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Does public ownership of utilities matter for local government water policies?

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Abstract

What differentiates local governments that implement water policies on equity and the environment? Analyzing a 2015 survey of 1,897 U.S. municipalities, we find municipalities that own their water utilities more likely have policies to protect low-income residents from disconnection and to implement water resource management. Respondents from 8% of municipalities report protecting residents from disconnection. State economic regulation of publicly owned utilities and Democrat-majority municipal governments are positively associated with policies protecting low-income households from shutoffs but bear no association with resource management. Public ownership of utilities and state economic regulation may play a role in meeting water policy goals.

Keywords

drinking water disconnection (shutoff), water resource management, municipal ownership

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1. Introduction

In the United States, local governments are increasingly seen as leaders of sustainability efforts (Homsy et al., 2019a; Liao et al., 2020; Opp et al., 2014; Zhang et al., 2017). In this article, we focus on what differentiates municipalities that implement equity and environmental policies in drinking water provision. Specifically, we explore the factors that differentiate municipalities that protect low-income households from disconnection (shutoffs) and those that implement resource management policies. We give attention to the drivers of municipal water policies and the role of public utility ownership, as well as the role of state regulatory oversight of government-owned utilities.

Water utilities can be key partners in local government sustainability efforts, as their operations are at the intersection of sustainability's three E's: equity, environmental protection, and economic development. The provision of drinking water faces increasing challenges across all three of these sustainability domains in the United States. But what role does local government utility ownership play in meeting equity and environmental goals?

With respect to equity, water is becoming less affordable to an increasingly large segment of the U.S. population, especially poor people and people of color (Baird, 2010; Butts and Gasteyer, 2011). For example, tens of thousands of residents in Detroit, Michigan lose their water service every year due to unpaid bills, despite numerous programs to aid low -income households (Cwiek, 2018; Stafford, 2016). In Baltimore, the cost to finance needed infrastructure improvements pushed water rates up 127 percent over eight years, forcing thousands of low-income households into default (Colton, 2017). Although some utilities have customer - assistance programs, many of these programs fall short of helping residents emerge from water debt, which makes them an inadequate solution for households owing thousands of dollars for past water service (Swain et al., 2020).

In the wake of the COVID-19 pandemic, some cities, such as Detroit, have endeavored to restore water service to shutoff households so residents can wash their hands (Mosley and Hagan, 2020). Several states have suspended energy and water shutoffs (State Response Tracker, 2020), and more than 400 cities have placed moratoriums on water shutoff (Food and Water Watch, 2020). But will shutoff protection continue once the pandemic is over?

With respect to the environment, there also are increasing concerns about water resource management, particularly under conditions of scarcity. California recently suffered its worst drought in 200 years (Griffin and Anchukaitis, 2014) and the situation is expected to get worse as global temperatures climb (Cook et al., 2015). Both water shortages and flooding are growing threats due to climate change. The prospect of shortages has brought attention to demand-side and supply-side resource management.

The role of utility ownership and state economic regulation are both important in shaping utility governance (Beecher 2013a). These factors might help differentiate which local governments might implement water policies focused on equity or the environment.

This study presents results from a 2015 survey of local governments to understand why some protect residents from disconnection and implement water resource management policies. In the next section, we examine the literature around water utilities, public service provision, and local government environmental policy. The analysis highlights the limitations in the existing literature and points us to our main questions. Can we differentiate U.S. municipalities that implement equity and environmental policies by whether the water utility is publicly owned? Does state economic regulation, which is primarily focused on efficiency and pricing, also have an impact on equity and environmental policy? What other factors differentiate local governments that implement equity and resource management policies in the water area? We present the results of our analysis and discuss the implications for understanding the drivers of local government water utility policy.

2. Water utilities and environmental sustainability

The development of sophisticated municipal water systems in the United States resulted from supply and public health challenges of the 19^{th} and early 20^{th} centuries. In the 21^{st} century, aging infrastructure, population growth, climate change, and the potential for private investment shape the debate (Cooley, 2012). Water utilities in the United States, due to the renewable nature of the good provided, are positioned to be leaders in sustainability (Beecher, 2016). In this section, we explore the relevant literature in four key areas: equity (water disconnection), water resource management, public versus private delivery systems, and economic regulation by state public utility commissions. We focus on the implications for local government policy.

