# Privatization as Political Decoupling:

# Water Conservation and the 2014-2017 California Drought[1]

- Working Paper -


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## Abstract

Over the past three decades, decoupling has emerged as a regulatory strategy for promoting conservation, especially in the energy sector. Decoupling refers to the separation of a firm's revenues from the volume of its product consumed. Decoupling allows companies to pursue resource efficiency free from financial risk. Similarly, when private firms provide public services, they separate public policies from their political costs. This political decoupling allows governments to pursue controversial policies while avoiding their attendant political risks. Applied to environmental policy, this theory implies that unpopular conservation policies are more likely to be adopted and succeed when implemented through private firms. Our empirical subjects are California water utilities and their responses to that state's 2014–2017 drought. Analysis shows that, compared with those served by municipal utilities, private utilities adopted more aggressive conservation measures, were more likely to meet state conservation standards, and conserved more water.



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Over the past three decades, *decoupling* has emerged in the United States as a regulatory strategy for promoting resource conservation, especially in the energy sector, where electricity is generated mainly by private utility companies. In regulatory economics, decoupling refers to the separation of a firm's revenues from the volume of its product consumed. Private firms generally prefer maximizing revenue by selling more of their product, *ceteris paribus*. Where consumption of that product generates significant negative externalities or causes common pool resource problems, revenue maximizing by individual firms can be collectively inefficient and unsustainable. Promoted by conservation activists, decoupling allows firms to pursue resource efficiency without its usual attendant financial risk. If conservation causes revenue shortfalls that threaten profits, decoupling provides for automatic rate increases in order to maintain revenue for the utility. Decoupling thus insulates firms from the financial risk of conservation.

Like private firms, public agencies at all levels of government also provide services that are environmentally costly. Unlike firms, public agencies are not profit-maximizers; government actions are determined through a political process, with production and consumption decisions determined according to political preferences. Where citizens and/or their elected officials prefer environmental sustainability, government agencies will pursue sustainable policy. However, where a majority of the public prefers greater consumption of environmental resources, conservation policies are unpopular, and so expose government officials to political risks. Konisky & Teodoro (2016) argue that this political risk is part of what makes government agencies more difficult to regulate than private firms.

We argue that, where policy goals can be achieved through regulation of private firms, private provision of public services allows governments to separate public policies from their political costs. By shifting production or service provision from the public to the private sector, governments can achieve policy goals through regulation, while shifting the accompanying political risks to the private sector, where they are less acutely felt. The result is a *political decoupling* that allows governments to achieve policy goals while insulating officials from their political costs. One implication is that, where financial decoupling exists, regulated private firms are more likely to comply with environmental regulations than are government agencies, because the latter bear electoral costs that the former do not.

Our empirical subjects are public and private water utilities' responses to a recent drought in California. In 2015, severe drought conditions throughout California prompted the state government to order a mandatory reductions in urban water consumption. To achieve this goal, the state government set individualized conservation standards for 408 of its largest water suppliers based on their past consumption patterns. These utilities vary widely in service populations, ex ante consumption patterns, and several other characteristics. They also vary in ownership: 84 percent of the utilities subject to the mandate were owned and operated by local governments; the other 16 percent were owned by private, investor-owned firms.

Effective conservation measures reduce water sales, which in turn reduce utility revenues; aggressive conservation policies thus carry potentially severe financial risks for utilities. Where local governments provide water service, they absorb the financial risk associated with any conservation regulations that they impose. Where communities are served by private utilities, any rate revenue losses caused by local government conservation regulations are borne by the firms that own the utilities. In theory, both public and private water utility finance are effectively "decoupled" in California: public and private utilities alike can adjust future rates upward to recapture revenue lost due to conservation. Private water utilities in California enjoy rate decoupling through a state financial regulatory process, which allows them to recapture revenue lost due to conservation, largely insulated from the local political effects of conservation efforts. Local government water utilities are self-regulated with respect to pricing, setting their own rates through a local political process. However, water rates often are contentious political issues in California, which exposes local government utilities to political risks that private utilities typically avoid. Thus, while local government utilities are formally unconstrained in rate-setting, political risks may reduce their willingness to pursue conservation.

Analysis of data from California's recent drought demonstrates patterns that are consistent with our expectations about the effects of political decoupling: a) on average, communities served by private utilities adopted more stringent conservation regulations than those served by public utilities; and so b) private utilities were significantly more likely than their public counterparts to meet the state's conservation standards; and c) private utilities on average conserved more water than public utilities. Somewhat counterintuitively, then, private, profit-driven firms were more effective than were local government agencies in achieving the state's conservation goals.

We begin with a brief review of research on regulation of government agencies. We then describe the institutions that govern utility services in the United States and trace the logics that turn financial considerations into conservation incentives (or disincentives) for private firms and public agencies. Against this institutional backdrop we then introduce the

2012-2017 drought in California and that state's policy response to it. We argue that the institutions governing utility finance in California—specifically, rate decoupling—make the maintenance of revenue associated with aggressive conservation measures politically costlier for public utilities than for their private counterparts. Empirical evaluation follows, with analysis of irrigation restriction and water consumption data for the period of California's drought. We conclude with a discussion of the study's implications for environmental policy and governance more broadly.

## Regulated government and the (political) costs of conservation

Conventional theories characterize regulation as an effort by government to constrain or incentivize the behavior of individuals and/or profit-maximizing firms. However, many regulatory policies apply to government agencies as well as private firms. Environmental policies are clear examples in the United States, as tens of thousands of state and local government agencies are subject to laws regulating air, water, and waste (Konisky & Teodoro 2016). Research on government-regulating-government finds that public agencies are more difficult to regulate than private firms generally (Wilson & Rachal 1977), and that government agencies are significantly more likely than private firms to violate environmental regulations in particular (Durant 1985; Davies & Probst 2001).

