative party, and when banks were of low quality and thus required costly re-capitalization through government subsidies. Opper (2004), based on a cross-country analysis of privatizations in European transition economies, found that large-scale privatization is increasing in the presence of right-wing parties and is decreasing in the presence of political veto players, unemployment, and urbanization, while small scale privatization is less affected by these factors. Other studies have focused on the related issue of private contracting. López-de-Silanes *et al.* (1997) find that local governments are less likely to contract services out to private suppliers when public unions are strong, but are more likely to do so in the presence of state laws restricting county spending, as these diminish the benefits of provision by government employees. Levin and Tadelis (2007) present and test a model of the factors affecting city government service contracting decisions in the U.S. They find that private contracting is decreasing in resident sensitivity to quality and contracting difficulty and increasing in city size and experience with private service provision.

This last note on contracting raises an important issue: why should the ownership type of a water system be the focus of the present analysis and not government contracting

decisions? The answer is that neither is ideal; the critical issue we wish to capture is the level of government (versus private) *control* of the utility. Control is primarily exercised through two main channels: ownership and operation. Technically, water can be provided by three types of utilities: publicly-owned and operated, publicly-owned and privately-operated, or privately-owned and privately operated utilities. While it would be ideal to explore the determinants of each type of arrangement, to my knowledge, data that identify both ownership and operation of water utilities are not available for the U.S. (or any other country). Data on government contracting decisions are available; the most comprehensive dataset I know of comes from periodic surveys conducted by the International City/County Management Association (ICMA).<sup>4</sup> However, these data are not available on an annual basis, they focus on cities and thus miss a vast number of more rural areas, and they come from a survey with a response rate of only 20-25%. The most problematic facet of these data, however, is the fact that they exclude services that are not provided by the government. As such, while they distinguish the identity of the operator (public or private) of publicly-owned utilities, they ignore the 52% of U.S. water utilities that are privately-owned and operated, and that thus do not involve a government-provided service.<sup>5</sup> Ownership data, however, are available on an annual basis from the EPA and cover the entire universe of water utilities in the U.S. The problem with ownership data is that they conflate the former two provision arrangements; that is, it is not possible to distinguish between publicly-owned and operated systems versus publicly-owned and privately-operated systems. However, ICMA data indicate that only about 20% of government services are administered through private contracts, and the rest are provided in house (see Levin and Tadelis 2007). This would suggest that roughly 90% of water systems are either publicly-owned and operated or privately-owned and operated.<sup>6</sup> These types of systems represent the greatest extremes of public versus private control. Us-

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<sup>4</sup>These data were used, for example, by Levin and Tadelis (2007)

<sup>5</sup>Evelina Moulder, director of surveys at ICMA, reported that the survey was intended to elicit responses on contracting decisions (private contractor or in-house provision) *only* for publicly-owned water utilities. That is, surveyed city officials were not intended to answer the question of whether their government used in-house provision or private contracting if in fact the utility was privately-owned. She noted, however, that it may be the case that some surveyed city officials may have responded that there was private *contracting* when there was actually private *ownership*. This is another problematic feature of the data.

<sup>6</sup>Because 52% of systems are privately-owned, and 80% of publicly-owned systems are operated by the public sector, this gives  $52 + (0.8 \cdot 48) = 90.4\%$ , a rough calculation.

ing only ownership to identify control, however, will imply accepting some degree of data contamination given that this figure is not 100%. However, this problem is deemed second order compared to the more severe problems associated with the ICMA data. Given the differing units of analysis, furthermore, the ICMA data cannot be effectively matched with the EPA data. Ownership is thus regarded as a proxy for control. Public ownership indicates mostly public control and private ownership indicates private control.

### **2.3 Water Utilities in the United States**

Most Americans receive their drinking water from a Community Water System, which the Environmental Protection Agency (EPA) defines as a water provision network (or “system,” or “utility”) serving at least 25 people. The system is essentially a collection of equipment that treats and supplies water for human consumption.<sup>7</sup> As of 2003, there were just over 53,000 water systems in the U.S., serving most (275 million) Americans. Table 1 shows the approximate number of systems per county in 2003; the average is about 17, and the median is nine. Each system is either privately- or publicly-owned, and about 93% of publicly-owned systems are owned by local governments, with the rest under state or federal ownership. While privately-owned systems are slightly more prevalent than publicly-owned systems (52% are private), public systems serve about 83% of the consumer market. This is due to the fact that larger systems are more often public while smaller systems are more often private. Table 2 shows the number of water systems in 2003 by system ownership and system size category; Table 3 shows the number of service connections (taps) by ownership and size.

The state has responsibility over drinking water quality regulation, an authority granted to it by the EPA and usually administrated through a state environmental oversight agency.<sup>8</sup> All water systems in the county—public or private—face the same, EPA-mandated regulations and standards regarding appropriate treatment techniques, the maximum levels of harmful contaminants permitted in drinking water, and quality monitoring and reporting

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<sup>7</sup>The set of equipment may include—but is not limited to—water lines and pipes, pumps, treatment facilities (including settling basins, filters, and chemical treatments), and storage tanks.

<sup>8</sup>E.g., in California, the Department of Public Health has jurisdiction over water quality regulation; in Indiana, it is the Department of Environmental Management; in Maryland, it is the Maryland Department of the Environment.

requirements. Water systems must notify consumers, in a timely manner, of any violations they incur. In addition, systems must present consumers with an annual report, outlining a number of EPA-specified details regarding that system’s water quality performance over the past year. The goal of these regulations and reporting requirements is to ensure that water meets stringent national water quality standards, as mandated by the Safe Drinking Water Act, and to ensure that consumers and other interested parties are made aware of how their utilities measure up.

The state also has responsibility over water rate regulation, but usually only in the case of private utilities.<sup>9</sup> This authority is generally exercised by the state’s public utilities commission or a similar, independent state-level regulatory agency.<sup>10</sup> Different states determine what constitute fair rates in slightly different ways, but typically draw on the knowledge of economists, accountants, and engineers to analyze demand, owner expenses, and investment, thus settling on a rate of return via some pre-specified algorithm. While the regulatory environment may vary by state, rules within states tend to change slowly over time (Mann 1993). State public utilities commissions are also often charged with the regulation of service quality, and must approve activities such as the creation of a new water system or the laying of new equipment.

Beyond quality and rate regulation, most water systems—whether publicly or privately owned—are under the jurisdiction of local government authorities, such as city councilors or a county board of supervisors. These officials are either elected or appointed, and in addition to running the county (or municipality, or city), they have the authority to decide how best to provide drinking water service: through publicly- or privately-owned firms.<sup>11</sup> While the exact rules vary by state, these officials generally make ownership decisions when new systems are to be established, and are also able to seek changes to the ownership structure of existing utilities. In the case of privatization, they can seek a private buyer and negotiate the sale of one of their own water systems. Such sales are reportedly not difficult

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<sup>9</sup>Public utilities (regarded as nonprofits) are generally not rate-regulated.

<sup>10</sup>For example, in California, the California Public Utilities Commission is charged with rate regulation; in Indiana, it is the Indiana Utility Regulatory Commission; in Maryland, it is the Maryland Public Service Commission.

<sup>11</sup>In California, for example, members of an elected county board of supervisors are the local government authorities in charge of water system ownership decisions.

to manage when there is a will on the part of local authorities, as private buyers are generally readily available.<sup>12</sup> In the case of municipalization, the government can revoke a private system's operating authority if it, or a neighboring public water utility or other public body wishing to take over operations, condemns the private system on such grounds as the inability to meet demand, noncompliance with rate regulations, or poor water or service quality. Such a condemnation would presumably lead to a courtroom decision regarding whether the sale should be forced and, if so, what the government must pay in order to take over ownership of the assets.<sup>13</sup> If the owner of a private system wishes to sell the utility, local authorities may either take over the ownership or—subject to public utilities commission approval—transfer the assets to a private buyer.

Ownership changes are relatively infrequent, but do occur. During the period 1997-2003, for example, just over 5% of systems experienced ownership change. Of these, about 2% of systems underwent a privatization and about 3% underwent a municipalization. It is important to note, however, that changes in both directions should not be dismissed as unimportant “balancing out.” The relevant objects of study are the individual systems and local governments themselves, rather than national trends, and so changes on the margins can reveal valuable information about how ownership decisions are made. Appendix A presents two case studies of privatization and municipalization.<sup>14</sup>

Many utilities entail unique challenges. Fixed costs are high, the potential for competition is limited, and the sector has large externalities. Governments may encounter political obstacles to privatization, and private investors may worry about expropriation. While direct competition in water provision is difficult, indirect competition is more feasible. Such com-

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<sup>12</sup>This is especially true if local authorities “sweeten the deal” in order to attract a buyer. For example, according to Zeke Sushko of the Maryland Public Service Commission, the local government could agree to make certain investments before transferring ownership, deed over portions of the existing infrastructure to the purchaser at no cost or reduced cost, provide free or reduced-cost land for portions of the infrastructure, or streamline the approval process for the purchase. According to Fred Curry of the California Public Utilities Commission, “In my experience, private buyers are readily available.”

<sup>13</sup>It is important to note that private to public ownership changes may be difficult to bring about without some evidence that the private system has violated water quality, service quality, or rate regulations, failed to meet demand, or otherwise disappointed consumers or the government. However, the power of eminent domain allows for such takeovers, and the local government has the right to initiate court proceedings if deemed necessary or desirable. In the case where the private utility's contract specifically states that ownership reversal (with due compensation) will be permitted if so desired by the local government, the private firm will be less able to resist municipalization than in the aforementioned case in which the court determines the system's fate.

<sup>14</sup>It is important to note that while the word “privatization” is often used loosely to indicate any of a number of types of private sector participation in the water industry (such as through management contracts or leases), it is used here only in the context of asset ownership.

petition could take the form of competition for the market (through competitive auctions), competition through the threat of entry (Demsetz 1968), or “benchmark competition” (also known as “yardstick competition”), whereby the existence of a large number of water systems within close proximity of one another provides consumers and regulators with a frame of reference for what is reasonably achievable in terms of prices and quality in that particular area. Shleifer (1985) formalized a model of regulation via benchmark competition in which a regulated firm’s prices depend on other firms’ costs, but his findings may also apply to observable information other than prices, such as water quality. Even if consumers cannot choose among competing drinking water systems, utilities may face performance pressure if consumers or regulators can compare systems. Consumers could express their dissatisfaction through their elected representatives, while regulators could use the information from benchmark comparisons to demand price or quality changes, with potentially dramatic effects on firms.

### **3 Theoretical Model and Predictions**

The decision of local government officials between public and private utilities ownership is modeled as a choice over contractual form, and is based on Levin and Tadelis’ (2007) model of government service contracting decisions. Levin and Tadelis’ model is based on “buying a service” from a private firm, but it is easily extended to the more dramatic situation of actually ceding assets to the private sector, since privatization itself simply involves an ultra-long term commitment to a contracting relationship. While Levin and Tadelis describe the costs of drawing up a contract and stipulating the relevant details of the service to be performed, it is easy to recast these costs as the costs of regulating and monitoring a private utility in the case of asset privatization. Given that privatization is a more dramatic decision than private contracting, however, it is likely to carry with it additional political costs that more classic contracting does not. For this reason, while Levin and Tadelis’ model can be adapted to the circumstances of privatization largely as-is, it is necessary to augment their

model in a way that can account for the power of political pressures on local governments' decisions. In what follows, the basic model is described. The innovation upon their model lies in recasting contracting costs as regulatory/ administrative costs, and then incorporating elements of the political process into its original design.

As in Levin and Tadelis' (2007) model, the local government is the principal, specifying a contract of the form  $(\hat{w}, \hat{q}, \hat{t})$ , where  $\hat{t}$  specifies a minimum amount of time that the agent must spend on the job,  $\hat{q}$  specifies a minimum quality standard, and  $\hat{w}$  specifies the amount the principle will pay if the agent meets these time and quality standards.<sup>15</sup> Time and performance (quality) requirements are assumed to be contractible, but labor intensity (effort) is not. It is not difficult to show that an optimal contract specifies a quality standard or a time requirement, but never both.<sup>16</sup> This implies two potential contracts—one specifying a minimum value of  $\hat{t}$ ,  $(\hat{w}, 0, \hat{t})$ , and one specifying a minimum value of  $\hat{q}$ ,  $(\hat{w}, \hat{q}, 0)$ . The decision between these two contract types can be thought of as a choice between internal water provision using salaried employees (who have minimal effort incentives) hired to work for  $\hat{t}$  hours in order to achieve the desired level of quality,  $\hat{q}$ , or instead ceding control of the industry to a private firm that can use any combination of time and effort desired to obtain a specified quality performance standard,  $\hat{q}$ . That is, the ownership decision is a decision over whether to use an employment contract (EC) or a performance contract (PC).