Equity: Water Shutoffs

Water poverty is an increasing concern in the United States. A household affordability benchmark used by the U.S. Environmental Protection Agency considers when water bills rise above two percent of the community's median household income (Baird, 2010; Czerwinski et al., 2017). Many researchers emphasize that a metric based upon a community's median household income may not accurately reflect the burden placed on the poorer residents in a water service area (Raucher et al., 2019). The affordability challenge can be particularly acute in small and rural communities because large cities can capture economies of scale and spread the burden of subsidizing water for low-income households across a wider ratepayer base (Baird, 2010). Minorities, in particular, suffer the impacts of poor water and sanitation infrastructure (Gasteyer et al., 2016). Water provided by investor-owned water companies tends to be more expensive than water provided by publicly owned utilities (Beecher and Kalmbach, 2013; Teodoro, 2019).

Water affordability is a function of rising water prices that are primarily associated with the estimated $473 billion needed to replace thousands of miles of aging pipes as well as update treatment plants and storage tanks around the nation (US EPA, 2018). Falling usage generally is also putting pressure on rates (Beecher and Chesnutt, 2012). For example, Baltimore, Maryland expects to make capital investments to its water and wastewater system in excess of $1 billion (Colton 2017). However, many of the city's low-income residents cannot afford to pay higher bills, and the number of households paying more than 2.5% of income for water will increase rapidly as water charges rise (Colton, 2017). In other cities, such as Boston and Detroit, utilities use shutoffs as an enforcement tool, and confusing billing practices contribute to this problem (Amirhadji et al., 2013). In Michigan, higher water rates fall disproportionately on people of color, usually in older, depopulated cities that have to spread higher costs across fewer people

(Butts and Gasteyer, 2011). When households cannot pay, shutoffs create a "moral and public health crisis" for poor residents and neighborhoods but fail to solve the revenue problem for utilities (Swain et al., 2020, p. 5).

Full-cost pricing of water is a tool for resource management and provides financial stability to utilities, but affects affordability for disadvantaged groups, which often need some kind of subsidy (Swain et al., 2020; Baird, 2010). Other forms of subsidy can come from either the utility (regardless of ownership) as well as from the municipal government. Some programs are utility-funded but run by other organizations. In St. Petersburg and Cocoa, Florida, the municipal water utilities do not have low-income assistance programs, but the cities do (Forrer et al., 2016). In St. Petersburg, the funding for municipal programs comes from a variety of sources, such as local charities (e.g. United Way or Catholic Charities), religious organizations, state, and federal agencies, but these may be less secure than a utility-funded program. In a study of 80 larger Midwest utilities, just over ten percent provided discounts for low-income customers; another 10 percent had senior discounts; and only about one-quarter had payment assistance programs available (Beecher and Kalmbach, 2013). Just under half of California's population is served by a water system with a low-income assistance program and the state has proposed implementing standards that provide for a 20 to 50 percent water bill discount to low-income households below 200 percent of the federal poverty level based on water rates (State Water Resources Control Board, 2019; Walton, 2017a). Raleigh, North Carolina passed the city's first water aid bill in 2016, which allows low-income residents to get an annual credit of $240 on their municipal water and sewer bills (Walton, 2017b).

Income-based pricing may be protective, but many policymakers question its effectiveness (Swain et al., 2020). Philadelphia's municipal water system is experimenting with a Tiered Assistance Program designed to match the cost of water to a resident's ability to pay, a need faced by more than 60,000 of the city's households (Walton, 2017a). Pierce, Chow, and DeShazo (2020) assert that states are the best level for providing low-income assistance programs in the utility sector. However, some state statutes may prohibit preferential treatment of specific customers; this has been interpreted as a constraint on the ability of a utility to fund low-income assistance programs (Pierce et al., 2020; Walton, 2017b; UNC Environmental Finance Center, 2017).

Environment: Water Resource Management

Traditional water planning focused on increasing supply rather than curbing demand (Hornberger et al., 2015). However, as access to new water sources becomes more difficult in some areas, efficiency and water resource management become increasingly important, with pricing strategies recognized as an effective demand-side policy tool for reducing water consumption. Although rarely used, pricing strategies can be more effective at inducing conservation than nonprice approaches (Olmstead and Stavins, 2009). There are numerous pricing structures meant to incentivize conservation of water, including excess-use surcharges, seasonal rates, and inclining-block rates, where consumers pay a higher rate as they use more water (Smith and Wang, 2008). Price effects may be more pronounced for low-income households, which face a disproportionate burden of increased rates (Wichman et al., 2016).