According to Konisky & Teodoro (2016) one reason for this public-private disparity is that environmental compliance is costlier for public managers than for private managers because, in addition to the direct costs of compliance, public officials must also absorb significant political costs when they comply with regulations (see also Lindsay 1976; Oates & Strassman 1978). For example, if an environmental regulation requires polluting facilities to install an expensive treatment technology, a regulated private firm's managers can comply and pass the costs on to consumers in the form of higher prices. When a government agency installs the same treatment technology, its public managers must engage in a costly political process to secure the resources necessary to attain compliance. Where compliance costs are high or politically salient, public managers and elected officials may risk their jobs.

## Utility regulation and the institutional logic of conservation

Electrical and gas utilities have faced a similar conservation dilemma for decades. For a host of environmental and economic reasons, governments over the past half-century have sought to encourage energy efficiency through conservation. Although utility owners might support energy efficiency in principle, reduced consumption also reduces revenue in the short term, and so utility companies historically resisted conservation efforts for fear of threats to profitability. The dilemma led to the development of decoupling as a policy strategy to overcome this disincentive for conservation (Eto, Stoft & Belden 1997).

A parallel dilemma faces water utilities. Drinking water utilities in the United States provide an excellent context in which to analyze the political costs of environmental conservation because a majority of Americans receive this critical service from local government agencies, but a significant private water utility sector also exists in the U.S. The officials who govern water also face balancing conservation needs against political costs (Mullin & Rubado 2017). Here we introduce the institutions and processes that govern water pricing in the United States. Specifically, we focus on how public and private utilities experience the financial and political costs of conservation when faced with scarcity.

**Utility pricing.** As with electricity or gas, drinking water provision is natural monopoly due to its high fixed costs and enormous economies of scale. The large and medium-sized water utilities that serve most Americans are predominantly government-owned: about 85 percent of Americans who receive drinking water utility service are served by local governments, with the remaining 15 percent served by private, Investor-Owned Utilities (IOUs) (Konisky & Teodoro 2016).

In the United States, all but the very smallest water utilities operate on a fee-for-service basis: customers pay periodic fees in exchange for service. Nearly all of these utilities charge customers according to price schedules that include both fixed and volumetric elements (Warmath 2015): customers pay a fixed monthly charge for a connection to the system, and an additional charge for each volumetric unit of water consumed. Although water utilities are natural monopolies, volumetric charges allow for more equitable pricing than simple fixed rates because they tie customers' demands to the costs of serving them (AWWA 2012). Volumetric charges can also provide economic incentives for conservation, and utilities seeking to reduce overall water consumption frequently use higher volumetric charges, progressive rate schedules, or seasonal pricing pursuant to conservation (Gaur, Matthews and Phan 2015; Mullin 2008).

In order to avoid the economic inefficiencies that typically follow monopoly pricing, utilities in the United States are subject to government price regulation (Breyer 1982; Viscusi, Vernon and Harrington 2000). However, the political institutions that govern privately-owned and government-owned utilities are fundamentally different, and so present utilities with very different financial consequences for conservation.

**Private water price regulation: the Public Utilities Commission.** In the United

States, pricing for privately-owned utilities is regulated by state Public Utilities Commissions (PUCs). The precise names and institutional forms that PUCs take vary from state to state, but in California the PUC is composed of five commissioners, who are appointed by California's governor and confirmed by its Senate to serve fixed, staggered six-year terms. The commissioners are supported by a staff of more than a thousand attorneys, economists, engineers, administrative law judges, and others.[2] California's water utilities are skewed in favor of the public sector as they are in the rest of the US, with private utilities serving about 20 percent and local government utilities about 80 percent of the population (Kenney 2014).

Water rate setting under PUC regulation proceeds under the *cost of service* principle (Breyer 1982). According to this principle, utility owners are limited to a recovering their actual cost of providing service, plus a legally-sanctioned rate of return on their capital investment. Private utility owners must justify their rates by accounting for all operating expenditures, as well as their utilities' capital value. Because utility revenue under the cost of service principle is a function of capital investments, private companies tend to invest heavily in their utilities, which can lead to economically inefficient over-investment (Averch and Johnson 1962). A significant goal of the PUC process is to constrain pricing and guard against such over-investment.

The PUC rate setting process is technocratic, legalistic, and adversarial. Attorneys representing the utility make a formal case for their rates to the PUC, armed with voluminous economic, engineering, and legal analysis. Utilities' rate proposals are

[2] Along with water, California's PUC regulates pricing for energy, telecommunications, and transportation.

scrutinized by the PUC's Office of Ratepayer Advocates (ORA), whose own lawyers, economists, and engineers argue for lower rates on behalf of utility customers. Ultimate rate-setting authority lies with the Commission itself. PUC rate processes draw scant media attention, and although its hearings are public, they usually are lightly attended.

**Public water utility price regulation: local government.** American local governments (including counties, municipalities, and special districts) that own drinking water utilities operate them as enterprises on a fee-for-service basis. State laws authorize these local governments to set their own service rates to cover the costs of providing service, but legally prohibit them from using utilities as profit centers. Beyond this general limitation, however, local governments are essentially self-regulated with respect to pricing for utility services (Corssmit 2010).[3] This "self-regulation" means that public water utility rates are set by local legislatures: county commissions/councils for county utilities, city councils for municipal utilities, and boards/commissions for special district utilities.

Consequently, rate-setting for public water utilities is subject to the political calculations of local government managers and elected officials (Glennon 2004; Mullin 2009; Teodoro 2010). For municipal utilities, water customers are also voters who prefer lower rates to higher rates, ceteris paribus (Timmins 2002). Raising water rates in the name of resource efficiency can be a "political high-wire act" (Postel 1999, 235), often with negative electoral consequences for local politicians who stoke voters' ire through rate increases (Martin, et al. 1984). Unlike the technocratic, legalistic PUC process, rate-setting for municipal utilities can be a raucous, contentious affair with extensive public involvement,

[3] Two states are exceptions. In Wisconsin, both public and private utilities are subject to price regulation by the Wisconsin Public Services Commission. Publicly owned utilities in Indiana may opt for price regulation by the Indiana Utility Regulatory Commission.

especially in contexts of extreme water scarcity, income inequality, or infrastructure costs (Brandt, Locklear and Noyes 2015).