The agent is assumed to be endowed with  $T \geq 0$  units of time. If the agent agrees to a performance contract,  $t \leq T$  units of time are devoted to working for the principal and the remainder are applied to an outside job that pays a reservation wage of  $r > 0$  per unit of time. Thus,  $t \geq 0$  is time spent on the job and  $e \geq 0$  is the agent's effort intensity. The cost to the agent of effort when working for the principal is  $c(e)$  per unit of time, and we assume that  $c', c'' > 0$ . If the agent spends  $t$  hours working for the principal at effort level  $e$ , he is paid a wage  $w \geq 0$  and his utility is given by

$$U_A = w - c(e)t + r(T - t)$$

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<sup>15</sup>Hats indicate values specified in a contract by the local government official.

<sup>16</sup>Levin and Tadelis (2007) show this explicitly for a similar model (Proposition 1).

The agent maximizes utility by choice of  $e$  and  $t$ , with a different constraint for each type of contract. In particular, the constraints for each contract type are:

$$t > \hat{t} \quad (\text{EC constraint})$$

$$(\rho + e)t \geq \hat{q} \quad (\text{PC constraint})$$

The principal values both high quality,  $q$ , and low costs of provision. In the context of water provision by utilities, quality includes the cleanliness, appearance, and price of water, the promptness with which leaks and cutoffs are fixed, and the efficiency and promptness of communications with customers, among other factors. Quality is given by

$$q = (\rho + e)t$$

where  $\rho > 0$  is baseline productivity. Gross surplus is increasing in  $q$ . Costs of provision are of three types: wages required to satisfy the traditional incentive compatibility and individual rationality constraints of the agent, administrative and regulatory costs, and political costs—each to be discussed in turn.

In a world without administrative (regulatory) and political costs associated with ceding industry control to a private firm, any desired  $q$  can be obtained at lower cost from a performance contract than from an employment contract.<sup>17</sup> This follows from revealed preference; under private ownership, the agent chooses  $t^*$  and  $e^*$  in order to achieve a specified quality standard  $q$  at least cost. Constraining the problem to a specific value of  $t$  can only increase the costs to the agent of obtaining quality level  $q$ , thus weakly decreasing his utility and weakly increasing the wage required to induce him to accept the contract. Using salaried employees for in-house provision thus entails productive inefficiencies that are not present under a performance contract.

Nonetheless, the assumption that privatization comes without administrative and political costs is unrealistic. If these costs are high enough, the ability to avoid them by using an employment contract may more than compensate for the productive inefficiencies of an employment contract. We assume that while the costs of monitoring compliance with  $\hat{t}$  are

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<sup>17</sup>This is shown by Levin and Tadelis (2007), Proposition 2.

minimal, enforcing a performance contract to obtain  $\hat{q}$  requires non-trivial administrative and regulatory costs. Thus, the principal faces a cost-benefit analysis problem in which he must trade off the productive efficiency benefits of a performance contract and any political benefits that it would entail with its administrative and political costs. Either ownership arrangement may entail political costs, depending on the (assumed to be exogenous) preferences of the population.<sup>18</sup>

We assume both that the agent is able to find a willing private firm—with the utility function specified above—to take over control of the utility with probability one, and that performance-based contracts (those establishing the required  $\hat{q}$  that must be achieved by the private firm) are optimally achieved by full utility ownership privatization rather than through something resembling a public-private partnership wherein the government owns the assets and the private firm operates the utility (“partial privatization”). The first assumption is supported by civil servant reports that private buyers of water utilities in the U.S. are generally readily available.<sup>19</sup> The second is partially supported by the fact that about 85% of privately-run water utilities in the U.S. are additionally privately-owned.<sup>20</sup> This can be understood on a more theoretical level as full privatization carrying the same political costs as partial privatization, but fewer administrative costs. We therefore only consider the case of full privatization, and leave a richer model considering all three ownership-operation arrangements to future research.

Specifying a performance contract entails administrative and regulatory costs equal to  $d(\hat{q}, m)$ . Here,  $m$  captures administrative difficulties such as the difficulty of setting up regulatory standards for water rates and customer service, monitoring them, and adjusting them over time (e.g., in response to inflation, rising input prices, population growth, or as a result of decisions by the private firm to invest in expanding the water provision network). Particularly in an industry as critical to human health and the functioning of the economy

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<sup>18</sup>Accordingly to models of Tiebout competition, these preferences may not indeed be exogenous. However, this simplifying assumption is made in the present model. The fact that water provision is only one of many important government services suggests that this may be a not-wholly unrealistic assumption with respect to any single industry.

<sup>19</sup>Interviews with Zeke Sushko (Maryland Public Service Commission) and Fred Curry (California Public Utilities Commission).

<sup>20</sup>Based on ICMA data on the prevalence of private contracting by local governments and EPA community water utility ownership data.

as water, a private firm cannot be turned loose without any regulatory safety net. However, the monitoring and enforcement of standards has its own set-up and operating costs (Barzel 1982). We expect  $m$  to be relatively low when a locality and its local policymakers have experience with privatization (especially if the utility in question is already private<sup>21</sup>), access to an existing regulatory framework that can be extended to the utility in question, or a fairly clear idea of what quality standards are appropriate to impose. Such factors would significantly diminish administrative costs. We assume that

$$d_m > 0, d_q > 0, d_{qq} > 0, d_{qm} > 0 \text{ and } d(0, m) = 0$$

That is, administrative and regulatory costs are increasing in administrative difficulty and in the quality standard specified in the performance contract, the costs of contracting are convex in  $q$ , it is increasingly hard to specify and enforce performance for higher quality levels, and there is no administrative cost if the performance contract does not demand any performance from the private firm.

The principal's ideal choice of ownership will not only depend on administrative and regulatory costs associated with privatization, but also on its political costs or benefits. This is where our theoretical model departs from Levin and Tadelis (2007). As in Grossman and Helpman (1996), we can view the local government's political objective to be the maximization of a weighted sum of the aggregate welfares of voters and members of special interest groups. While we assume that incumbent local politicians and policymakers are office-motivated and thus have reelection as their primary goal, the welfare of key interest groups may enter their utility function given that political contributions and support from interest groups can be used to sway undecided or inactive voters. In our model, we assume only one relevant interest group: organized labor in the water sector. Note that the principal will either choose an employment (time-based) contract or a performance contract. We assume that the principal suffers a political cost if his chosen form of water provision conflicts with the form desired by organized labor, and an additional political cost if it conflicts with

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<sup>21</sup>Note that  $d$  is not zero for already-private utilities, since administrative and regulatory costs are ongoing, and not a one-time expenditure. It is conceivable, however, that  $m$  (and thus  $d$ ) would be lower if private ownership were already in place. This can explain the persistence of one type of ownership despite small perturbations in relevant state variables.

the form desired by voters. In particular, suppose that  $x_c \in \{0, 1\}$  is the contractual form actually chosen, which is a dummy variable for private ownership (1 indicates a performance contract and 0 indicates an employment contract). Suppose also that each voter  $i$  has ideal point  $x_i \in \{0, 1\}$ , where 1 again indicates a performance contract and 0 an employment contract. Assuming an odd number of voters, the median voter has ideal point  $x_m \in \{0, 1\}$ . Similarly, organized labor will have an ideal point  $x_u \in \{0, 1\}$ , where the value of  $x_u$  will depend on whether the water industry is currently organized under an employment or a performance contract; organized labor desires the existing ownership arrangement to remain in place because it guarantees a stream of benefits which may be lost or diminished if the industry is completely restructured.

The utility of voter or interest group  $i$  is given by

$$U_i = (x_c - x_i)^2$$

Let  $\lambda \in [0, 1]$  be a parameter indicating the pareto weight that the decision maker places on the median voter's utility, and let  $1 - \lambda$  be the pareto weight placed on organized labor's utility. Clearly, the weights sum to one, with the value the principal places on voters, relative to organized labor, increasing in  $\lambda$ . We assume that, *ceteris paribus*, the principal wishes to minimize the weighted sum of political costs,  $f$ , by choice of contract,  $x_c$ :

$$f = \lambda(x_c - x_m)^2 + (1 - \lambda)(x_c - x_u)^2$$

In the case of a performance contract (PC),  $x_c = 1$ , and  $f$  becomes

$$f_{PC} = \lambda(1 - x_m)^2 + (1 - \lambda)(1 - x_u)^2, \text{ where } f_{PC} \in [0, 1]$$

In the case of an employment contract (EC),  $x_c = 0$ , and  $f$  simplifies to

$$f_{EC} = \lambda x_m^2 + (1 - \lambda)x_u^2, \text{ where } f_{EC} \in [0, 1]$$

Thus, the use of either type of contract—employment or performance—may entail strictly positive political costs, depending on the preferences of voters and organized labor. In cases where the chosen policy is in complete agreement with the ideal policy of both

groups, political costs of that policy are  $f = 0$ . When the chosen policy is different than the ideal policy of both groups, political costs are  $f = 1$ . When the chosen policy is the ideal point of voters but not of organized labor, political costs will be equal to  $1 - \lambda$ , and when the chosen policy is the ideal point of organized labor but not of voters, political costs will be equal to  $\lambda$ . In any eventuality, political costs are located somewhere in the interval  $[0,1]$ , with the size of the cost depending on the relative importance of the median voter to organized labor whenever there is disagreement between the median voter's interests and organized labor's interests. Clearly,

$$\partial f_{EC}/\partial x_m > 0, \partial f_{EC}/\partial x_u > 0, \partial f_{PC}/\partial x_m < 0, \text{ and } \partial f_{PC}/\partial x_u < 0$$

That is, the political costs of an employment contract are increasing in both median voter support and organized labor support for performance contracts, and the political costs of a performance contract are decreasing in voter and organized labor support for performance contracts. The condition for a performance contract to have net political benefits compared to an employment contract is therefore

$$f_{EC} > f_{PC}$$

Note that  $x_c = 1$  if and only if  $\hat{t} = 0$ , and  $x_c = 0$  if and only if  $\hat{t} > 0$ . Thus,  $x_c$  is an indicator variable that takes on the value of 1 when  $\hat{t} > 0$ , and  $f$  can be thought of as a function of  $\hat{t}$  and the preferences of the median voter and organized labor:  $f(\hat{t}, x_m, x_u)$ .

Additionally, sensitivity to quality can vary across localities. This is intuitive. Sensitivity may be affected by how politically active the population is (and thus the magnitude of the mandate perceived by elected officials to look out for civilian interests), the fraction of the population made up of vulnerable groups like small children and pregnant women,<sup>22</sup> or even the degree to which citizens have tangible benchmarks for comparing how their utility is performing to how other utilities perform. If the quality provided is  $q$ , we can denote principal sensitivity to  $q$  by  $s$ . If the costs of provision are  $k$ , then the principal's net benefit is  $V(q, s) - k$ , where we assume that  $V_q(q, s) > 0$  and  $V_{qs}(q, s) > 0$ . Thus, the principal's

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<sup>22</sup>Even the EPA and local health departments warn these groups to be cautious about water, mercury consumption from fish, etc, as any contamination will typically have the most deleterious effects on these groups.

gross utility is increasing in the quality of the product delivered, and the benefits of a given increase in quality are increasing in the principle's sensitivity to quality.

Taking into account the three types of costs discussed, The implied cost function is

$$C(q, m) = \min\{W(q|EC) + f_{EC}, W(q|PC) + d(q, m) + f_{PC}\}$$

where  $W$  is the wage required to meet the agent's incentive compatibility and individual rationality constraints. The principal's optimization problem is then

$$\begin{aligned} \max_{(\hat{w}, \hat{q}, \hat{t})} V(e, t, s) - \hat{w} - d(\hat{q}, m) - f(t, x_m, x_u) \\ \text{s.t. } (e, t) = (e^*(\hat{q}, \hat{t}), t^*(\hat{q}, \hat{t})) \\ \hat{w} - c(e)t + r(T - t) \geq rT \end{aligned}$$

The model yields a number of theoretical predictions:

**Proposition 1** An increase in private contracting difficulty,  $m$ , makes the principal more likely to use an employment contract.

**Proposition 2** An increase in the importance of quality,  $s$ , makes the principal more likely to use an employment contract.

**Proposition 3** The principal is more likely to use an employment (performance) contract as it becomes more clear that the median voter supports an employment (performance) contract, for any  $\lambda > 0$ .

**Proposition 4** The principal is more likely to use an employment (performance) contract as it becomes more clear that organized labor supports an employment (performance) contract, for any  $\lambda < 1$ .