Despite their potential efficiency, water price increases for conservation purposes can be politically difficult (Olmstead and Stavins, 2009) and counterintuitive to utilities that may see revenues drop as they sell less water (Beecher, and Chesnutt, 2012; Kenney, 2014). Beecher and Kalmbach (2013) found that only about 10 percent of utilities in the U.S. Great Lakes region charged higher rates at higher usage levels, which might be explained by water conditions. Pricing structures aimed at managing demand for other municipal services have been successful. For example, some municipalities have used unit-based pricing to encourage lower household trash production (Gradus et al., 2019), and utilities have used pricing to promote efficiency in electricity (Allcott, 2011).

Other demand-side approaches to water include efficiency standards for toilets, fixtures, and appliances have been very effective in reducing water usage (DeOreo, Mayer, Dziegielewski, and Kiefer, 2016). These operate effectively across households regardless of income (Wichman et al., 2016). Some cities have implemented programs to accelerate fixture replacement, for example, by inducing the purchase of water-saving equipment or induce conservation with rebates, but their effectiveness may be limited (Olmstead and Stavins, 2009; Maggioni, 2014). A study of water conservation in four European cities found that multiple policies (including infrastructure investments, increased use of water-efficient appliances, and universal metering) worked in tandem to reduce water usage (Stavenhagen et al., 2018).

Greywater reuse is a supply-side sustainability measure by which local governments provide, require, incentivize, or allow the use of reclaimed water on landscapes or for other non-consumptive purposes. In the United States, such uses of greywater account for less than five percent of municipally supplied water, but could grow (Grant et al., 2012; Sgroi et al., 2018; Yerri and Piratla, 2019). Water reuse is practiced in various cities (for example in California and Texas) and holds promise as technologies change to make the practice more cost-effective in some areas (Wilcox et al., 2016; Yerri and Piratla, 2019).

There is little research on the drivers of local government water resource policies. In general, the understood risk to a community, as with climate change, seems to be a factor for inducing sustainability action (Zahran et al., 2008). Reactions to disasters, such as prolonged drought, can encourage sustainability actions (El-Khattabi, 2018; Homsy et al., 2019a). Studies of neighboring communities facing similar drought conditions in California show a wide range of conservation efforts (Sierra Club, 2011). Among California communities, household income, city size, and staff support (but not political party) are positively associated with the adoption of water-efficiency policies (Bulkeley and Betsill, 2005; Homsy et al., 2019b; Bedsworth and Hanak, 2013).

Public ownership may also matter to local water policies. Public water utilities are more likely to pay attention to conservation (Furlong et al., 2018; Furlong, 2016a, 2016b) and this has been one driver for reasserting municipal control of water in the United States (Mann and Warner, 2019). Similar results have been found with publicly owned local electric utilities in the United States (Homsy, 2018, 2016). U.S. water utilities sit in a multi-level governance system where both local and state policy matters (Bulkeley and Betsill, 2005; Homsy et al., 2019b).

Publicly owned versus privately owned water supply

In the United States, drinking water provision has remained largely in the public sector. Publicly owned water utilities serve 87 percent of customers in the United States. Utilities that are not publicly owned account for a large number of water systems (46%), but they serve a much small share of total customers((U.S. EPA 2017). In some areas, pressure to privatize can come from the desire for non-governmental investment in infrastructure (Lieberherr and Fuenfschilling, 2016). Although cities can access capital markets at lower rates, debt limits and fiscal constraints mean that some local governments have limited capacity to fund desired upgrades (Furlong, 2016a). Private drinking water companies seek to acquire systems where residents have the means to pay, but without substantial political influence to control rate increases (Lieberherr and Fuenfschilling, 2016; Greiner, 2016). Privatization can be ideologically driven by the goals of smaller government or greater efficiency in the provision of drinking water (Beecher, 2008).

Much of the research into the impact on privatization centers on the operational efficiency of utilities. In a study of water utilities in France and the United Kingdom, Dore et al. (2004) found that the private provision of drinking water offered no efficiency advantages over public provision. A meta-regression analysis of studies published from 1960-2010 also finds no statistical support for lower costs through private water operations (Bel et al., 2010). Overall, research findings are mixed and private ownership does not appear to offer a clear advantage (Beecher, 2013a).