The political calculus of rate-setting for the public utility is thus divergent for public and private utilities. Whereas private utilities tend to over-invest in order to maximize rate revenue (Averch and Johnson 1962), public utilities tend to under-invest in order to minimize the political cost of high rates (Lindsay 1976; Konisky and Teodoro 2016).

**Conservation revenue risk & rate decoupling.** Volumetric pricing creates the same conservation quandary for water utilities as it does for electric and gas utilities because reduced water demand results in reduced revenue for the utility (Beecher 2010). Most of a water utility's costs are fixed and unrelated to volume of water consumed: reservoirs, treatment plants, transmission mains, hydrants, meters, and other infrastructure must be built and maintained as long as demand is greater than zero. Similarly, the personnel costs associated with operating and administering the utility system are generally fixed in the short-term. Fluctuations in demand due to weather conditions or conservation initiatives can cause short-term revenue to fall much faster than fixed costs (Chessnutt & Beecher 1998). This mismatch means that utilities in water-scarce regions face a resource dilemma: reducing demand in the name of sustainability risks significant revenue loss.

Recognizing that such revenue concerns create a strong disincentive for conservation in energy utilities, several state PUCs have adopted a strategy of *decoupling* for electricity and gas over the past three decades (Lewis & Sappington 1992). As noted earlier, "decoupling" refers to the separation of a utility's profit from the quantity of energy delivered to its customers. Promoted by conservation activists, decoupling allows utilities to pursue conservation without fear of financial losses: if the conservation causes shortfalls in revenue, automatic rate increases are imposed on the entire customer base in order to guarantee sufficient revenue for the utility. A robust literature in regulatory economics takes up the merits, drawbacks, and empirical results of decoupling (Eto, Stoft & Belden 1997; Lesh 2009; Brennan 2010; Sullivan, Wang & Bennett 2011; Zarnikau 2012; Chu & Sappington 2013; among many others). Today about half of U.S. states have adopted rate decoupling for electricity and/or natural gas utilities.[4] For present purposes, the main significance of decoupling is that it eliminates the main financial disincentive for PUC-regulated private utilities to promote conservation. At the same time, decoupling shifts the revenue risk associated with conservation from investor-owned utilities to their customers, who must compensate the firm for lost revenue after the fact.

## Privatization as political decoupling

When democratic governments set public policies, they are accountable to citizens for the cost and quality of those goods or services: officials must convince their citizens that the benefits of public policies justify their costs or face removal from office at election time. Regulated private firms have no such obligation. In situations where governments regulate governments, privatization of a public service changes the government's role from producer to regulator. In so doing, the "voice" of ordinary citizens becomes less immediate, and so private provision of a public service reduces popular influence over the policy process (Warner & Hefetz 2002). When combined with rate decoupling, privatization of public services shifts to private firms the political risks that might otherwise discourage democratic governments from pursuing controversial public policies like environmental

[4] See http://www.c2es.org/us-states-regions/policy-maps/decoupling for a list of states with decoupling policies for energy utilities.

conservation. Government officials are likely to weigh political risks more heavily than do private firm managers. In this way, privatization provides a kind of political "decoupling" alongside rate decoupling; drinking water service in California offers a useful example.

**Decoupling in water.** Broadly, there are two ways to incentivize water conservation under a utility model: pricing and restrictions. A pricing approach uses rates as a signal to encourage efficient water use, while restrictions set proscriptions on water use. Both approaches are widely used in the United States, and empirical research generally finds that both can drive water conservation (Olmstead & Stavins 2009; Mansur & Olmstead 2012; Wichman, Taylor and von Haefen 2016). However, research on drought response finds consistently that local government water restrictions are especially effective in driving immediate reductions in water consumption (Reed 1982; Kenney, Klein & Clark 2004; Halich & Stephenson 2009; Robinson & Conley 2017). For present purposes, a key difference between the two approaches is their effects on utility revenue: price-based conservation strategies generate revenue while reducing water consumption; water restrictions reduce consumption without generating any new revenue. Water restrictions are thus potent, but financially risky, instruments for conservation.

In 2008, California's PUC decoupled water sales from water revenue for private utilities with the introduction of a Water Revenue Adjustment Mechanism (WRAM) (Crew & Kahlon 2014).[5] Unsurprisingly, private utilities take advantage of this provision when conservation requirements cause a loss of sales revenue: financial losses associated with reduced sales volumes are recouped in future rate increases through WRAM. Decoupling

[5] To date, only one other state (New York) has adopted decoupling for water utilities regulated under the state utility commission.

thus shifts the financial risk of conservation from utilities' investor-owners to their customers. Under decoupling, customers have few means of resisting such rate increases, so long as the increases are approved by the PUC.

As self-regulated enterprises also may adjust their rates at any time through the political process if conservation measures cause revenue shortfalls.[6] However, doing so exposes the utility's leaders to political risk (Beecher, Chesnutt & Pekelney 2001; Postel 1999): whatever their attitudes toward sustainability, citizen-customers who reduce water use in the name of conservation are likely to be unhappy at the prospect of paying higher bills when they have used less water.

**Political decoupling.** An important implication of these differences in incentives is that privatization of a public service (in this case, drinking water provision) results in a *political decoupling* of a public policy (in this case, conservation) from their political costs to government officials. If effective policies are financially costly, private firms and public agencies experience those costs in different ways. Financial decoupling and a technocratic PUC process insulates private firms from political costs. For public agencies, the political costs of the price increases necessary to recoup financial losses are borne by politicians, who are accountable to their voters, not the PUC. Anxious to please their citizen-customers, politicians are less likely to pursue those politically and financially costly measures. The somewhat counterintuitive result is that politically risky policies are more likely to be effective when they are carried out by private firms than by public agencies.