The propositions follow directly from the equations specified, and are proved and discussed further in Appendix D. Their implications for an empirical analysis of the factors affecting water utility ownership choice are clear, although appropriate proxies must be found for  $m$ ,  $s$ ,  $x_m$ , and  $x_u$ . This is discussed in the next section. For the purpose of testing the propositions, we hereafter refer to an employment contract as public ownership and a performance contract as private ownership.

## 4 Dataset and Empirical Approach

The empirical analysis tests the predictions of the model in two contexts: a (2000) cross-sectional analysis of the “rough equilibrium” distribution of ownership types across U.S. water utilities, and a (1997-2002) panel data analysis examining the factors that induce local authorities to make occasional changes to the existing ownership structure, with a particular focus on privatization. This approach results in a critical examination of the model’s predictions, allowing us to determine whether they find support in equilibrium conditions, in marginal changes, in neither, or in both.

In the panel dataset, an observation is a water system-year, and there are a total of 356,914 observations. All data were collected at the most detailed level of observation possible, to allow for the greatest possible precision in studying localized ownership decisions. In some cases, water system-level variables were available, but more commonly, only county-level or state-level data could be found. All water system-level variables come from the EPA’s Safe Drinking Water Information System Federal Database (SDWIS/FED) of community water systems, and are available for 1997-2003. These data are collected by states and reported to the EPA; the EPA Office of Water provided them. Variables include the system’s ownership type (public-local, public-state, public-federal, Native American, or private), annual violations of various EPA water quality regulations, approximate population served, and water type supplying the system (ground, surface, etc). The empirical analysis excludes water systems that are federally-owned or state-owned, and focuses only on those that are owned by the local government or that are private. The reason is simple: the theoretical model is designed to apply to the case of local decision-makers acting as principal, where the distinctive feature of localized decisions is the fact that they are made with some degree of political accountability and sensitivity to local conditions and preferences.<sup>23</sup> Given that about 96% of publicly-owned systems are owned locally, however, the model applies to

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<sup>23</sup>As the example of the privatization of Fort Lee, Virginia’s federally-owned water system (detailed in Appendix A) demonstrates, ownership changes for federal (or state-owned) systems are likely insensitive to the types of factors motivating decisions at the local level, where ownership is under the jurisdiction of the local government. For example, this particular privatization occurred after, in 1997, the Department of Defense ordered the armed services to privatize 1,600 of their federally-owned utilities systems by 2003. Such blanket decisions are quite removed from the theoretical model’s assumptions.

the vast majority of U.S. water utility ownership decisions, and it makes sense to restrict our attention to those. County-level variables include the fraction of the population voting for the republican candidate in the most recent presidential election,<sup>24</sup> the fraction of the population served by a private system, average personal income, population, election participation rates, the fraction of the population under age five, and the Herfindahl-Hirschman Index for the water system “industry.”<sup>25</sup> State-level variables include the average score (0-1, with 0 being completely pro-tax and 1 being completely anti-tax) applied by the National Taxpayers Union (NTU) to the state’s current national senators and representatives—based on roll call voting,<sup>26</sup> unionization rates, the budget deficit per capita, the unemployment rate, the fraction of the population served by private systems, and average rainfall. Table 4 describes and summarizes the panel dataset variables and their sources.

For the cross-sectional analysis, the year 2000 was selected because of the greater availability of additional control variables in that year, owing to the 2000 Census. These variables include the fraction of the state’s water utilities that were privately owned in 1896,<sup>27</sup> the fraction of the county population considered rural,<sup>28</sup> and the fraction of the county population that is living in poverty, that is Hispanic, that is under age five, that voted in the last presidential election, and that has water charges included in their rent or condo fee. Table 5 describes and summarizes the cross-sectional dataset variables and their sources. An observation is a water system-year, and there are 51,182 observations.

The dependent variable in the cross-sectional analysis is a dummy variable for private ownership. The dependent variable in the panel data analysis is a dummy for whether the

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<sup>24</sup>Data on county support for republican House and Senate candidates are also available. However, the politics of all republicans are not comparable. Using county data for a national race makes this measure of support for the Republican Party comparable across counties. For 1997-1999, data for the 1996 race are used and support for Robert J. Dole is used. For 2000-2002, data for the 2000 race are used and support for George W. Bush is used.

<sup>25</sup>The HHI is a measure of market concentration, normally ranging from 0 to 10,000 but here adjusted to take on values between 0 and 1. A score of 0 indicates a completely competitive market and 1 indicates a completely monopolistic market. The US Department of Justice characterized a marketplace as competitive when HHI is less than 0.1. A moderately-concentrated marketplace has an HHI between 0.1 and 0.18; a highly-concentrated marketplace has an HHI of 0.18 or greater. About 83% of the counties in the sample had HHI>0.18 in 2003.

<sup>26</sup>NTU scores are based on every single vote in the US Congress in the given year that “significantly affects taxes, spending, debt, and regulatory burdens on consumers and taxpayers.”

<sup>27</sup>Until the late 1800s, water systems in the U.S. did not really resemble their modern-day counterparts. Indeed, “although there had been the need for larger water systems in the 1700s and early 1800s, their development was held back awaiting a number of important manufacturing breakthroughs that today we take for granted. These include: piping, pipe installation, steam and electrical power, and pumps” (NHDES 1999). 1896 is thus chosen because it roughly corresponds to the time when modern systems emerged. It is also the first year for which I could find nation-wide data on water systems and their ownership.

<sup>28</sup>This is according to the Census Bureau. For more detail, see: [http://www.census.gov/geo/www/ua/ua\\_2k.html](http://www.census.gov/geo/www/ua/ua_2k.html)

water system experienced a change to private ownership in that year (i.e. it is a dummy for privatization). Only systems eligible for privatization are included in the panel data analysis so that a system is not perceived as failing to privatize simply because it is already private. We thus restrict the analysis to public systems and remove a system from the analysis after its initial year of private ownership. Systems frequently do undergo the opposite type of ownership change, which involves a reversion to public ownership and is known as municipalization. However, the decision to municipalize may be driven by factors other than the desire of local policymakers to municipalize, such as in the case of private firms that simply no longer wish to serve a locality. Furthermore, because of the strength of property rights protection in the U.S., it may be the case that a locality desires to revert back to public ownership but is unable to do so. Expropriation of assets—even with due compensation—is a tricky matter, and the legal costs may even make it virtually impossible. Unfortunately, we can only observe whether a municipalization actually takes place, and not whether policymakers intended to undertake such an ownership change. Based on the earlier-referenced conversations with water industry experts, however, it is generally easy to find private providers, and thus officials’ desire to privatize and actual privatization are expected to correspond quite neatly. The panel data analysis thus concentrates on privatization.

## **5 Cross-sectional Analysis of Distribution of Ownership Types**

The model is first tested in a context that allows us to determine whether the factors that theoretically drive ownership decisions appear in equilibrium. If the variables  $m$ ,  $s$ ,  $x_m$ , and  $x_u$  have remained relatively constant over a given period of time, then the predictions of the model should be detectable and testable in equilibrium. This analysis sheds light on the question: which factors can account for the present-day distribution of ownership types? This distribution has not changed dramatically over time, suggesting that location- and environment-specific factors may account for what resembles a rough equilibrium. This infrequency of change has been noted in previous research examining service contracting by

U.S. municipalities (see López-de-Silanes *et al.* 1997 and Levin and Tadelis 2007), and has been used as a justification for cross-sectional analyses ignoring changes. For example, Levin and Tadelis (2007) note:

Despite many popular press stories about...high profile privatization decisions... [there is] little evidence of any aggregate trend in contracting behavior. Based on this evidence, we will adopt the view that the broad pattern of city contracting is roughly stationary, though individual cities are adjusting on the margin.

For now we maintain the assumption of “rough stationarity”, and we relax this assumption in section 6. Because the dependent variable is binary, two nonlinear regression models are used and compared: logit and probit. These are econometric models 1 and 2 (EM 1 and EM 2), respectively. For the purpose of comparison, a linear probability model (LPM) is also estimated (EM 3):

$$P(priv_i = 1|\mathbf{x}) = \frac{e^{x\beta}}{1 + e^{x\beta}} \quad (1)$$

$$P(priv_i = 1|\mathbf{x}) = \int_{-\infty}^{x\beta} (2\pi)^{-1/2} e^{-v^2/2} dv \quad (2)$$

$$P(priv_i = 1|\mathbf{x}) = P(\beta_0 + \mathbf{x}\beta + \epsilon_i = 1|\mathbf{x}) = \beta_0 + \mathbf{x}\beta \quad (3)$$

$$\mathbf{x}\beta = \mathbf{z}_i\beta + \mathbf{y}_j\eta + \mathbf{w}_k\theta$$

Among the regressors,  $\mathbf{z}_i$  is a vector of water system-level variables,  $\mathbf{y}_j$  is a vector of county-level variables, and  $\mathbf{w}_k$  is a vector of state-level variables. All variables are for the year 2000, with the exception of the historical ownership variable, which corresponds to 1896. Table 5 summarize the variables. *Priv* is the dependent variable, which is a dummy for private ownership of water system  $i$ . The primary independent variables are those that proxy for the key variables described in propositions 1 through 4. Of less direct interest are several water system level control variables—related to water system size and source of water supply— included to increase statistical precision because of their potential correlation with other regressors.

We capture the strength of the median voter’s preference for a private ownership,  $x_m$ , in several ways. All of them stem from an observation that public water utilities in the U.S. engage in more cross-subsidization of customers than private firms, and frequently

operate at a loss (indeed, Census data indicate that public utilities spent \$1.20 for every \$1.00 received in revenue during 1997-2003). Subsidized groups and those supporting subsidization typically live in hard-to-serve areas, are financially disadvantaged, or subscribe to a political ideology supporting redistribution. These features of pro-public ownership voters can be operationalized in a number of ways. First, *ntuhouse* is the degree of anti-tax sentiment of the county's representatives in the House of Representatives,<sup>29</sup> and *Inc* is average county income per capita (in \$1000s). We expect private ownership to be increasing in each of these variables, as we take each to represent an increase in the value of  $x_m$ . Next, *rural* is the fraction of the county population considered rural by the US Census Bureau, *poverty* is the fraction of the county population living below the Census-defined poverty threshold, and *hispan* is the fraction of the county population that is of Hispanic origin. We expect an increase in each of these variables to represent a decrease in the value of  $x_m$ , and thus to be associated with a decrease in private ownership prevalence. Thus, we have five variables intended to capture various aspects of  $x_m$ , and all can be used to empirically test Proposition 3.

Pressure by the organized labor interest group is measured quite simply: *pubunion* is the fraction of public sector employees in the state participating in a union. This variable captures the strength of organized labor's pressure for public ownership. By Proposition 4, an increase in *pubunion* should reflect a decrease in  $x_u$ , and should make private ownership more likely.

Finding appropriate proxy variables for  $m$  requires a bit more ingenuity—and debatable assumptions—about the measurable factors that indicate relatively higher administrative and regulatory costs being associated with private ownership. We propose a number of potentially important variables. First, experience with privatization at the state level suggests the avoidance of some of the fixed and marginal costs associated with establishing an appropriate regulatory system. This can be measured in at least two ways. First, it

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<sup>29</sup>Data on citizens' representatives in the U.S. House of Representatives are obviously at the Congressional District level, and each county contains all or part of between 1 and 18 Congressional Districts in its territory. This required us to carefully match representatives with counties by making the simplifying assumption that the county's level of anti-tax sentiment is the unweighted, arithmetic average of the anti-tax sentiment of each of the representatives who represents any segment of the county.

can be measured by *histpriv*, which is the fraction of the state’s water systems that were under private ownership in 1896. A high value of this variable indicates a long history of state institutional experience with private ownership in this sector that may lower  $m$  and thus decrease the administrative cost of private ownership today. Second, *statepriv*, which is the fraction of the state water market served by a private system in the current year, indicates modern-day experience with private ownership that may also lower the costs of private ownership by lowering  $m$ . Another factor that may lower  $m$  is the competitiveness of the water market industry. High levels of competition allow regulators and consumers to benchmark their own utility, as it offers important and relevant information about what is reasonably achievable by the utility in terms of prices, water quality, and service quality. We measure this by assuming that a market is a county, and constructing *HHI*, the county’s Herfindahl-Hirschman Index for the water system “industry” ( $HHI = s_1^2 + s_2^2 + \dots + s_n^2$ , where  $s_i$  is the county market share—in terms of water connections—of the  $i^{th}$  water system in the county, and there are  $n$  total systems). While *HHI* does not capture direct competition—which is essentially non-existent in the water market—it is a good indicator of benchmark competition, and is likely to lower the contracting costs,  $m$ , associated with private ownership. Finally, if we expect regulatory economies of scale in large areas,  $m$  would also be decreasing in county population (in thousands), *pop*, and private ownership would become increasingly likely with higher population levels.