The understanding that privatization does not result in cost savings, has led to global interest in re-municipalization in water (Clifton et al., 2019; McDonald, 2018; Kishimoto and Petitjean, 2017). Private concessions are longstanding in France, but the process of re-municipalization of water has been most aggressive there, as localities believe they can serve their communities more efficiently with public ownership (Chong et al., 2015; Hall et al., 2013); more than 100 cities have canceled private concession contracts to bring operations water back under public control (Chong et al., 2015). In the United Kingdom, water service shutoffs, cherry-picking lucrative service areas, and a decrease in water quality led to increased interest in the possibility of having the government take back operations of water utilities (Lieberherr and Fuenfschilling, 2016). In the United States, nine percent of municipalities reported insourcing water delivery between 2007 and 2012 (Warner and Hefetz, 2012). Re-municipalization in the US is part of a pragmatic process of market management (Warner and Hefetz, 2020; Warner and Aldag, 2019).

The role of public utility commissions

Water governance is managed at the federal, state, local, and utility scales and varies across the fifty states. State PUCs (or public service commissions) are charged with regulatory oversight of privately owned and sometimes publicly owned utilities. This includes the approval of prices and financing arrangements, necessary because of the monopolistic nature of water utilities and the importance of the product they deliver (Beecher, 2008). For the most part, PUCs regulate investor-owned utilities; forty-five states regulate private water companies. Municipal utilities have been traditionally controlled by local governments that answer to voters, so most state legislatures perceive that oversight of these utilities would be redundant. Only six states (Indiana, Maine, Pennsylvania, Rhode Island, West Virginia, and Wisconsin) regulate government-owned utilities (UNC Environmental Finance Center, 2017). Five states (Georgia, Michigan, Minnesota, North Dakota, and South Dakota) do not regulate the water sector, mainly due to the limited presence of the private sector (Beecher, 2018).

PUCs are technocratic with expert staff who advise politically appointed members (Jones, 2006). The exact set of regulatory responsibilities each PUC has varies from state to state. Many PUCs regulate the conditions for disconnecting utility services. Most PUCs use a rate-base/rate-of-return (RBROR) methodology to set rates (Beecher and Kalmbach, 2013). PUCs approve rate increases and allow utilities to charge customers for the cost to provide the service.

Economic regulation promotes efficient resource allocation through pricing. PUCs operate under a long-standing and highly defined paradigm grounded in the law (Beecher 2013b). Although PUCs are not environmental regulators, and other agencies have this responsibility, a general review of their statutory authority indicates that many states "explicitly recognize the link between economic and environmental issues" in the context of a wide variety of regulatory proceedings (Dworkin et al., 2006).

3. Examining the data

We are interested in what differentiates municipalities that protect low-income households from water disconnection and those that enact water resource management policies. We draw our data from a survey of local governments we conducted with the International City/County Management Association in 2015. The survey covered the adoption of equity and environmental policies across numerous issue areas. The survey universe consisted of all counties, municipalities, and townships with more than 25,000 people as well as a one in 2.5 sample of municipalities and townships with between 2,500 and 24,999 people. The survey was sent to the chief administrative officer in the 8,562 governments in this universe. A total of 1,897 counties and municipalities responded (22% response rate). These local governments are our unit of analysis.

3.1 Dependent variables

We created two dependent variables, one for shutoff protection and one for water resource management policies, based on answers to a series of questions on the survey. For each dependent variable, we ran three models. The first model is of all municipalities in the sample; we then run separate models for those local governments that own their water utility and those that do not. For the first set of models (Table 2 a, b, & c), we use a binary dependent variable that indicates whether or not a local government has taken action to "protect low-income households from water service shutoff. " This phrasing is used in the 2015 sustainability survey and is understood to mean protection from disconnection due to non-payment of water bills. We are not able to distinguish between different kinds of shutoff protection programs. Only eight percent of municipalities in our sample reported having a program in place to protect low-income households from water shutoffs.

The second set of models address water resource management (Table 3 a, b, & c), using a count variable based on whether the government had taken actions to:

- “Provide for the reuse of greywater or reclaimed water on the landscaping of private homes or businesses.”

- “Reuse grey or reclaimed water in government buildings, public parks or public facilities.”
- “Use water price structure to encourage water conservation.”
- “Other incentives for water conservation behaviors by city, residents, and businesses.”

All of the above are the exact wording from the survey. On average, communities in our sample have less than one of these policies in place.

Both of our dependent variables are at the local government level. We do not know if these are imposed by the city, the utility, or state law. In keeping with our research questions, we control for utility ownership and PUC regulation in our models to test the association with water policies.