## Drought in California: a crisis and policy response

[6] Alternatively, local governments might shift money from other sources to its water utility. In practice, such transfers are rare and in some cities they are illegal.

The saga of California's recent drought provides an exceptional opportunity to evaluate this theory of privatization as political decoupling. The state of California began experiencing long-term drought conditions in 2007, when the seasonal mountain snowpack that many of the state's cities rely upon for water was unusually low. By 2013, the drought reached crisis conditions as the snowpack was just 17 percent of normal levels. In response, California governor Jerry Brown issued a statewide Water Action Plan in January 2014 that called for sweeping reforms to water consumption and management across all levels of government.[7] An official drought emergency was declared, and water utilities were required to report detailed conservation information to the state in June 2014. The drought continued to intensify, however; analysis of tree ring data indicates that 2012-2014 was the most severe drought in California for the past 1,200 years (Griffin and Anchukaitis 2014). By early 2015 California's mountain snowpack was effectively gone, leaving the state desperately short of water for urban supply.

In the face of this extraordinary drought, in April 2015 Governor Brown ordered the California State Water Resources Control Board (SWRCB) to impose restrictions on drinking water utilities designed to reduce potable urban water usage by 25 percent statewide.[8] Beginning in June 2015, SWRCB restrictions required California's water suppliers to reduce usage relative to their 2013 levels. The conservation regulation applied to water *suppliers,* not directly to water *consumers.* That is, SWRCB required utilities to cut water use by specified percentages; the means by which savings were achieved were left to the individual utilities. The initial conservation order remained in place through February

[7]The California Water Action Plan: http://resources.ca.gov/california_water_action_plan/
[8] Governor Brown Directs First Ever Statewide Mandatory Water Reductions: https://www.gov.ca.gov/news.php?id=18913

2016. In March 2016, the SWRCB reduced conservation standards for some utilities in response to increased rainfall in some regions of the state.

The emergency regulation assigned each urban water supplier its own conservation target, with standards ranging from 4 percent to 36 percent reductions relative to 2013 levels. These standards were formulaic, and varied based on utilities' historical average residential water consumption, measured as residential gallons per capital per day (R-GPCD).[9] In the interest of maintaining adequate water use to protect public health, the SWRCB set conservation standards progressively based on historical average residential water consumption: utilities with higher historical R-GPCD were assigned higher conservation targets, while utilities with relatively low historical R-GPCD were assigned less severe conservation standards.[10] Critically for present purposes, the conservation rules applied uniformly to publicly- and privately-owned utilities: conservation standards were assigned based on historical demand patterns and supply considerations, not on ownership or governance of the water utilities themselves. Analysis of these conservation standards (reported in the appendix) demonstrates that public and private utilities were not subject to significantly different standards.

To a significant degree, residential water demand in California is associated with non-agricultural outdoor irrigation (e.g., lawn watering), especially in the summer season. Many utilities, but not all, responded to the state's mandate by adopting outdoor irrigation restrictions—most commonly by limiting the number of days per week that customers were

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[9]State Water Resources Control Board Resolution NO. 2015-0032: http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2015/rs2015_0032.pdf

[10] Appendix A provides more detailed description of these conservation standards and how they were calculated.

allowed to water their lawns and gardens.

**Hypotheses.** Applied to the case of California water utilities and their responses to the 2015 drought regulations, some hypotheses follow from our theory of privatization as political decoupling. Thanks to the rate decoupling offered by California's WRAM, private utilities may impose restrictions on irrigation without fear of losing revenue due to reduced water sales; the PUC process will allow private utilities to recoup those losses in future years. For politicians who govern public utilities, the revenue losses that accompany irrigation restrictions force politically costly future rate increases that are likely to anger voters. Our first hypothesis follows:

> Hypothesis 1—Restrictions: Private water utilities adopt more stringent irrigation restrictions than public utilities.

Facing little financial risk and virtually no political costs, private water utilities can pursue conservation more aggressively, resulting in greater conservation. Our second and third hypotheses thus follow from the first:

> Hypothesis H2b—Compliance: Private water utilities are more likely than public utilities to meet the water conservation standards set by the SWRCB.

> Hypothesis H2b—Conservation: In response to drought declarations, private water utilities conserve more water than public utilities.