Three variables capture the parameter  $s$ , which is the policymaker’s sensitivity to the quality of the product delivered. First, because water is so important for human health and because small children are the most vulnerable group in this regard, we expect that  $s$  is increasing in the fraction of the population that is under the age of five, *under5*, and thus that privatization is decreasing in the relative size of the under-five population. Second, those who do not pay a monthly water bill, but instead have water included in their rent or condo fee, are likely to be less sensitive to water quality issues than those who pay their own monthly water bills or personally contact service men when there are problems with the supply. We expect the principal to be less sensitive to water quality issues when a large

number of his citizens are not sensitive, and thus we expect that  $s$  is decreasing in the fraction of the county's population that has water included in their rent or condo fee,  $pctinrent$ . This would imply more private ownership with a higher value of  $pctinrent$ . Finally, the greater voter turnout in elections, the larger we expect principal sensitivity to quality,  $s$ , to be. Thus, we expect  $s$  to be increasing in the fraction of the population that voted in the last presidential election,  $fracvoted$ . We would thus expect private ownership to be decreasing in  $fracvoted$ .

To increase statistical precision, a number of water-system level controls are also included. These include a set of dummies for the source of water used (ground water, surface water, ground water under the direct influence of surface water, purchased ground water, purchased surface water, or purchased ground water under the influence of surface water, with ground water forming the base group) and a set of dummies for the water system's size (very small, with 25-500 connections; small, with 501-3,300; medium, with 3,301-10,000; large, with 10,001-100,000; or very large, with 100,000+, with very small systems forming the base group).

Table 6 presents the results from estimating EM 1, EM 2, and EM 3. Nearly all of the regressors are statistically significant determinants of ownership type, and the signs of most of the coefficients are as anticipated. We use robust (Huber/White) standard errors. The linear and nonlinear models tell a consistent story, and the logit and probit results are similar, as shown in Figure 1. As a result, the paper focuses on the final specification of EM 1.

To better interpret the baseline logit model, marginal effects were computed. Throughout, all other regressors are set to their sample means in determining the marginal effect of a regressor. Table 9 presents the partial derivative of the predicted probability of private ownership with respect to each of the independent variables in the model (standard errors are computed via the delta method). The table also presents several other interesting marginal effects: the change in the predicted probability of private ownership as each of the regressors changes from its minimum to its maximum, and from  $1/2$  a standard deviation below to  $1/2$

a standard deviation above its mean. Several interesting results emerge, which are illustrated in Figures 2 through 9 in Appendix C. The predicted probabilities of private ownership in the sample range from 0.005 to 0.984, with a mean of 0.504.

Proposition 1 is supported. First, as the HHI increases (benchmark competition decreases), we see a concomitant decrease in the probability of private ownership. In particular, as  $HHI$  increases by a standard deviation, centered at its mean, the probability of private ownership decreases by 0.035. This implies that monopolistic counties, in which a small number of systems or a single system serve most of the market, make public ownership more probable than it is in counties with a large number of systems. As described, this is consistent with a story of benchmark competition reducing the value of  $m$  and thus increasing the likelihood of private ownership. Second, private ownership is increasing in both current and historic private ownership at the state level. In particular, a standard deviation increase in  $histpriv$ , centered at its mean, increases the probability of private ownership by 0.088. The effect of a similar increase in  $statepriv$  is 0.051.<sup>30</sup> This suggests that patterns of institutional experience with private ownership from over a century ago still have a powerful impact on modern day ownership patterns.

Proposition 2 also finds strong support in the data. Sensitivity to quality,  $s$  was expected to increase in the fraction of the population under age five and in the fraction of the population that votes, and we thus expected each of these factors to be associated with less private ownership. In keeping with expectations, a one standard deviation increase in the fraction of the population under age five, centered at its mean, decreases the probability of private ownership by 0.013. A similar increase in the fraction of the population that votes decreases the probability of private ownership by 0.050. Finally, as predicted, as the fraction of the population whose water is included in their rent increases by one standard deviation about its mean—something predicted to lower  $s$ —the probability of private ownership increases by 0.016. These findings show the importance of sensitivity to quality for ownership decisions.

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<sup>30</sup>With an average of more than 1000 water systems per state, we consider this regressor to be exogenous.

The results also generally support Proposition 3, as all of the factors conjectured to affect the value of  $x_m$  do appear to affect the probability of private ownership, and in the expected direction. First, private ownership is increasing in the anti-tax sentiment of the county's representatives in the U.S. House of Representatives. A standard deviation increase in anti-tax sentiment, centered at its mean, increases the probability of private ownership by 0.042. Second, a standard deviation increase in the fraction of the population that is considered rural, centered at its mean, decreases the probability of private ownership by 0.114. In addition, a standard deviation increase in the fraction of the population living in poverty, centered at its mean, decreases the probability of private ownership by 0.02, and a similar increase in the fraction of the population that is Hispanic decreases the probability of private ownership by 0.047. Finally, a standard deviation increase in per capita personal income, centered at its mean, increases the probability of private ownership by 0.060. These findings suggest that public ownership is more probable in areas that are ideologically pro-tax (pro-redistribution), poor, rural, or have high concentrations of minorities—all areas where we would expect the value of  $x_m$  to be high. All five regressors support Proposition 3. The findings on union membership similarly support Proposition 4. We find that a standard deviation increase in public union membership, centered at its mean, decreases the probability of private ownership by 0.026.

The results of this section strongly support Propositions 1 through 4, and suggest a constellation of factors that may impact the present-day distribution of ownership types across U.S. water systems. However, we have so far assumed a (rough) stationarity of both ownership and the explanatory variables over time, which is unlikely. When the stationarity assumption is relaxed, and attention is accordingly turned to the causes of changes in ownership (in particular, the causes and correlates of privatization), the same variables could potentially have very different impacts. This is the subject of the next section, which tests the theoretical predictions of the model in this new, more realistic context.

## 6 Panel Data Analysis

### 6.1 Explaining Privatization

In the previous section, the predictions of the theoretical model were tested indirectly, through an analysis of whether the effects of  $m$ ,  $s$ ,  $x_m$ , and  $x_u$  are detectable in equilibrium. Underlying the analysis was a somewhat implausible assumption that all variables were at their unchanging, equilibrium values. This assumption is now relaxed so that the predictions of the model can be tested directly. In particular, we use a panel dataset in order to study the determinants of a particular type of ownership change: privatization.

We focus on privatization and leave the study of the determinants of municipalization for future research. As discussed earlier, public to private ownership changes are largely under the control of local policymakers, thus accurately reflecting their aims and desires. Private to public ownership changes, on the other hand, involve additional legal complexities. If there is no wrongdoing on the part of a privately-owned water system (demand is met, at regulation-conforming prices, and without violations of water or service quality regulations), it may be difficult, expensive, or impossible for the government to force the sale of the system's assets. Furthermore, data on the details of attempted municipalizations—whether successful or not—are not available. As a result, the latent variable—a local policymaker's preference over ownership—is less visible in the case of municipalization than in the case of privatization. Any results on the factors affecting municipalization would need to be interpreted with extreme caution.<sup>31</sup> Privatization is therefore our dependent variable.

The factors identified as proxies for  $m$ ,  $s$ ,  $x_m$ , and  $x_u$  in the cross-sectional analysis should continue to serve as proxies in a panel data analysis. Intuitively, it is hard to believe that  $m$ ,  $s$ ,  $x_m$ , and  $x_u$  would *not* change over time, which makes a panel analysis appropriate. The challenge lies in finding proxies that change over time and for which data are available over time. While slight adaptations are made to the previous set of proxies, we capture  $m$ ,  $s$ ,  $x_m$ , and  $x_u$  with a substantially similar set of variables as in the previous anal-

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<sup>31</sup>An initial empirical analysis of municipalization is available upon request, but we are uncertain about how to interpret it.

ysis. In addition, the analysis now incorporates a variable excluded from the cross-sectional regressions because it is too “fast-moving” to realistically represent an equilibrium value: the utility’s compliance with EPA water quality regulations. This varies substantially from year to year, but violations of EPA regulations can in some sense be thought of as evidence of consumer insensitivity to product quality, given that violations can be avoided by operator attentiveness to quality (even if that attentiveness comes at greater cost of water for the consumer). As predicted by Proposition 2, we expect privatization to be increasing in insensitivity to quality, and thus to be increasing in violations of EPA regulations by public systems.

The annual number of violations of health-related EPA regulations per 1,000 consumers is used as a measure of water contamination. Water quality is decreasing in the (discrete) number of such violations. Health-related violations include two major types of violations: treatment technique violations and maximum contaminant level violations. If a system’s treatment process does not meet EPA standards during a periodic inspection, or if periodic, mandatorily-sampled water reveals an amount of a health-threatening contaminant in excess of EPA-permitted levels, a system accrues a “health-based violation.” Independent, state-certified laboratories inspect water and report violations to the EPA each quarter.

As in section 5, an observation is a water system-year and the dependent variable is binary. Here, however, the dependent variable is a dummy indicating that a publicly-owned water system changed to private ownership (privatized) during the course of the current year.<sup>32</sup> Several empirical issues should be kept in mind. First, there are likely a number of important explanatory factors that vary across cross-sectional units but that do not change over time; in particular, the characteristics of the institutional environment and the rules governing ownership changes in a given area. Similarly, there are likely other explanatory factors that change over time but not across systems. One way of effectively dealing with both types of unobserved heterogeneity, given that we have a panel, is by using water system and

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<sup>32</sup>In the raw data, ownership for year  $t$  is the ownership type of the water system at the start of year  $t$ . As a result, it is assumed that public ownership in year  $t$  and private ownership in year  $t + 1$  indicates that a privatization occurred during year  $t$  (causing the new ownership arrangement to appear at the start of year  $t + 1$ ). Thus, while data on all variables are available for 1997-2003, the panel data analysis only includes the years 1997-2002 since knowledge of ownership at the start of 2003 does not allow one to ascertain whether or not an ownership change occurred *during* 2003.

year fixed effects. Second, the health violations variable may be endogenous. It is likely that water quality affects ownership changes *and vice versa*.<sup>33</sup> This suggests that ownership type and water quality may be determined by a set of simultaneous equations. This endogeneity motivates the use of an instrumental variable.

## 6.2 Empirical Approach

The analysis of factors affecting privatization proceeds in several steps. First, summary statistics of potential explanatory variables are presented for two types of systems: systems privatizing and systems not changing ownership in the current year. A brief comparison suggests that a number of factors might explain privatization. Second, an initial econometric analysis is performed: one which ignores the unobserved heterogeneity (both in the time and cross-sectional unit dimensions) and the endogeneity of the health violations data. The results suggest that nonlinear models—specifically, logit and probit models—yield results similar to those of the LPM. Given the inherent complications of doing two-way (water system and year) fixed effects models in the presence of nonlinearities,<sup>34</sup> and the difficulty of additionally incorporating instrumental variables techniques to address the endogeneity problem, the similarities of the three models justify proceeding with the LPM.<sup>35</sup> After adding two-way fixed effects and dealing with the endogeneity, we arrive at the baseline model: a fixed effects linear probability model estimated by instrumental variables. Throughout, standard errors are robust to heteroskedasticity, and we cluster on the water system; individual disturbance terms are assumed to be independent across water systems, but are allowed to be arbitrarily correlated for observations within the same water system. Several interesting implications regarding the causes of privatization emerge, and the predictions of the theoretical model find strong support in the data.

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<sup>33</sup>Wallsten and Kosec (2007) find that the ownership type of a water system affects violations of these two types of EPA regulations.

<sup>34</sup>Unconditional fixed effects logit and probit models are biased, and there is not a sufficient statistic for a conditional fixed effects probit model. While a conditional fixed effects logit model does not result in biased estimates, it still involves dropping all observations for which the dependent variable is constant (these are not even used in defining the intercept term), which may not be desirable.

<sup>35</sup>Noting that the curves in figures 2 through 10 are all close to linear gives us some additional confidence that the use of a linearized model is appropriate.

Table 8 presents summary statistics of potential explanatory variables for systems that privatized in a given year and systems that did not. Immediately apparent is the fact that privatization is an unlikely event. For every privatization in a given year, there are about 123 public water systems that remain public. This is not unexpected, and reflects the fact that ownership changes are not without transaction costs, and that the current arrangement likely already affect certain preferences of local authorities. The question is—how predictable versus idiosyncratic is privatization? The summary statistics reveal important differences in the means of the explanatory variables for public systems that privatized versus those that did not. As expected, privatization is associated with more health-related water quality violations, more support for the Republican Party, more anti-tax sentiment, a lower HHI (and thus more competitiveness, in terms of benchmark competition), experience with private ownership at the county level, a higher budget deficit per capita, and higher income. There are also unexpected findings; privatization is associated with higher union participation, greater voter turnout in the last presidential election, and higher unemployment rates. The findings are not conclusive, however, and call for a rigorous, multivariate analysis.