3.2 Independent variables

The independent variables for these two sets of models cover seven main areas of interest: utility ownership, PUC jurisdiction, community values, drought experience, capacity, metropolitan status, and partisan politics. Table 1 contains descriptive statistics of all variables.

Ownership. This variable, drawn from the ICMA survey, indicates whether or not the local government owns the water utility. We expect public ownership of the water utility will be positively correlated with the dependent variables, due to a greater public orientation.

PUC jurisdiction. Numerous factors, in addition to ownership, may impact local water policies. Among these factors are external institutions, such as state public utility commissions (Beecher, 2013b). This variable describes the extent to which a state PUC regulates government-owned utilities. Based on Beecher (2018) and a review of state PUC websites, we classified states into three groups: no regulation of publicly owned water utilities (44 states), comprehensive regulation of government-owned water utilities (Maine and Wisconsin), and some jurisdiction (Indiana, Pennsylvania, Rhode Island, West Virginia). The third category includes cases where municipalities might only be regulated by the PUC if their service extends beyond municipal boundaries or they might be able to opt in or out of state economic regulation. We expect a positive correlation, as PUC regulation centers on efficient pricing but also encompasses consumer protection (Beecher 2013b). This variable is dropped in models 2c & 3c because the sample contains municipalities that do not own their water utility.

Community values. These variables seek to gauge the commitment that the local community may have to sustainability in general and water in particular. One indication that these issues are a priority is the adoption of social equity and environmental protection as goals in comprehensive or other local plans. The presence of a clearly stated goal would be positively correlated with each of our dependent variables. We also include in each model the dependent variable from the other model as another measure of community values.

Drought experience. The ICMA survey asked if a local government has had to respond to a major disaster over the past 15 years, and then asked about a series of disaster types. One of the options was for a drought. Communities that experienced a major drought, and those in the arid West, are expected to be more aware of water issues and likely to implement water resource management policies.

Table 1 – Descriptive Statistics of Model Variables				
(n= 1,897 US municipalities and counties)	Mean	Standard Deviation	Min	Max
Dependent variables				
Protect low-income households from water shutoff [a]	0.08	0.27	0	1
Water resource management index [a]	0.69	1.03	0	4
Independent variables				
Ownership				
Government-owned utility [a]	0.55	0.50	0	1
Community values				
Equity goal in sustainability plan [a]	0.26	0.44	0	1
Environment goal in sustainability plan [a]	0.47	0.50	0	1
Drought experience				
Western U.S. community [a]	0.19	0.39	0	1
Experienced a drought in last 15 years [a]	0.11	0.32	0	1
Local Fiscal Capacity				
Per capita income (logged) [c]	28,794	12,186	5,235	152,128
Local govt revenue per capita ($1000s) [d]	1.76	1.48	0.01	18.17
Politics				
Governing body is majority Democrats [a]	0.17	0.37	0	1
Controls				
Population in 2010[e]	61,046	279,075	641	9,818,605
Density in 2010 [e]	1,646	1,992	0.07	20,519
Role of state public utility commission (number & percent)				
No PUC regulation of govt-owned utility [a]	1,593	83.9%		
Some PUC regulation of govt-owned utility [a]	227	12.0%		
Comprehensive regulation of govt-owned utility [a]	576	4.1%		
Metropolitan status (number & percent)				
Urban [f]	288	15.2%		
Suburb [f]	1,033	54.5%		
Rural [f]	576	30.3%		

Data Sources: [a]ICMA Sustainability Survey, 2015, [b]UNC Environmental Finance Center 2017 and Beecher 2018, [c]American Community Survey (2010-2014), [d]US Census of Government Finance 2012, [e] US Census 2010, [f] OMB 2013.

Local Fiscal Capacity measures how well-positioned municipalities and counties might be in terms of the resources needed to enact policy change. We measure this by per capita income (Five-year 2010-2014 American Community Survey estimates) and local government revenue per capita (2012 Census of Government Finance). We expect both measures to be positively related to equity and environmental policymaking.

Partisan politics examines party affiliation of local officials. On the survey, respondents were asked to characterize their governing body as majority Republican, majority Democrat, evenly split, or no party affiliation. We expect those with a majority identifying with the Democratic party would be more inclined to implement shutoff protection and resource management policies.

Metropolitan status. We differentiate metro status using the U.S. Office of Management and Budget delineations for metro status and principal city (US OMB, 2013). Metro core includes the principal cities and counties in metropolitan areas. Suburbs are all other metro communities, and rural are coded as non-metropolitan.