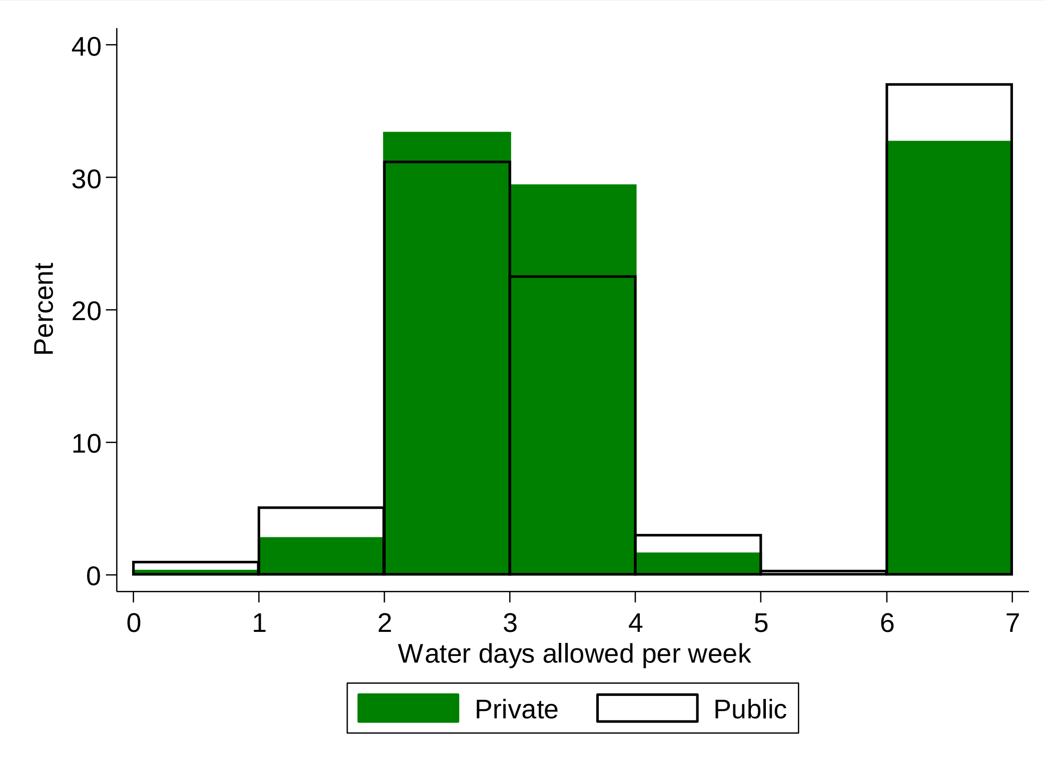
## Data and methodology

We evaluate these hypotheses by analyzing water conservation data from the SWRCB's Monthly Reporting Archive,[11] which includes monthly observations of 408 utilities for the period of California's official statewide drought: June 2015-April 2017. We

[11] California State Water Board's Monthly Reporting Archive: http://www.waterboards.ca.gov/water_issues/programs/conservation_portal/conservation_reporting.shtml

merged these data with water utilities' information from the Environmental Protection Agency's Safe Drinking Water Information System (SDWIS) and community demographic and economic data from the U.S. Census' 2013 American Community Survey's five-year estimates (ACS).[12] Eliminating utility-months with missing data yielded a final dataset of 13,936 utility-months.

Figure 1. Irrigation Restrictions by Public and Private Utilities, June 2014-April 2017




**Variables.** The dependent variable for hypothesis H1 is the stringency of *irrigation restrictions* imposed by the utility, which we measure as the number of days' irrigation of lawns and gardens allowed. Utilities allowed irrigation an average of 4.05 days per week, but restrictions varied considerably, both across utilities and within utilities over time. More than half of utility-months (55.6%) allowed irrigation three or four days per week;

[12] The ACS reports demographic and economic data by city, and so matching utilities to demographic data for municipal utilities was simple. To match these data with special district and private water utilities, we used ACS data for the primary city served listed in the SDWIS for the utility.

more than a third (36.1%) no restrictions at all, while 0.8 percent (113 utility-months) banned outdoor irrigation entirely. Figure 1 depicts the distribution of irrigation restrictions during the drought for public and private utilities.

For hypotheses H2a and H2b, the dependent variables are policy outcomes, which we measure in two ways, reflecting the two hypotheses. The dependent variable for H2a is *compliance* with the conservation targets set by the SWRCB, which we measure as a dummy that equals 1 if a utility meets the conservation standard, 0 otherwise. For H2b, the dependent variable is each utility's monthly percentage water *conservation* compared to the same month in 2013. This measure of utility $i$ in month $t$ of is calculated as:

$$Water\ conservation_{i,t} = \frac{Water\ Production\ 2013_{i,t} - Water\ Production\ 2015,\ \ 2016{,}2017_{i,t}}{Water\ Production\ 2013_{i,t}} \quad \text{(Eq. 1)}$$

The key independent variable in all three hypotheses is a dummy that equals 1 if a water utility is owned by private investors and 0 if it is owned by a government (either municipal or special district).[13] We include a number of variables to control for the characteristics of each utility in our analysis. First, we control for the percentage *conservation standard* set by SWRCB, which we expect to positively predict irrigation restrictions (H1) and overall conservation (H2b), but negatively predict compliance (H2a) because meeting a higher standard is more difficult). A utility's water source may also have an impact on conservation, because ground water supplies are expected to be less threatened by drought, and so utilities that rely on *groundwater* might have less incentive to conserve water.

[13] To test for potential heterogeneous effects of local government form on water conservation (Mullin 2008; Mullin & Rubado 2017), we specified additional models (not reported here) with special districts and municipalities designated with separate dummies. We found no statistically significant difference between general-purpose governments and special districts with respect to regulatory compliance or overall conservation.

Similarly, we utilities that *purchase* their water from wholesale water supplies may impose lighter restrictions and conserve less water because they do not face a direct supply threat from drought.

Table 1. Descriptive summary

| Variable | Obs | Mean | StDev | Min | Max |
|---|---|---|---|---|---|
| Irrigation days allowed per week | 14,182 | 4.05 | 2.30 | 0.00 | 7.00 |
| % water conservation compared to 2013 | 14,182 | 18.67 | 13.51 | -108.42 | 79.23 |
| Complies with conservation standard (1/0) | 4,896 | 0.53 | 0.50 | 0.00 | 1.00 |
| Private | 14,182 | 0.15 | 0.36 | 0.00 | 1.00 |
| % Conservation standard | 14,180 | 8.96 | 12.47 | 0.00 | 36.00 |
| State Mandate in Effect | 14,182 | 0.35 | 0.48 | 0.00 | 1.00 |
| Ground water | 14,182 | 0.34 | 0.47 | 0.00 | 1.00 |
| Purchased water | 14,182 | 0.43 | 0.50 | 0.00 | 1.00 |
| Total population served logged | 14,180 | 10.69 | 1.10 | 4.61 | 15.23 |
| Percent poverty | 13,938 | 15.11 | 7.04 | 1.80 | 34.10 |
| Percent black | 13,938 | 4.35 | 5.16 | 0.00 | 43.12 |
| Percent Hispanic | 13,938 | 36.75 | 22.08 | 0.00 | 97.77 |
| Median household income ($1000s) | 13,938 | 64.38 | 22.88 | 27.50 | 236.53 |

Community characteristics can also potentially influence water conservation. To account for their effects, we include controls for the *population* size (logged), *median household income*, *poverty* rate, and percentages *black* and *Hispanic* population served by the utilities. We expect that minority and/or poor populations might be less likely to meet conservation standards because they might have less discretionary consumption and therefore less potential for relatively easy additional water conservation. By the same logic, we expect median household income to correlate positively with water conservation because wealthier customers might have greater ex ante discretionary water consumption that could be reduced with relatively little inconvenience.