As a first step toward such an analysis, we pool the data and estimate EM 4, EM 5, and EM 6 under two assumptions that will be relaxed shortly: first, that  $\alpha_i$  and  $\gamma_t$ —the water system and year fixed effects—are components of the composite error term that are uncorrelated with the regressors, and second, that *hlthviols* is an exogenous variable.

$$P(\text{private}_{it} = 1|\mathbf{x}) = \frac{e^{x\beta}}{1 + e^{x\beta}} \quad (4)$$

$$P(\text{private}_{it} = 1|\mathbf{x}) = \int_{-\infty}^{x\beta} (2\pi)^{-1/2} e^{-v^2/2} dv \quad (5)$$

$$P(\text{private}_{it} = 1|\mathbf{x}) = P(\beta_0 + \mathbf{x}\beta + \epsilon_{it} = 1|\mathbf{x}) = \beta_0 + \mathbf{x}\beta \quad (6)$$

$$\mathbf{x}\beta = \mathbf{z}_i\beta + \mathbf{y}_j\eta + \mathbf{w}_k\theta$$

$$\epsilon_{it} = \alpha_i + \gamma_t + v_{it}$$

The composite error term  $\epsilon_{it}$  contains both water system and year fixed effects and a dis-

turbance term,  $v_{it}$ . Several of the explanatory variables in  $\mathbf{x}\beta$  were defined in the previous analysis, and their definitions do not change except that they now cover the period 1997-2002. Among the new variables, *hlthviols* is the number of violations of health-related EPA regulations in water system  $i$  in year  $t$ . *Bdpc* is the state budget deficit per capita (total state and local expenditures minus total state and local revenues, divided by the state population), which may have immediate implications for whether highly-subsidized public ownership, as a redistribution mechanism, is even feasible. This makes it a desirable control variable. *Ntusen* is the degree of anti-tax sentiment of the county’s representatives in the U.S. Senate.<sup>36</sup> *Repubprez* is the fraction of the population in county  $i$ , in year  $t$ , supporting the Republican Party’s candidate in the most recent presidential election. This captures another aspect of the political views of the median voter. *Unemp* is the fraction of the adult population in county  $i$  that was unemployed in year  $t$ , and is meant to capture the degree of need for subsidies (assumed to be most easily brokered under public ownership).

The coefficients and standard errors from estimating EM 4, EM 5, and EM 6—in addition to the marginal effects of the logit and probit models when the other variables are set to their sample means—appear in Table 9. Because the dependent variable is binary, there are drawbacks of using a linear model.<sup>37</sup> Nevertheless, estimating EM 6 yields good estimates of the partial effects of the regressors on *privatize* near the center of the distribution of  $\mathbf{x}$  (which is evident in the similarities between the results of the LPM and the nonlinear models).<sup>38</sup> Because of these similarities, and because of the difficulties—in the context of nonlinear models—involved in correcting for the fact that both  $\alpha_i$  and  $\gamma_t$  are likely correlated with the explanatory variables and *hlthviols* is endogenous, we use a LPM for the rest of the analysis.

Adding two-way fixed effects to the linear probability model of EM 6 solves the unobserved heterogeneity problem;  $\alpha_i$  and  $\gamma_t$  are added to  $\mathbf{x}\beta$ , and  $\epsilon_{it}=v_{it}$ . Table 10 includes

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<sup>36</sup>Time-series data on anti-tax sentiment of the county’s representatives in the U.S. House of Representatives were not available.

<sup>37</sup>First, this model implies that a ceteris paribus one unit increase in each explanatory variable has a constant marginal effect on *privatize*, regardless of the initial value of that variable or the values of other variables. This is unreasonable since  $0 > P(\textit{privatize} = 1|\mathbf{x}) > 1$ . A second, related drawback is the fact that the LPM allows for negative fitted values.

<sup>38</sup>Furthermore, if the logit and probit models are consistent and unbiased, the LPM will be as well.

the addition of fixed effects to the general specification of Table 9. First, year fixed effects are added, then water system fixed effects, and then both (columns 1, 2, and 3 of Table 10). A more complicated task is finding an instrument for the endogenous regressor, *hlthviols*. Fortunately, data on the state’s average annual precipitation, in inches, were available for the entire period. It is reasonable to suppose that this variable, denoted *rain*, is exogenously determined and uncorrelated with the error term. Rainfall is determined by essentially uncontrollable, random factors and is unlikely to change system ownership except through its effect on water quality. Moreover, we expect rainfall to be positively correlated with health-related violations. As the EPA warns: “Storm water runoff...[often] carries sediment and contaminants with it to a surface water body or infiltrates through the soil to ground water,” and if this becomes severe enough, “degraded [drinking] water quality becomes apparent” (EPA 2001). More rigorous tests confirm that rain is indeed positively correlated with *hlthviols* and that the model is identified.<sup>39</sup> Accordingly, *hlthviols* is regressed on *rain* and the included exogenous variables in order to obtain  $\hat{hlthviols}$ —which is then used in place of *hlthviols* in EM 6. Equation 6 in Table 10 includes water system and year fixed effects, and the model is estimated by instrumental variables (IV) using *rain* as an instrument. This is the baseline model.

A few technical points are in order. The baseline model has one endogenous regressor and one instrument. In the first stage regression, the coefficient on *rain* is significant at the 1% level (the t-statistic is 2.59). The value of the Anderson likelihood-ratio test statistic results in a rejection (at the 1% level) of the null hypothesis that the smallest canonical correlations of *hlthviols* and *rain* are zero, offering strong evidence that the proposed instrument is positively correlated with the endogenous regressor (Hall *et al.* 1996). Combined with the previous arguments for the lack of correlation between *rain* and the disturbance process of this model, it appears to be exactly identified. Furthermore, empirical tests offer some measure of confidence that the model does not suffer from problems of weak instruments.<sup>40</sup>

<sup>39</sup>Several factors confirm that instrumentation and fixed effects are necessary. First, tests of endogeneity—both on the pooled and the fixed effects models—lead to a rejection of the null hypothesis that *hlthviols* is exogenous at the 1% level. Second, the fixed effects are jointly significant.

<sup>40</sup>A Stock-Yogo weak identification test is performed (Stock and Yogo 2002). The Cragg-Donald F statistic is 7.085, and thus it is in the mid-range of conventional Stock-Yogo critical values (just under 15% maximal IV size). The IV procedure is thus

### 6.3 Results

The panel analysis supports most of the predictions of the theoretical model. When examining the partial effects of different regressors—most of them proxying for the variables central to the model—it is important to keep in mind that switches to private ownership are a rare event due to transaction costs and the fact that current ownership arrangements reflect somewhat of an equilibrium. As a result, even small absolute changes in the probability of privatization may represent a large multiplicative increase in the likelihood of privatization.

Proposition 1 does not receive the robust support from the panel analysis that it received from the cross-sectional analysis, casting some doubt that contractual difficulty is driving utility ownership changes (to private ownership) on the margins. First, the coefficient on *HHI* is negative, which suggests that as the degree of benchmark competition decreases, the probability of privatization decreases, as expected. However, while the sign of the coefficient is as predicted by Proposition 1, the result is not significant at conventional significance levels. There is furthermore no evidence that the amount of privatization of the water industry at the county level, *countypriv*, has any significant impact on privatization of water system *i*. *Pop* and *bdpc* also fail to achieve significance in the baseline model. Thus, the robust support for Proposition 1 that was found in a simple cross-sectional analysis of the rough equilibrium of ownership types across the U.S. does not appear in an analysis of the factors driving changes in one system’s ownership. This may be evidence that the factors that lead to more difficult-to-negotiate contracting situations are sufficiently important and slow to change over time that they have been incorporated in the choice of ownership decades ago, leaving little room for them to drive changes on the margins.

Proposition 2 is supported, suggesting that increased sensitivity to quality is associated with less privatization. Sensitivity to quality, *s*, was expected to be increasing in the fraction of the population that is under age five and in the fraction of the population that votes, and we thus expect each of these factors to be associated with less privatization.

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considered a sufficient improvement over OLS, especially given that most of the key results are significant at the 1% level and the Stock-Yogo critical values correspond to  $\alpha = 0.05$ .

Additionally, disregard of EPA drinking water quality regulations by local governmental officials suggests a lack of sensitivity to quality among these officials and their consumers (presumably, greater sensitivity to quality would cause these officials to avoid such violations even at great expense), and we thus expect privatization to be increasing in EPA violations. In keeping with expectations, an increase of 0.1 in the fraction of the population that voted in the last elections decreases the probability of privatization by 0.021. Additionally, one additional annual violation of EPA health-related drinking water regulations (per 1,000 population) is associated with an increase of 0.066 in the probability of privatization. Both of these findings support Proposition 2. The coefficient on the fraction of the population under age five is not significant, however, and thus there is no evidence that a larger population of relatively more vulnerable persons (children) contributes to less privatization. Overall, these results are interesting, as they suggest that sensitivity to quality does drive ownership decisions. From a development perspective, they appear to suggest that civic involvement via active participation in fair elections—where feasible—reduces the likelihood of privatization. Given increasingly frequent headlines in the developing world about protested utility privatizations, this result seems particularly relevant.

The results also generally support proposition 3, as many of the factors conjectured to affect the value of  $x_m$  do appear to affect the probability of privatization, and in the expected direction. First, an increase of 0.1 in the anti-tax sentiment of the county's representatives in the Senate is associated with an increase in the probability of privatization of 0.0065. This result is significant at the 1% level and represents a near doubling of the base probability of privatization. Thus, there is evidence that the anti-tax sentiment of the median voter has a significant effect on the policy decision of local government officials regarding whether or not to privatize. This is even after controlling for the degree of support for the Republican party among voters. Support for the Republican party has an additional, highly significant and positive effect on the probability of privatization; an increase of 0.1 in the fraction of the population voting for a Republican candidate in the most recent presidential election increases the probability of privatization by 0.012. We also find that the coefficient on income

per capita at the county level is positive, and the coefficient on the fraction of people that are unemployed is negative, although neither of these later two effects are significant. Overall, the findings suggest that privatization is more probable in areas that are ideologically anti-tax (anti-redistribution) and pro-Republican party—all areas where we would expect the value of  $x_m$  to be high—which supports Proposition 3. The findings on union membership support Proposition 4. An increase of 0.1 in the fraction of the working population that is involved in a union is associated with a reduction of 0.049 in the probability of privatization. This is a particularly dramatic effect given the base privatization probability of 0.008, and suggests that public unions may hold a very powerful sway over local policymakers.

The results of this section strongly support Propositions 2 through 4, and offer no evidence in support of (or against) Proposition 1. Interestingly, this suggests that sensitivity to quality and political factors—rather than the ease or difficulty of regulating and monitoring a private firm—are driving ownership changes on the margins. This may suggest that local officials are a great deal more responsive to political concerns than to efficiency concerns, although it may also simply indicate that such regulatory costs are slow to change and were incorporated into ownership decisions decades ago.

## 7 Conclusion

What factors ultimately determine a policymaker’s choice over public versus private ownership of utilities? That is, how do governments go about weighing the efficiency of private firms against the associated regulatory costs and against the potentially greater ability of public firms to prioritize cross-subsidies and product quality? Despite recent trends toward privatization in various network industries throughout the world, little is known about the drivers of ownership decisions. Much of the literature on the causes of “privatization” relates to government decisions regarding whether to provide services in house or contract them out to private parties (López-de-Silanes *et al.* 1997; Levin and Tadelis 2007), generally ignoring what would motivate the decision to give away ownership rights entirely. Furthermore,

most existing papers focus on rough cross-sectional equilibria instead of rigorously analyzing changes to the ownership structure of a given firm over time. The literature that does treat ownership privatization tends to focus on large-scale privatizations that may differ substantially from typically small utilities privatizations (see, for example, Clarke and Cull 1998; Opper 2004). Additionally, most empirical work does not test a specific theoretical model, and simply aims to simultaneously test the implications of various theories and intuitions—an approach with obvious drawbacks. This paper contributes to the existing literature by explicitly examining ownership changes instead of only contracting decisions, performing both cross-sectional as well as panel data analysis, examining small and moderate-sized firms—which are more intimately related to day-to-day local public policy—instead of only large firms or entire industries, and doing so within the confines of an explicit theoretical model with testable empirical predictions. It does so using a unique firm-level panel dataset covering the universe of community water utilities in the United States over the period 1997-2003. The theoretical model yields several fairly sharp predictions regarding the physical, political, and institutional factors influencing utility ownership decisions, which are then tested in several ways. As expected, local conditions that increase the costs of administrating and regulating private utilities make private ownership less likely. However, there is also strong evidence that utility ownership decisions are a function of the political interests of the median voter as well as organized labor, and that increased voter sensitivity to water service quality makes public ownership more likely. While all of these factors explain the rough equilibrium distribution in ownership types, quality-sensitivity and political concerns appear to be the most important factors accounting for privatization on the margins. From a development perspective, we interestingly find that civic involvement via participation in fair elections decreases the likelihood of private ownership and privatization. This has interesting implications in the developing world, where privatization of water and other industries is becoming increasingly frequent, and is often protested by the poor.