Controls. We use population and population density as controls. These data come from the 2010 US Census and have been shown to be positively related to equity and environmental policymaking.

3.3 Limitations

The research has several limitations. First, the largest municipalities by population (100,000 or more) and the smallest (under 25,000) are slightly overrepresented in the sample, while those communities with populations between 25,000 and 99,999 are underrepresented. Fifteen percent of communities were metropolitan principal cities or counties, 54 percent suburbs, and 30 percent rural communities. Urban and suburban jurisdictions are somewhat overrepresented and rural underrepresented. Second, the survey only identified whether the local government owned the utility and does not distinguish among other ownership forms, which include private ownership but also other models. Third, the dependent variables in our models only measure the adoption of policies and not their scope or effectiveness. Fourth, the survey only measured if the local government protected residents from water service shutoffs in a yes or no fashion. Shutoff protection policies may also be imposed by the state and implemented by state agencies (namely, PUCs). There are various ways that local governments provide low-income assistance separate from utilities and numerous ways that such programs are funded (Forrer et al. 2016). We do not have more detailed information on the nature of the applicable programs. Fifth, we grouped the four water resource management policies together and are not able to distinguish them. Finally, our analysis is at the municipal, not the utility level. Policies can be implemented at various levels: federal, state, and local. City administrators may not be fully aware of policies expressed only through the utility. Lack of a local policy does not necessarily indicate a lack of policy or activity in an area as it may come from another level. Our interest is in the perceptions of city managers with regard to their municipality's programs in these two areas of water policy.

4. Water utilities and sustainability policies

The results of our regression models are presented in Tables 2 & 3. The first set of models in Table 2 uses logistic regression to differentiate which local governments protect low-income residents from water shutoff. The results are expressed as odds ratios, which measure the odds that a one-unit change in the independent variable will result in a community policy to protect low-income households from disconnection. A value above one means increased odds; below one means decreased odds. For example, if a utility is government-owned, the municipality is about two times more likely to have water shutoff protection policies (coeff.= 2.222).

The second set of models in Table 3 uses a Poisson regression because the dependent variable is a count of water resource management policies adopted by local governments. The results are expressed as incidence rate ratios, which provides the estimated change in the count of water resource management policies given a one-unit change in the independent variable. A value above one means an increased rate; below one means a decreased rate. For example, if a utility is government-owned, the municipality is expected to have adopted water resource management policies three times more often (coeff.=2.953) than communities without a government-owned water system; put another way, communities that own their water utilities are predicted to have about three of the four policies measured.

The central question for our research is the role of government-owned utilities in these sustainability actions. We find an overall positive correlation between public ownership of a water utility and local government policies related to shutoff protection and resource management (Tables 2 & 3). Jurisdictions with government-owned providers of drinking water are more than twice as likely to protect households from disconnection and are predicted to have almost three times more water resource management policies in place.

A second goal of this study was to understand the possible impact of the state PUCs on equity and environmental protection. The results are mixed. In the overall model for protection from water shutoff (Model 2a) we see that in states where PUCs comprehensively oversee publicly owned utilities, municipalities are more than twice as likely to protect low-income households from water shutoffs. However, if the state only provides partial regulation, there appears to be no effect on local shutoff policies (Model 2a). We also ran these dependent variables in models that just included places with public ownership (Models 2b and 3b) and those without public ownership (models Models 2c and 3c). Only in the water shutoff protection model does the state PUC play a significant positive role, and only in the states with comprehensive regulation. In the water resource management models (Models 3a and 3b), we see that comprehensive state regulation has no effect and some regulation is associated with a lower likelihood of implementing water resource management policies. Further analysis should assess the scope of PUC regulation in those states with limited regulation to understand what might explain this negative effect.

We find some support for previous research that community values matter for water sustainability. Local governments with equity specified as a goal in their sustainability plan are almost twice as likely to protect low-income residents from shutoffs. Interestingly, the impact of a community stating an explicit equity goal in its plan only boosts the odds of water service protection in communities with a municipal utility (model 2b); it appears to have no impact on places without a municipal utility (2c). This demonstrates the importance of public ownership. Utilities that are not integrated into the local government may be less bound by local goals or policies.