Our analysis of *irrigation restrictions* (H1) includes a dummy variable set at 1 for the months in which the *state mandate* was in effect (June 2015-May 2016), 0 for the period when the mandate was lifted but the state drought declaration remained in effect (June 2016-April 2017). Our *compliance* (H2a) and *conservation* (H2b) models include controls for *irrigation restrictions.* The compliance model includes only the months during which the state mandates were in effect. The descriptive statistics of all variables are reported in Table 1.[14]

We employ different statistical estimators to evaluate the three hypotheses. To model the continuous dependent variables in H1 and H2b, we use Ordinary Least Squares regression. For hypothesis H2a's binary dependent variable we use logistic regression. Both sets of models include month fixed effects to account for unobserved temporal variation and apply robust standard errors clustered by utility. The demographic and utility variables do not vary over time, and so the unique combinations of these variables effectively serve as fixed effects for each utility.[15]

## Results: public and private utility responses to drought

Table 2 reports our estimates of *irrigation restrictions* (H1). Table 3 reports our models of *compliance* with state conservation standards (H2a), and Table 4 shows our estimates of overall *conservation* (H2b, Model C). These analyses yield results consistent with all three hypotheses. Private utilities imposed significantly more stringent irrigation restrictions: Table 2 indicates that, all else equal, private utilities allowed .20 fewer days irrigation per

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[14] A small number of observations are missing due to the loss of some utilities' community information.
[15] Serial autocorrelation may cause biased estimates if, for a given utility, conservation in past months affects the likelihood or level of conservation in current or future periods. As an additional robustness check against such bias, we also fitted models for H1 and H2 with lagged dependent variables. The effect of private ownership on conservation remains positive and significant in both estimates when a lagged dependent variable is included.

week than public utilities.

Table 2. Determinants of irrigation restrictions, June 2015-April 2017

| OLS Regression<br>DV: Days Irrigation Allowed per Week | Coefficient<br>(Robust St.Error) | p-value |
|---|---|---|
| Private | -0.20<br>(0.08) | .01 |
| % Conservation standard | -0.01<br>(0.01) | .11 |
| State Mandate | -3.46<br>(0.20) | <.01 |
| Ground water | -0.12<br>(0.15) | .44 |
| Purchased water | -0.06<br>(0.14) | .67 |
| Total population served (log) | 0.10<br>(0.06) | .07 |
| Percent poverty | 0.02<br>(0.01) | .14 |
| Percent black | -0.01<br>(0.01) | .25 |
| Percent Hispanic | -0.01<br>(0.00) | <.01 |
| Median household income ($1000s) | 0.00<br>(0.00) | .63 |
| Constant | 5.42<br>(0.77) | |
| Observations | 13,936 | |
| R-squared | 0.42 | |

Estimates include month fixed effects not reported. Robust standard errors clustered by utility.

Turning to outcomes, Table 3 indicates that private ownership strongly and positively predicts the likelihood that a utility met the state's conservation standards during the period of the state's mandate. All else equal, private utilities were 86 percent more likely than public utilities to achieve *compliance* with conservation standards in a given month. Overall water *conservation* was also greater for private utilities, according to Table 4.

During drought, private utilities conserved an average of 1.70 percent more water each month than their public counterparts relative to 2013. For both the compliance and conservation models, the relationship between private ownership on conservation is strong, statistically significant, and robust to multiple specifications.

Table 3. Determinants of compliance with state conservation standard, June 2015-May 2016

| Logistic Regression<br>DV: Compliance with state mandate | Coefficient<br>(Robust St.Error) | p-value | Odds Ratio |
|---|---|---|---|
| Private | 0.62<br>(0.19) | <.01 | 1.86 |
| % Conservation standard | -0.13<br>(0.01) | <.01 | 0.88 |
| Days irrigation allowed per week | -0.03<br>(0.06) | .63 | 0.97 |
| % Residential use | -0.01<br>(0.01) | .03 | 1.01 |
| Ground water | -0.20<br>(0.20) | .82 | .82 |
| Purchased water | -0.43<br>(0.17) | .01 | .65 |
| Total population served (log) | -0.02<br>(0.07) | .74 | .98 |
| Percent poverty | -0.01<br>(0.02) | .61 | .99 |
| Percent black | -0.01<br>(0.01) | .66 | 1.00 |
| Percent Hispanic | -0.01<br>(0.00) | .01 | .99 |
| Median household income ($1000s) | 0.01<br>(0.01) | .10 | 1.01 |
| Constant | 3.46<br>(0.86) | | |
| Observations | 4,812 | | |
| Log pseudolikelihood | -2439.26 | | |
| Wald $X^2$ (DF) | 518.55 | | |
| Pseudo $R^2$ | 0.27 | | |

Estimates include month fixed effects not reported. Robust standard errors clustered by utility.

Table 4. Determinants of monthly water conservation, June 2015-April 2017

| OLS Regression<br>DV: Percent conservation relative to 2013 | Coefficient<br>(Robust St.Error) | p-value |
|---|---|---|
| Private | 1.27<br>(0.72) | .02 |
| % Conservation standard | 0.26<br>(0.04) | <.01 |
| Days irrigation allowed per week | -0.04<br>(0.14) | .76 |
| Ground water | -1.22<br>(0.99) | .22 |
| Purchased water | -3.31<br>(0.82) | <.01 |
| Total population served (log) | -0.46<br>(0.27) | .09 |
| Percent poverty | -0.03<br>(0.07) | .61 |
| Percent black | -0.04<br>(0.05) | .40 |
| Percent Hispanic | -0.05<br>(0.02) | <.01 |
| Median household income ($1000s) | 0.05<br>(0.02) | .04 |
| Constant | 5.98<br>(3.78) | |
| Observations | 13,936 | |
| $R^2$ | 0.36 | |

Estimates include month fixed effects not reported. Robust standard errors clustered by utility.