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## Appendix A: Case Studies

Name: City of Santa Fe Water System (formerly Sangre de Cristo Water Company)

Location: Santa Fe, New Mexico

Ownership from 1997-2003: Private to Public in 2001

EPA size classification: Large (serves 50,000 to 100,000)

EPA identification number: NM3505126

Retail population served: 60,000

### Description of ownership:

In 1995, the city of Santa Fe agreed to purchase the local water utility from the Public Service Company of New Mexico (PNM) for \$58 million. City Councilor Art Sanchez led the utility buyout, arguing that the water supply is too critical a resource to be left to the private sector. He and other city officials promised that the purchase would lead to a customer rate decrease.<sup>1</sup> Between 1995 and 2001, a PNM operating division called Sangre de Cristo Water Co. continued to operate the system under contract.<sup>2</sup> In late 2001, the city of Santa Fe finally took full control and ownership of the water company. The promised rate decrease did not materialize.<sup>3</sup>

Name: Fort Lee

Location: Fort Lee, Virginia

Ownership from 1997-2003: Public to Private in 2001

EPA size classification: Large (serves 10,001 to 50,000)

EPA identification number: VA3149247

Retail population served: 11,594

### Description of ownership:

In 1997, the Department of Defense ordered the armed services to privatize 1600 of their federally-owned utilities systems by 2003. Following the order, the Army's Fort Lee turned over its drinking water distribution system to Virginia American Water Company, a subsidiary of American Water Works, Inc., in 2001. The privatization of the Fort Lee water system is projected to save the Army \$1.4 billion over a 25-year period as a result of reduced operating costs.<sup>4</sup> Virginia-American Water Company's water rates are set by the Virginia State Corporation Commission.<sup>5</sup>

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<sup>1</sup> Navrot (2001)

<sup>2</sup> Sharpe (2002).

<sup>3</sup> Navrot (2001).

<sup>4</sup> Cahlink and Harris (2002).

<sup>5</sup> Virginia State Corporation Commission (2004).

## Appendix B: Tables

**Table 1: Water Systems Per County in 2003**

Water Utilities (CWS) Per County	Fraction of Counties
1	0.04
2 to 5	0.26
6 to 10	0.23
11 to 20	0.25
21 to 40	0.14
41+	0.09

\*Fractions do not total to 1.0 because of rounding error

**Summary Statistics, Utilities Per County:**

Mean: 16.76

Median: 9

Mode: 6

**Table 2: Number of Active Systems in 2003**

Ownership	System Size				
	Very small	Small	Medium	Large	Very large
Private	21,774	3,751	630	458	50
Local Govt.	6,469	9,359	3,716	2,879	309
State Govt.	205	241	75	30	1
Federal Govt.	137	108	87	67	0
Native Am.	452	165	26	3	0
Public/Private	711	619	135	66	6
Unknown	547	132	24	13	0
<b>Total</b>	<b>30,295</b>	<b>14,375</b>	<b>4,693</b>	<b>3,516</b>	<b>366</b>

Note: Size categories established by US EPA based on average daily population served:  
 Very small: 25 – 500      Small: 501-3,300      Medium: 3,301 – 10,000  
 Large: 10,001 – 100,000      Very Large: 100,001 +

**Table 3: Total Population Served in 2003**

Ownership	System Size				
	Very small	Small	Medium	Large	Very large
Private	3,082,896	4,564,502	3,608,747	13,691,534	19,550,550
Local Govt	1,547,284	13,854,549	21,707,493	81,009,849	102,691,886
State Govt.	44,854	373,175	420,248	805,723	103,414
Federal Govt.	26,502	188,273	519,075	1,507,352	0
Native Am.	82,764	223,255	141,477	48,860	0
Public/Private	146,950	880,510	684,030	1,517,788	1,275,450
Unknown	79,223	184,846	148,678	307,092	0
Total	5,010,473	20,269,110	27,229,748	98,888,198	123,621,300

Note: Size categories established by US EPA based on average daily population served:  
 Very small: 25 – 500      Small: 501-3,300      Medium: 3,301 – 10,000  
 Large: 10,001 – 100,000      Very Large: 100,001 +

**Table 4: Panel Dataset, Summary of Variables**

Variable	Description	Data source	Obs.	Mean	Std. Dev.	Min	Max
Privatize	Dummy - water system changed from public to private ownership during current year	US Environmental Protection Agency (2004)	130771	0.008	0.089	0	1
Hlthviols	Violations of EPA health regulations during current year (treatment technique + maximum contaminant level violations)	US Environmental Protection Agency (2004)	356644	0.869	7.101	0	1375
HHI	County's Herfindahl-Hirschman Index (HHI), divided by 10,000; Index of competitiveness of the water industry in that county ("market")	Constructed, based on US Environmental Protection Agency data (2004)	356914	0.286	0.190	0.027	1
Pubunion	Fraction of those employed by the public sector that are in a union (state-level)	Current Population Survey (1997-2003)	355578	0.124	0.062	0.031	0.267
Ntusen	National Taxpayers' Union (NTU) score of level of anti-tax sentiment of county's representatives in U.S. Senate, in most recent election	National Taxpayers' Union (2007)	355571	0.471	0.243	0.035	0.861
Repubprez	Fraction of the voting population voting for the republican candidate in the most recent national presidential election (1996 or 2000 election)	CQ Voting and Elections Collection (2007)	351923	0.500	0.116	0.104	0.925
Countypriv	Fraction of CWS-served county population served by a private water system	US Environmental Protection Agency (2004)	356914	0.171	0.219	0	1
Inc	Per capita personal income, thousands of dollars (county level)	U.S. Census (1997-2003)	353583	25.193	6.535	5.233	85.984
Fracvoted	Fraction of the county that voted in the most recent presidential election	CQ Voting and Elections Collection (2007)	356832	0.373	0.085	0.000	0.978
Unemp	Fraction of the adult population that is unemployed	U.S. Census (1997-2003)	229616	5.180	2.207	0.700	33.200
Under5	Fraction of the county population that is under age five	U.S. Census (1997-2003)	356910	0.065	0.011	0.026	0.126
Pop	County population, in thousands	U.S. Census (1997-2003)	356910	308.181	864.455	0.312	9862.088
Bdpc	State budget deficit per capita (total state and local expenditures minus total state and local revenues, divided by the state population)	U.S. Census (1997-2003)	355578	-0.253	0.821	-6.654	3.787
Rain	Average annual precipitation, in inches (state level)	National Climatic Data Center (2004)	354342	37.307	13.538	5.380	71.220

**Table 5: 2000 Cross-Section Dataset, Summary of Variables**

Variable	Description	Data source	Obs.	Mean	Std. Dev.	Min	Max
Priv	Dummy - water system is privately owned	US Environmental Protection Agency (2004)	46778	0.521	0.500	0	1
Ntuhouse	National Taxpayers' Union (NTU) score of level of anti-tax sentiment of county's representatives in U.S. House of Representatives, in most recent election	National Taxpayers' Union (2007)	50146	0.497	0.165	0.16	0.910
Inc	Per capita personal income, thousands of dollars (county level)	U.S. Census (2000)	50753	25.736	6.818	9.556	85.826
Rural	Fraction of county population living in rural areas, as defined by the U.S. Census	U.S. Census (2000)	51073	0.440	0.296	0	1
Poverty	Fraction of county population living below the U.S. Census Bureau-defined poverty threshold	U.S. Census (2000)	51073	0.126	0.056	0.021	0.523
Hispan	Fraction of county population that is of Hispanic origin	U.S. Census (2000)	51073	0.079	0.122	0	0.981
Pubunion	Fraction of those employed by the public sector that are in a union (state-level)	Current Population Survey (2000)	50959	0.336	0.186	0.090	0.706
Histpriv	Historical fraction of water systems in state that are privately owned (data are from 1896)	Baker (1897)	50504	0.557	0.224	0	1
HHI	County's Herfindahl-Hirschman Index (HHI), divided by 10,000; Index of competitiveness of the water industry in that county ("market")	Constructed, based on US Environmental Protection Agency data (2004)	51182	0.286	0.190	0.035	1
Statepriv	Fraction of CWS-served state population served by a private water system	US Environmental Protection Agency (2004)	51182	0.134	0.125	0	0.584
Under5	Fraction of the county population that is under age five	U.S. Census (2000)	51181	0.065	0.011	0.031	0.120
Pop	County population, in thousands	U.S. Census (2000)	51181	308.586	861.005	0.356	9519.34
Inrent	Fraction of county population with drinking water included in their rent (receiving no explicit bill for water)	U.S. Census (2000)	51181	0.097	0.053	0.012	0.537
Fracvoted	Fraction of the county that voted in the most recent presidential election	CQ Voting and Elections Collection (2007)	51165	0.387	0.085	0	0.781
Source_GW	Dummy - water source is ground water	US Environmental Protection Agency (2004)	48355	0.747	0.435	0	1
Source_PGW	Dummy - water source is purchased ground water	US Environmental Protection Agency (2004)	48355	0.039	0.193	0	1
Source_SW	Dummy - water source is surface water	US Environmental Protection Agency (2004)	48355	0.082	0.275	0	1
Source_PSW	Dummy - water source is purchased surface water	US Environmental Protection Agency (2004)	48355	0.122	0.328	0	1
Source_GWUSW	Dummy - water source is ground water under the influence of surface water	US Environmental Protection Agency (2004)	48355	0.009	0.093	0	1
Source_PGWUSW	Dummy - water source is purchased ground water under the influence of surface water	US Environmental Protection Agency (2004)	48355	0.001	0.032	0	1
Size_vsmall	Dummy - system is considered "very small," serving 25-500 consumers	US Environmental Protection Agency (2004)	51182	0.587	0.492	0	1
Size_small	Dummy - system is considered "small," serving 501-3300 consumers	US Environmental Protection Agency (2004)	51182	0.262	0.440	0	1
Size_medium	Dummy - system is considered "medium," serving 3301-10,000 consumers	US Environmental Protection Agency (2004)	51182	0.082	0.274	0	1
Size_large	Dummy - system is considered "large," serving 10,001-100,000 consumers	US Environmental Protection Agency (2004)	51182	0.063	0.243	0	1
Size_vlarge	Dummy - system is considered "very large," serving 100,000+ consumers	US Environmental Protection Agency (2004)	51182	0.007	0.081	0	1

**Table 6: Cross-sectional Analysis Regression Results**

Dependent Variable: Dummy for Private Ownership in 2000 (mean: 0.521)	Logit Model (EM 1)			Probit Model (EM 2)			Linear Probability Model (EM 3)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ntuhouse	0.024 (0.31)		0.169 (2.04)*	0.000 (0.00)		0.077 (1.62)	0.005 (0.44)		0.024 (2.05)*
Inc	0.044 (14.18)**		0.035 (10.09)**	0.024 (13.63)**		0.018 (9.43)**	0.006 (13.85)**		0.005 (10.05)**
Rural	-1.752 (31.84)**		-1.553 (22.98)**	-1.010 (31.73)**		-0.901 (23.11)**	-0.287 (33.28)**		-0.246 (24.66)**
Poverty	1.333 (3.82)**		-1.446 (3.81)**	0.726 (3.69)**		-0.855 (3.99)**	0.162 (3.15)**		-0.235 (4.39)**
Hispan	-0.269 (2.09)*		-1.552 (9.94)**	-0.156 (2.20)*		-0.860 (9.91)**	-0.048 (2.48)*		-0.241 (10.70)**
Pubunion	-0.532 (7.54)**		-0.552 (6.19)**	-0.306 (7.48)**		-0.344 (6.71)**	-0.086 (7.96)**		-0.074 (5.60)**
Histpriv		1.450 (23.00)**	1.534 (21.14)**		0.816 (22.52)**	0.853 (20.54)**		0.231 (24.40)**	0.242 (23.38)**
HHI		-0.515 (7.77)**	-0.741 (10.25)**		-0.287 (7.56)**	-0.415 (10.02)**		-0.080 (7.96)**	-0.105 (10.01)**
Statepriv		1.619 (14.80)**	1.610 (13.79)**		0.951 (15.25)**	0.963 (14.47)**		0.239 (14.87)**	0.225 (13.49)**
Under5		8.164 (5.78)**	-5.057 (3.08)**		4.399 (5.46)**	-3.168 (3.36)**		1.267 (5.96)**	-0.722 (2.96)**
Pop		0.000 (2.34)*	0.000 (3.48)**		0.000 (2.28)*	0.000 (3.74)**		0.000 (1.32)	0.000 (2.68)**
Inrent		7.003 (22.88)**	1.230 (2.90)**		3.933 (22.88)**	0.668 (2.78)**		1.062 (23.78)**	0.183 (3.02)**
Fracvoted		-1.348 (6.66)**	-2.857 (10.14)**		-0.726 (6.32)**	-1.562 (9.68)**		-0.216 (7.01)**	-0.452 (10.97)**
Constant	1.102 (7.97)**	-0.140 (0.90)	2.121 (8.87)**	0.716 (9.15)**	-0.045 (0.51)	1.305 (9.57)**	0.768 (39.15)**	0.539 (23.06)**	0.897 (26.54)**
Includes Water System Size Dummies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Includes Water Source Dummies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	43353	43832	42958	43353	43832	42958	43353	43832	42958
R-squared							0.40	0.40	0.42