With regard to overall water resource management (model 3a), having an environmental protection goal in the sustainability plan is not significant. This could be because environmental protection is a broad goal and may not be directly focused on water. Utilities may have their own plans not reflected in these data. If a community protects low-income residents from water

Table 2 –Regression Results: Protection from Water Shutoff (odds ratios)

	Model 2a All localities	**Model 2b Publicly owned**	**Not publicly owned**
Unit of analysis: US municipalities and counties, 2015	N=1,897	N=1,052	N=845
Ownership			
Publicly owned utility	**2.222		
Role of state PUC			
Some PUC regulation of govt-owned utilities	1.607	0.876	
Comprehensive PUC regulation of govt-owned utilities	*2.194	**2.454	
Community values			
Equity goal in sustainability plan	*1.860	**1.776	2.276
Water resource management index (0-4)	**1.692	**1.458	**2.981
Drought experience			
Western U.S. community	0.898	1.012	0.529
Experienced a drought	1.201	1.528	0.205
Local Fiscal Capacity			
Per capita income (logged)	*0.979	0.987	*0.949
Local govt revenue per capita	1.076	1.082	1.087
Metropolitan status (reference: metro core)			
Suburb	*2.121	*2.043	3.222
Rural	*2.015	1.802	2.928
Politics			
Governing body majority Democrat	*1.584	1.589	1.813
Controls			
Population in 2010	1.094	1.146	0.954
Density in 2010	1.000	**1.000	1.000

* 0.05 level of significance; ** 0.001 level of significance

Table 3 –Regression Results: Water Resource Management (incidence rate ratios)

	Model 3a All localities	Model 3b Publicly Owned	Model 3c Not Publicly Owned
Unit of analysis: US municipalities and counties, 2015	N=1897	N=1,052	N=845
Ownership			
Publicly owned utility	**2.953		
Role of state PUC			
Some PUC regulation of govt-owned utilities	**0.493	*0.492	
Comprehensive PUC regulation of govt-owned utilities	0.680	0.796	
Community values			
Environment goal in sustainability plan	1.060	1.032	1.222
Protect households from shutoffs	**1.604	**1.424	**5.605
Drought experience			
Western U.S. community	**1.541	**1.518	**1.918
Experienced a drought	**1.350	*1.283	**1.835
Capacity			
Per capita income (logged)	**1.011	**1.010	**1.014
Local govt revenue per capita	1.022	1.018	1.073
Metropolitan status (reference: metro core)			
Suburb	1.094	1.033	1.411
Rural	0.855	0.857	0.879
Politics			
Governing body majority Democrat	0.883	0.902	0.807
Controls			
Population in 2010	**1.196	**1.195	**1.288
Density in 2010	**1.000	1.000	**1.000

* 0.05 level of significance; ** 0.001 level of significance

shutoff, it is more likely to engage in water resource management. For every water resource management policy adopted by the local government, the odds that they also have protection from water shutoff increase by about 69 percent. The sub-models (models 3b and 3c) show largely the same results. Across both models, we find that shutoff protection and resource management go hand in hand. Communities that have experienced drought or are in the Western

United States appear more inclined to implement the water resource management policies considered, as expected.

We used two common variables to measure local government capacity with the expectation that places with higher capacity would be more likely to implement sustainability policies. Places with higher per capita income are less likely to protect their residents from water shutoff, but they enact more water resource management policies. Municipalities with a majority Democratic governing board were more likely to protect low-income residents from shutoff, but we see no difference in the level of resource management policies. Local government revenue per capita is not significant in either model. This could be because water utilities typically operate on an enterprise basis with separate budgets from the overall municipality.

After controlling for other factors, our multi-variate regression finds that suburbs and rural municipalities are about twice as likely as metro core municipalities to have policies in place to protect residents from shutoffs. However, metropolitan status seems to have no bearing on local governments' water resource management practices. Population size is positively related to resource management policies, but not significant with regards to protecting customers from water shutoffs. Density is positive and significant in both models.

5. Discussion

Five important insights come from this analysis. First is the role of the government in providing water services. Some scholars argue that public ownership of utilities can align with local government policies that include a broader set of values, beyond just cost efficiency, and can better address equity and environmental concerns (Furlong et al., 2018; McDonald, 2018; 2016; Hall et al., 2013). We see evidence of these values, as we find a higher rate of protection from water shutoff and higher use of water resource management measures among localities with publicly owned utilities. What might explain this? Research on sustainability policies, in general, finds that governments with publicly owned utilities are more likely to implement both social equity and environmental policies (Liao et al., 2019). Research on the impact of government ownership of electric utilities finds local governments with municipal-owned power companies were more likely to implement sustainability actions in the community for two main reasons (Homsy, 2016). First, government ownership allowed the utility to reflect the values of the local community. Second, municipalities with publicly owned utilities had access to more capacity to address environmental issues. Our results suggest the same may hold true for water utilities.