The control variables yield some notable results, too. The stringency of the state conservation standard negatively predicts irrigation days allowed (though the result falls short of conventional statistical significance). As expected, the state conservation standard significantly affected both the likelihood of compliance (negatively, in Table 3) and relative monthly water conservation (positively, in Table 4). These findings imply that higher standards stimulated utilities to pursue greater conservation, but also raised the difficulty of meeting the standard. Water source had no clear relationship with irrigation restrictions, but groundwater and purchased water supply negatively predict water conservation.

Some community characteristics yielded notable results, too. As utility size (measured as log population) increased, irrigation restrictions were less stringent, and conservation declined. Percentage Hispanic population positively predicts irrigation restrictions, but negatively predicts water conservation. Household income has no significant relationship with irrigation restrictions, but positively predicts conservation. These findings may suggest relative elasticity of demand for water among different segments of the population. We do not find statistically significant correlations with poverty or percentage black population.

The irrigation restrictions have surprising effects in the conservation models (Tables 3 and 4): as days of outdoor irrigation allowed increased, so did the likelihood of compliance and total conservation. In other words, more stringent irrigation restrictions correlate with less conservation. This unexpected correlation may indicate reverse causality, as utilities may have imposed irrigation restrictions in pursuit of conservation precisely because they were falling short of their targets. This observed relationship between irrigation restrictions and conservation outcomes deserves further investigation (e.g., Mullin & Rubado 2017).

## Aftermath

Significant rain and snow returned to California in the winter of 2015-2016. By late spring 2016, the state's reservoirs and snowpacks had recovered markedly, particularly in Northern California. Noting the improving conditions, the SWRCB lifted the conservation regulations imposed on water utilities, but encouraged utilities to continue conservation efforts by setting their own targets beginning in June 2016. During the mandatory conservation period the state's utilities cut water consumption 24 percent overall—a significant savings, but just short of the SWRCB's 25 percent target (Fears 2016). In April 2017 a triumphant Governor Brown celebrated the state's conservation achievements and declared an official end to the drought emergency. But reduced water consumption during the drought resulted in financial losses for many local government water utilities across the state in what a prominent *New York Times* article called "the paradox of conservation" (McPhate 2017).

**The political costs of conservation.** The politics of water conservation in the City of Redlands following the state's 2015 drought order provides a useful illustration of the conservation order's local political costs. Redlands is a municipality of about 70,000 in San Bernadino County that owns and operates a public water utility. Following Governor Brown's emergency declaration, the SWRCB assigned a 33% conservation standard. The city responded with a series of conservation measures, including subsidies for retrofitting homes with high-efficiency fixtures and restrictions on outdoor irrigation, which was limited to just two days per week. Although the city reduced water consumption, it achieved only 11.3% conservation and met its assigned conservation standard in just two out of the 12 months that the state mandate was in effect.

Despite missing its conservation goals, reduced water consumption in Redlands caused a revenue loss of about $2 million by early 2016. With its utility's costs mostly fixed, the revenue loss left the city with a financial crisis. Utility staff recommended a 19 percent rate increase to cover the shortfall. More than 3,000 citizens attended a raucous, five-hour

City Council meeting to protest the proposal. The council ultimately approved the rate hike in recognition of the financial realities facing the utility. The vote was 4-1, with first-term Councilman John James leading the effort.

Widespread protest followed the decision, with more than 3,000 citizens filing official protests against the rate increases (Emerson 2016a). The two city council seats scheduled for election in November 2016 drew six challengers, at least three of whom campaigned explicitly against the water rate increase (Emerson 2016b). Although his long-serving fellow incumbent survived the challenge, Councilman James narrowly lost his re-election bid.

Similar processes played out in cities and special districts across California, with drought-related rate increases prompting public protests and/or legal challenges in Alameda County Water District, East Bay Municipal Utility District, Hillsborough, Los Angeles, Pleasanton, and Yorba Linda, among others.

## Conclusion

The financial burdens of conservation ultimately fall to customers of utility enterprises with high fixed costs, whether they are public or private. Although it remains controversial, rate decoupling has proven effective in aligning utilities' financial interests with conservation. The regulatory process that governs ratemaking for private utilities is technical and professional, not popular. Free from the revenue risks that accompany reduced consumption, utilities can pursue resource efficiency and meet conservation aims while maintaining profitability. Government enterprises do not seek profits, but they nonetheless rely on rate revenue and so risk significant financial losses when conservation efforts succeed. Government utilities are legally and democratically authorized to set their own rates, but raising rates—however fiscally necessary or environmentally prudent—carries heavy political costs for officials.

These dynamics played out during the California drought of 2014-2017. Our analysis demonstrates that when the state ordered water utilities to conserve, private utilities adopted more stringent conservation regulations, were much more likely to comply with the conservation mandate, and saved significantly more water than public utilities. Privatization of a public service (in this case, drinking water) decoupled conservation from its attendant financial and political risks. The ironic result was that private firms proved to be more effective instruments of state policy than did government agencies, not because private firm managers are publicly-motivated, but because they are largely insensitive to the policy's political costs.

The case of public and private water conservation in California offers broader lessons for politics, policy, and public administration. Debates over privatization typically focus primarily on efficiency, often with a related concern for democratic governance (Warner & Hefetz 2002). The idea of privatization as political decoupling recasts privatization not only as an efficiency-democracy tradeoff, but also as a matter of policy *effectiveness*—especially with respect to environmental conservation. Buffered from the political risks of controversial policies and more responsive to regulatory sticks and carrots, private firms may be more effective than public agencies in implementing controversial public policies, whether or not they are more efficient. Understanding privatization as political decoupling may help explain the rise of private contracting for military and security operations, for example. Where military action risks unpopular casualties, the use of private contractors instead of military personnel partially obscures those risks from the public (Singer 2005). In such instances, privatization may be financially costly but politically prudent for governments that seek to insulate security policy from its political costs.