Robust (based on Huber-White standard errors) z statistics in parentheses

+ significant at 10%; \* significant at 5%; \*\* significant at 1%

**Table 7: Cross-sectional Logit Model, Marginal Effects and Changes in Probability**

Variable	Mean	Marg. Effect	Std. Err	z	P> z	[ 95% C.I. ]	min->max	+ - sd/2
Histpriv	0.551	0.383	0.018	21.13	0	0.347577	0.419	0.325 0.088
HHI	0.290	-0.185	0.018	-10.25	0	-0.22055	-0.150	-0.175 -0.035
Pubunion	0.346	-0.138	0.022	-6.19	0	-0.181569	-0.094	-0.085 -0.026
Ntuhouse	0.500	0.042	0.021	2.04	0.042	0.001569	0.083	0.032 0.007
Statepriv	0.144	0.402	0.029	13.79	0	0.34496	0.459	0.225 0.051
Inc	25.901	0.009	0.001	10.09	0	0.007089	0.011	0.541 0.060
Rural	0.439	-0.388	0.017	-22.98	0	-0.420789	-0.355	-0.368 -0.114
Under5	0.065	-1.263	0.410	-3.08	0.002	-2.06729	-0.458	-0.112 -0.013
Pop	0.000019	0.00001	3.48	0.001	0.000008	0.000029	315.82	0.174 0.017
Poverty	0.124	-0.361	0.095	-3.81	0	-0.54682	-0.176	-0.176 -0.020
Hispan	0.078	-0.388	0.039	-9.94	0	-0.46399	-0.311	-0.326 -0.047
Inrent	0.097	0.307	0.106	2.9	0.004	0.099824	0.514	0.159 0.016
Fractvoted	0.395	-0.713	0.070	-10.14	0	-0.851203	-0.576	-0.506 -0.050

(\*) Marg. Effect is for discrete change of dummy variable from 0 to 1

**Table 8: Summary Statistics on Privatization**

Explanatory Variable	Description	Privatization			No Privatization		
		Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Hlthviols	Violations of EPA health regulations during current year (treatment technique + maximum contaminant level violations)	1040	0.596	5.264	129587	0.367	3.255
HHI	County's Herfindahl-Hirschman Index (HHI), divided by 10,000; Index of competitiveness of the water industry in that county ("market")	1040	0.288	0.165	129731	0.300	0.189
Pubunion	Fraction of those employed by the public sector that are in a union (state-level)	1040	0.144	0.052	129725	0.128	0.060
Ntusen	National Taxpayers' Union (NTU) score of level of anti-tax sentiment of county's representatives in U.S. Senate, in most recent election	1040	0.555	0.221	129719	0.471	0.240
Repubprez	Fraction of the voting population voting for the republican candidate in the most recent national presidential election (1996 or 2000 election)	1040	0.519	0.119	128112	0.490	0.120
Countypriv	Fraction of CWS-served county population served by a private water system	1040	0.121	0.173	129731	0.104	0.167
Inc	Per capita personal income, thousands of dollars (county level)	1040	25.161	5.908	128492	24.083	6.290
Fracvoted	Fraction of the county that voted in the most recent presidential election	1040	0.394	0.061	129682	0.381	0.083
Unemp	Fraction of the adult population that is unemployed	616	5.580	2.106	129682	5.067	2.259
Under5	Fraction of the county population that is under age five	1040	0.065	0.010	129727	0.065	0.011
Pop	County population, in thousands	1040	203.042	393.683	129727	283.915	870.218
Bdpc	State budget deficit per capita (total state and local expenditures minus total state and local revenues, divided by the state population)	1040	0.254	1.001	129725	0.185	-0.849
Rain	Average annual precipitation, in inches (state level)	1040	36.650	9.298	129378	36.448	12.244

**Table 9: Panel Analysis Regression Results, Pooled Models**

	Logit Model (EM 4)		Probit Model (EM 5)		Linear Probability Model (EM 6)
	(1 - model)	(1 - M.E.)	(2 - model)	(2 - M.E.)	(3)
<b>Dependent Variable:</b> Dummy for Privatization (mean: 0.008)					
Ntusen	2.790 (10.99)**	0.0099 (12.44)**	0.941 (10.94)**	0.941 (10.94)**	0.016 (11.54)**
Repubprez	-0.702 (1.86)+	-0.0025 (-1.85)+	-0.283 (1.96)*	-0.283 (1.96)*	-0.003 (1.01)
Inc	0.033 (4.64)**	0.0001 (4.38)**	0.016 (5.55)**	0.016 (5.55)**	0.000 (3.53)**
Unemp	8.553 (8.23)**	0.0005 (9.16)**	2.718 (7.60)**	0.064 (11.43)**	0.055 (7.78)**
Pubunion	8.553 (8.23)**	0.0303 (9.24)**	2.718 (7.60)**	2.718 (7.6)**	0.055 (7.78)**
Hlthviols	0.003 (0.54)	0.000012 (0.53)	0.003 (1.00)	0.003 (1.00)	0.000 (1.00)
Under5	6.926 (1.84)+	0.0246 (1.84)+	2.128 (1.42)	2.128 (1.42)	0.046 (1.52)
Fracvoted	-1.855 (3.98)**	-0.0066 (3.73)**	-0.939 (4.55)**	-0.939 (4.55)**	-0.013 (3.20)**
Bdpc	0.014 (0.51)	0.0000 0.5	0.011 (0.78)	0.011 (0.78)	-0.001 (1.12)
Countypriv	1.532 (8.43)**	0.0054 7.96	0.573 (7.75)**	0.573 (7.75)**	0.015 (6.66)**
Pop	-0.000 (5.08)**	-0.000002 -5.16	-0.000 (5.29)**	0.000 (5.29)**	-0.000 (10.79)**
HHI	0.302 (1.53)	0.0011 (1.53)	0.112 (1.47)	0.112 (1.47)	0.004 (2.62)**
Observations	92702		92702		92702
R-squared					0.01

Robust (based on Huber-White standard errors) z statistics in parentheses

+ significant at 10%; \* significant at 5%; \*\* significant at 1%

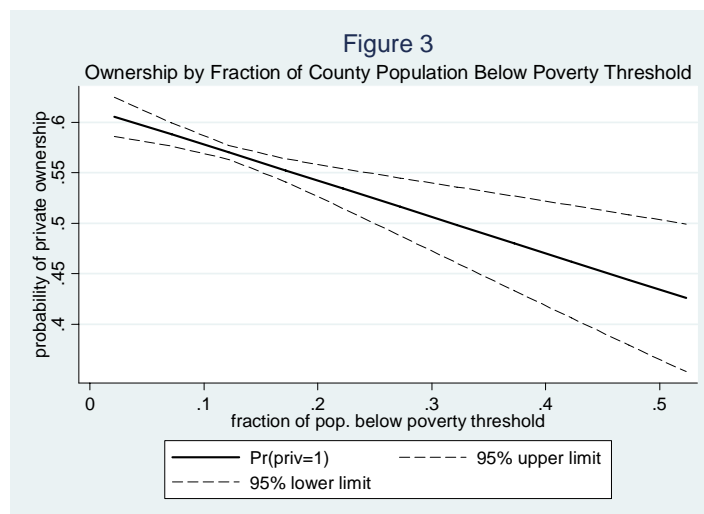
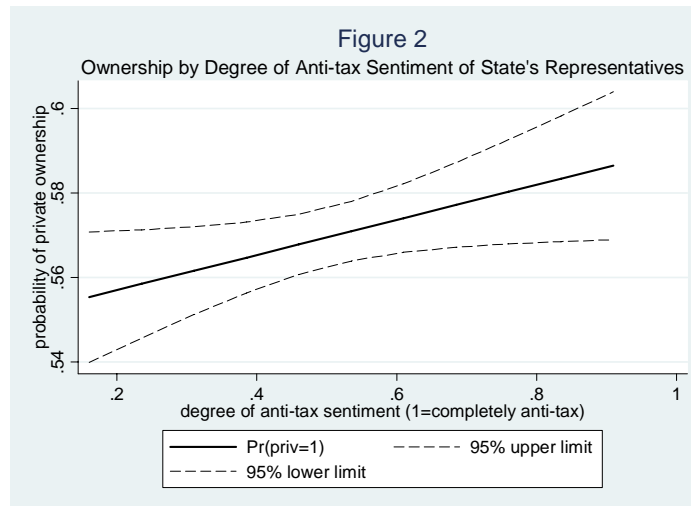
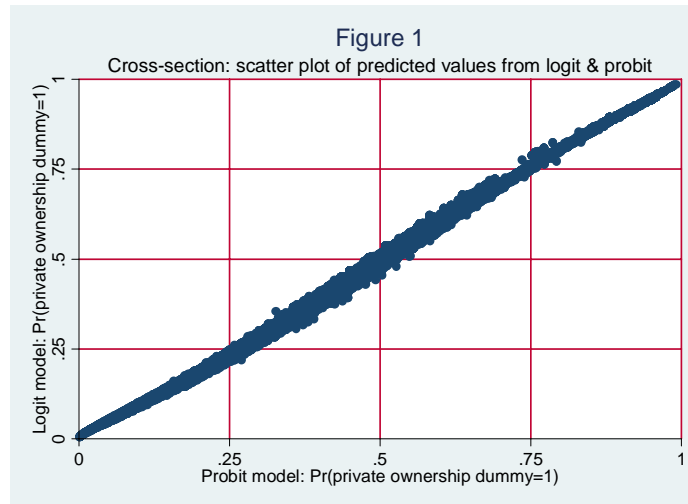
**Table 10: Panel Analysis Regression Results, Fixed Effects Linear Probability Model**