Second, can regulated utilities that are not publicly owned (particularly profit-oriented utilities) embody the public values as expressed by a community? The lower likelihood of protection from shutoffs and lower use of resource management measures in communities with nongovernmental utilities confirms Furlong’s (2016b) findings that few investor-owned utilities fall into line with community values, despite various strategies designed to encourage their public orientation. Profit orientation, despite regulation, may push public and community development goals to secondary status (Mann and Warner, 2019; Lobina, 2017). As communities struggle to deal with the cost of needed water infrastructure investments, privatization may appeal to many local governments, especially those with low capacity, but this may limit the local government's ability to meet local social equity and environmental goals. Further research with more precise data on the various ownership structures would help elaborate the findings here.

Third, this empirical analysis expands our understanding of PUCs. State PUC oversight is positively correlated to shutoff protection only under the most comprehensive regulatory regimes. PUCs protect ratepayers in the context of monopolistic operation while ensuring that utilities have the revenue they need to cover their costs. Some legal scholars maintain that PUCs have broader power (Dworkin et al., 2006). Our empirical analysis indicates that PUC oversight increases the odds that local governments with publicly owned utilities will protect low-income households from water shutoffs. This finding shows PUC regulation is focused on more than just cost recovery (Beecher 2013b). However, we find PUC oversight is associated with the adoption of fewer water resource management policies in those states with less comprehensive policies. Although PUCs may consider environmental issues in planning, certification and ratemaking, they consider equity and environmental goals in relation to economic goals.

Fourth, we find that having a Democratic majority on the governing body increases the odds that the municipality will have policies to protect low-income people from water shutoffs, as hypothesized. However, we found that a Democrat majority had no significant impact on water resource management policies. This is in contrast to studies of broader environmental policies, which find a positive political effect compared to Republican-controlled governments (Liao et al., 2020).

Finally, the apparent lower odds of protection from water shutoffs in the metro core is a surprise. We expected metro core cities to be more attuned to social equity concerns regarding water shutoffs. It may be that principal cities are more likely to have government-owned utilities organized on an enterprise (or "corporatized") basis, whereas suburban and rural communities may treat the water utility as a department integrated within the rest of the local government. If there is a higher degree of corporatization in principal -city water utilities, then transfers (or cross-subsidies) from the general local government budget may not be possible. Scholars have raised concerns that corporatization of publicly owned services can undermine social and environmental objectives because the focus of attention shifts from community development to financial concerns (Clifton et al., 2016; McDonald, 2014). Future research might include measures of utility corporatization in its various forms to explore these points.

5. Conclusion

This research analyzes the factors that differentiate communities that have water policies related to equity and the environment. We find that ownership matters, as communities with publicly owned utilities appear more inclined to protect residents from water service shutoffs and engage in water resource management.

As water shutoff threats accelerate, researchers need to continue to examine whether and how states regulate shutoffs. In the midst of the COVID-19 pandemic, many states and cities have placed moratoriums on water shutoffs. Will this continue after the crisis? Local governments and utilities sometimes face tensions when it comes to promoting conservation and maintaining affordability, including pricing strategies (Homsy, 2016, 2018; Beecher, 2016). In the interests of equity, utilities will need to find alternatives to disconnecting customers from such a vital resource as water; these options may come in the form of low-income assistance programs, prepaid metering, and the use of flow restrictors (Beecher, 2016). Some state policies may limit customer-assistance programs (UNC Environmental Finance Center, 2017; Walton, 2017b), but our research shows state regulation can play a positive role.

Our research is among the first to examine the impact of PUC regulation in the water sector on something other than economic or financial performance. While we found a positive impact of PUC jurisdiction on protecting low-income households, we found a negative association with local water resource management. However, only six state PUCs regulate publicly owned water utilities to a relevant degree. One area for future research is to examine the impact of different state legislative and regulatory policies on publicly and privately owned utilities. While states regulate privately owned water utilities, policies vary. While we find that public ownership of water utilities is more important in achieving sustainability goals, future research could help us clarify whether state economic regulators might play a greater role for different types of utilities. Our study shows the potential importance of both public ownership and state regulation in promoting local equity and environmental policies going forward.

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