But decoupling public policy from its political costs through private administration does not eliminate those costs so much as obscure them and/or place them beyond the ordinary citizen's reach. Even assuming that efficient and effective regulatory regimes constrain firm behavior, privatization makes the public policy process more technocratic than democratic. Engagement with regulatory processes requires a degree of sophistication and that mutes the voices of many citizens and privileges professionals (Mosher 1968). In California's recent drought, regulated private firms were more effective conduits of environmental policy than were government agencies. Indeed, without the superior performance of private utilities, it is unlikely that California would have attained its much-celebrated statewide conservation during the height of the drought. That private firms proved to be effective partners in California's conservation effort offers important lessons for development and implementation of environmental policy. One of those lessons may be that the price of environmental sustainability may be weakened democratic local governance.

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## APPENDIX A: CALIFORNIA CONSERVATION STANDARDS

In May, 2015, the SWRCB adopted an emergency regulation to implement a mandatory 25 percent statewide reduction in potable urban water use between June 2015 and February 2016. [16] To achieve the reduction, the emergency regulation assigned each urban water supplier serving more than 3,000 connections to one of nine tiers based on their R-GPCD for the months of July – September 2014. Each tier of utilities was then assigned a conservation standard that ranged between 4 percent and 36 percent, with higher historical R-GPCD utilities receiving higher conservation standards. Table A1 reports R-GPCD levels and corresponding conservation standards for the nine tiers.

Table A1. Urban Water Supplier Conservation Tiers (June 2015-February 2016)

| Tier | Average July-September 2014 R-GPCD | | Conservation Standard |
|---|---|---|---|
| | From | To | |
| 1 | | | 4% |
| 2 | 0 | 64.99 | 8% |
| 3 | 65 | 79.99 | 12% |
| 4 | 80 | 94.99 | 16% |
| 5 | 95 | 109.99 | 20% |
| 6 | 110 | 129.99 | 24% |
| 7 | 130 | 169.99 | 28% |
| 8 | 170 | 214.99 | 32% |
| 9 | 215 | 612.00 | 36% |

In February 2016 the SWRCB adopted extended emergency water conservation regulation.[17] Credits and adjustments to urban water suppliers' conservation standards ranged from 2 percentage points to 8 percentage points. The regulation provided credits in

[16] SWRCB RESOLUTION NO. 2015-0032 https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2015/rs2015_0013.pdf

[17] State Water Board Adopts Extended Emergency Water Conservation Regulation http://www.waterboards.ca.gov/press_room/press_releases/2016/pr2316_reg_extension.pdf

three ways: "1) Considering the differences in climate affecting different parts of the state; 2) Providing a mechanism to reflect water-efficient growth experienced by urban areas; and 3) Recognizing significant investments made by suppliers toward creating new, local, drought-resilient sources of potable water supply." The regulation created penalties for "homeowners' associations or community service organizations that block, stifle or threaten homeowners from reducing or eliminating the watering of vegetation or lawns during a declared drought emergency in violation of existing law."

In May 2016 the SWRCB adopted a statewide water conservation approach that replaced the prior percentage reduction-based water conservation standard with a localized "stress test" approach that required urban water suppliers act to ensure at least a three year supply of water to their customers under drought conditions.[18] This May 2016 revision effectively ended the mandatory conservation order for California drinking water utilities.

**Disparate conservation standards for public and private utilities?** The possibility that SWRCB set different conservation standards for public and private utilities raises the specter of inferential error in comparative analyses of conservation: observed public-private differences might be mainly driven not by their relative financial/political risks, but rather because they were assigned systematically different standards. Fortunately, there are good reasons to believe that private ownership is not associated with the SWRCB's conservation standards. First, according to the SWRCB's resolution outlining the conservation rules, the standards are designed based on each water utility's past consumption patterns as

[18] State Water Board Adopts 'Stress Test' Approach to Water Conservation Regulation http://www.waterboards.ca.gov/press_room/press_releases/2016/pr051816_waterconsreg.pdf

described above, not its ownership. As a further test, we analyze the correlation between private ownership and the assignment of conservation standards using a cross-sectional

OLS regression. The unit of analysis in this model is the utility, with the percentage conservation standard as the dependent variable. Results are reported in Table A2. Our findings indicate that the conservation standards were mainly determined by R-GPCD (as expected), purchased water, and total population. We find no statistically significant evidence that private ownership predicts the conservation standard that the SWRCB assigned to the utility.

Table A2. Determinants of Monthly Water Conservation Standards (June 2015)

| | Model 5 | |
|---|---|---|
| | Coef. | SE |
| Private | -1.050 | (0.76) |
| R-GPCD in reporting month | 0.137** | (0.01) |
| Outdoor irrigation days allowed per week | -0.008 | (0.02) |
| % Residential use | 0.895 | (0.76) |
| Ground water | -0.791 | (0.72) |
| Purchased water | 0.450† | (0.25) |
| Total population served logged | -0.396† | (0.22) |
| Percent poverty | -0.081 | (0.07) |
| Percent black | 0.044 | (0.06) |
| Percent Hispanic | 0.010 | (0.01) |
| Median household income ($1000s) | -0.020 | (0.02) |
| Constant | 7.939* | (3.90) |
| Observations | 396 | |
| AIC | 2389.612 | |
| BIC | 2437.389 | |
| R-squared | 0.681 | |

Note: † p<0.1, * p<0.05, ** p<0.01. Cross-section OLS models. The dependent variable is the conservation standard set by CPUC in June 2015. Robust standard errors clustered by utilities in parentheses.