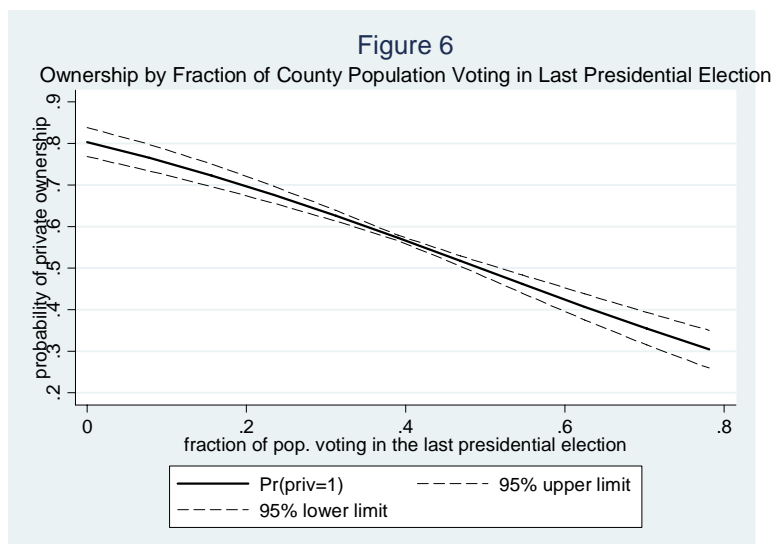
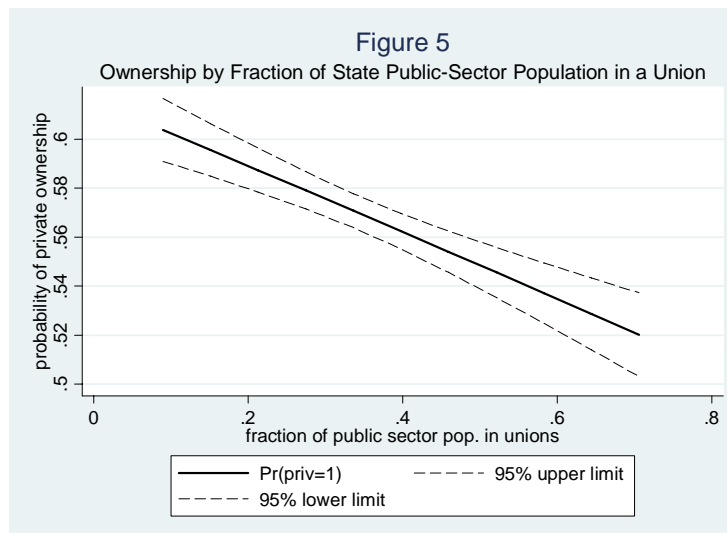
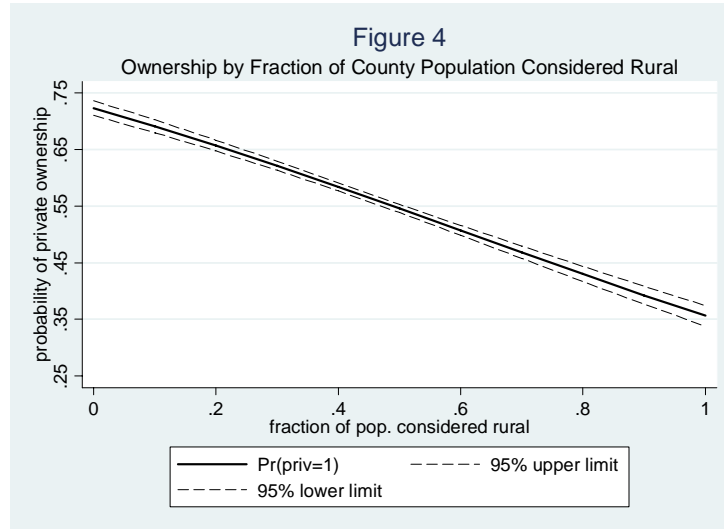
<b>Dependent Variable:</b> Dummy for Privatization (mean: 0.008)	(1)	(2)	(3)	(4)	(5)	(6)
Ntusen	0.016 (11.54)**	0.041 (13.22)**	0.048 (13.93)**	0.016 (11.08)**	0.067 (4.52)**	0.065 (6.10)**
Repubprez	-0.003 (1.01)	0.091 (13.21)**	0.081 (6.90)**	0.002 (0.50)	0.121 (5.30)**	0.115 (3.11)**
Inc	0.00021 (3.53)**	0.00104 (5.00)**	0.00058 (2.22)*	0.00020 (3.13)**	0.00135 (1.95)+	0.00133 (1.32)
Unemp	0.00115 (8.72)**	-0.000311 (0.99)	0.00032 (0.96)	0.00133 (9.35)**	0.0000179 (0.02)	-0.000284 (0.33)
Pubunion	0.055 (7.78)**	-0.449 (13.97)**	-0.429 (13.89)**	0.052 (7.47)**	-0.487 (3.71)**	-0.489 (3.74)**
Hlthviols	0.000 (1.00)	0.000 (0.35)	0.000 (0.29)	-0.003 (2.24)*	0.068 (2.09)*	0.066 (2.42)*
Under5	0.046 (1.52)	-0.364 (2.38)*	-0.190 (1.25)	0.055 (1.73)+	0.250 (0.42)	0.217 (0.41)
Fracvoted	-0.013 (3.20)**	-0.088 (5.85)**	-0.112 (6.54)**	-0.002 (0.37)	-0.222 (2.64)**	-0.214 (2.70)**
Bdpc	-0.00057 (1.12)	-0.00067 (1.65)+	0.0040 (9.87)**	-0.0011 (1.46)	0.00071 (0.40)	-0.00093 (0.26)
Countypriv	0.0155 (6.66)**	-0.00122 (0.38)	-0.000466 (0.14)	0.0153 (6.46)**	-0.00416 (0.44)	-0.00446 (0.47)
Pop	-0.0000018 (10.79)**	-0.000014 (2.18)*	-0.000018 (2.65)**	-0.0000017 (8.17)**	-0.000018 (1.24)	-0.000018 (1.14)
HHI	0.004 (2.62)**	-0.002 (0.23)	-0.007 (0.95)	0.004 (2.86)**	-0.034 (1.17)	-0.033 (1.23)
Observations	92702	92702	92702	92549	92034	92034
R-squared	0.01	0.02	0.02			
Includes Year Fixed Effects?	Yes	No	Yes	Yes	No	Yes
Includes Water System Fixed Effects?	No	Yes	Yes	No	Yes	Yes
Instruments for <i>Hlthviols</i> with <i>Rain</i> ?	No	No	No	Yes	Yes	Yes

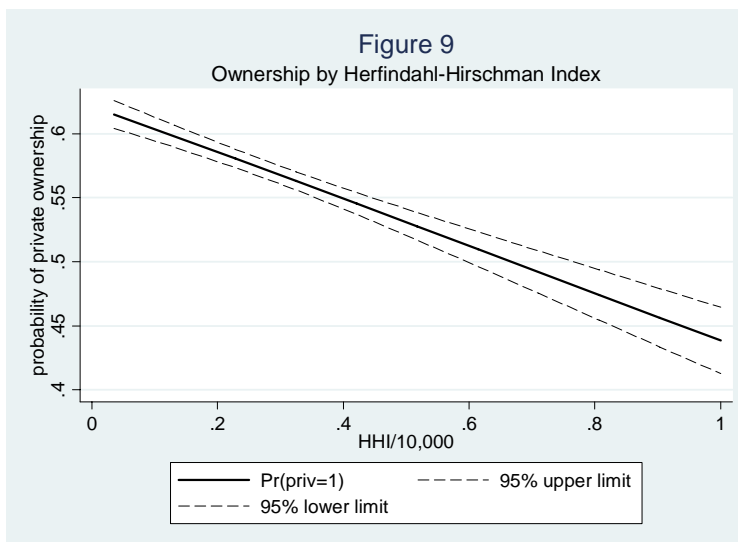
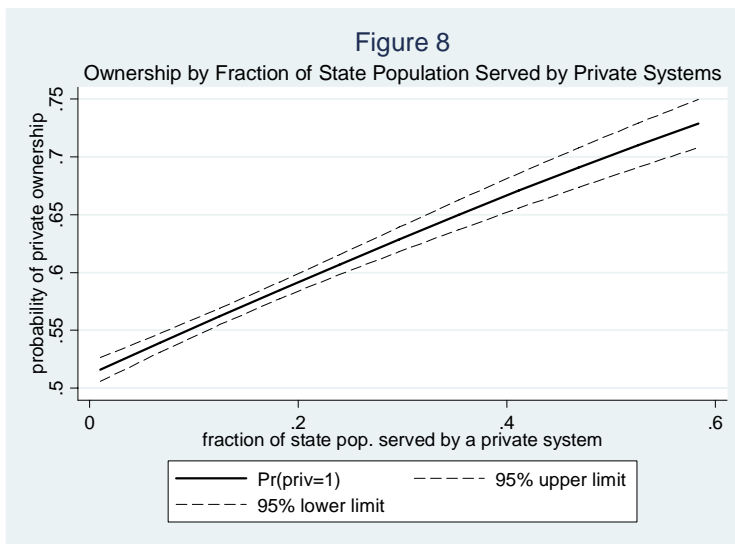
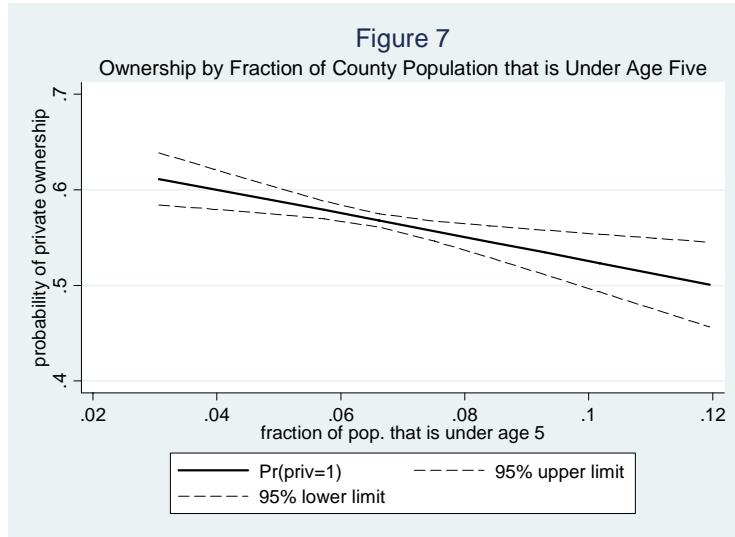
Robust (based on Huber-White standard errors) z statistics in parentheses

+ significant at 10%; \* significant at 5%; \*\* significant at 1%

## Appendix C: Figures







## Appendix D: Theory Details

**Proposition 1:** An increase in contracting difficulty,  $m$ , makes the principal more likely to use an employment contract.

Suppose contracting difficulty is increased from  $m$  to  $m'$ . Because  $d(0,m) = 0$  by assumption,  $d(0,m') = 0$ . However,  $d(q,m') > d(q,m) > 0$  for any specified  $q$ . Thus, the costs of implementing any specified quality level increase in  $m$  under a performance contract, but the costs of implementing any quality level remain constant as  $m$  increases when there is an employment contract. Furthermore, keeping  $q$  fixed,  $m$  does not affect the agent's maximization problem, and  $V(\cdot)$  does not depend on  $m$ . The wages the principal must pay to satisfy the agent's IC and IR constraints therefore do not change. Furthermore, we assume that political costs are not a function of  $m$ . Thus, an increase in  $m$  makes a performance contract less likely to be optimal. The optimal quality, however, may go up or go down.

**Proposition 2:** An increase in the importance of quality,  $s$ , makes the principal more likely to use an employment contract.

For any given, specified level of  $q$ , an increase in  $s$  from  $s$  to  $s'$  is assumed to affect neither regulatory costs nor political costs, but it does affect the principal's gross benefit function,  $V(\cdot)$ . Because  $V_{q,s}(\cdot) > 0$ , an increase in  $s$  increases the optimal quality level  $q$  and may change the optimal form of contracting from a performance contract to an employment contracting (although the reverse is not possible).

**Proposition 3:** The principal is more likely to use an employment (performance) contract as it becomes more clear that the median voter supports an employment (performance) contract, for any  $\lambda > 0$ .

As long as  $\lambda > 0$ , the utility of the median voter enters into the principal's political utility function and thus his optimization problem. Because  $f(\cdot)$  is strictly increasing in the square of the Euclidean distance between  $x_c$  and  $x_m$ , an increase in  $E(x_m)$  increases  $E(f)$  if  $x_c = 0$ , and an increase in  $E(x_m)$  decreases  $E(f)$  if  $x_c = 1$ . Furthermore, because  $x_c$  and  $x_m$  are assumed to be exogenous and do not affect  $d(\cdot)$ ,  $V(\cdot)$ , or the agent's optimization problem, they affect the optimal choice of contract only through their effect on  $f$ . Thus, employment contracts are more likely when the median voter desires them, and the same is true for performance contracts. Clearly, the effect of the median voter's ideal point depends on the pareto weight  $\lambda$  and the relative importance of the various types of costs.

**Proposition 4:** The principal is more likely to use an employment (performance) contract as it becomes more clear that organized labor supports an employment (performance) contract, for any  $\lambda < 1$ .

As long as  $\lambda < 1$ , the utility of organized labor enters into the principal's political utility function and thus his optimization problem. Because  $f(\cdot)$  is strictly increasing in the square of the Euclidean distance between  $x_c$  and  $x_u$ , an increase in  $E(x_u)$  increases  $E(f)$  if  $x_u = 0$ , and an increase in  $E(x_u)$  decreases  $E(f)$  if  $x_u = 1$ . Furthermore, because  $x_c$  and  $x_u$  are assumed to be exogenous and do not affect  $d(\cdot)$ ,  $V(\cdot)$ , or the agent's optimization problem, they affect the optimal choice of contract only through their effect on  $f$ . Thus, employment contracts are more likely when organized labor desires them, and the same is true for performance contracts. Clearly, the effect of organized labor's ideal point depends on the pareto weight  $\lambda$  and the relative importance of the various types of costs.