The Context of Responsiveness: Resident Preferences, Water Scarcity, and Municipal Conservation Policy

David Switzer
University of Missouri

Abstract

The extent to which municipal policy is determined by the preferences of residents is a topic of growing importance. Recent work on the subject has challenged conventional wisdom and found that municipal policy is often, but not always, responsive to the ideology of residents. This paper takes up an important potential implication of these findings, exploring how resident ideology may interact with issue severity in the adoption of municipal policy. Hypotheses suggest that resident preferences will have the greatest effect in the presence of high issue severity and that issue severity will have the largest impact when residents have ideological preferences in line with policy solutions. I test hypotheses using municipal water rates, with models showing that the effects of resident ideology and water scarcity interact with each other to influence water conservation policy.

KEY WORDS: urban studies, environment, governance, regional governance

自治区政策在多大程度上由居民偏好所决定，这是一个越来越重要的话题。近期有关该主题的研究挑战了传统看法，发现自治区政策时常对其居民的思想予以响应。本文从这些研究发现的一个潜在意义出发，探究在采纳自治区政策时居民思想可能如何与议题严重性产生相互影响。假设认为，居民偏好将在议题严重性较高时发挥最大效果，并且议题严重性将在居民思想偏好与政策解决措施相一致时发挥最大影响。我以自治区水费为例检验了假设，模型显示，居民思想和水资源匮乏二者产生相互作用，进而影响节水政策。

关键词: 城市研究, 环境, 治理, 区域治理

La medida en que la política municipal está determinada por las preferencias de los residentes es un tema de creciente importancia. El trabajo reciente sobre el tema ha desafiado la sabiduría convencional y ha encontrado que la política municipal a menudo, pero no siempre, responde a la ideología de sus residentes. Este documento aborda una importante implicación potencial de estos hallazgos, explorando cómo la ideología de los residentes puede interactuar con la gravedad del problema en la adopción de la política municipal. Las hipótesis sugieren que las preferencias de los residentes tendrán el mayor efecto en presencia de una alta gravedad del problema y que la gravedad del problema tendrá el mayor impacto cuando los residentes tengan preferencias ideológicas en línea con las soluciones políticas. Pruebo hipótesis utilizando tarifas de agua municipales, con modelos que muestran que los efectos de la ideología de los residentes y la escasez de agua interactúan entre sí para influir en la política de conservación del agua.

PALABRAS CLAVE: estudios urbanos, medio ambiente, gobernanza, gobernanza regional

Representation in a democracy is fundamentally about elected officials pursuing political actions that represent the will of the residents they represent. For a long time, the consensus view at the local government level was that due to vertical constraints and horizontal competition, local government policy is limited in its ability to represent resident ideological preferences. The belief held that since local governments are subject to the decisions of state governments and because they face competition from each other, local elected officials are not responsive to the ideological preferences of their constituents.

Recent work in urban policy has shown that this understanding of local government is largely incorrect, finding that across a number of policy areas, local governments are quite responsive to the preferences of the residents they serve (see Warshaw, 2019, for an excellent overview of this literature). This finding is not universally true, however, as other work finds inconsistent evidence of the influence of ideology and partisanship on municipal policy (Hughes, Miller Runfola, & Cormier, 2018; Krause, Hawkins, Park, & Feiock, 2019; Lubell, Feiock, Edgar, & de la Cruz, 2009; Sances, 2019). Mostly separate from the literature on the responsiveness of local government policy to resident preferences, scholars have also investigated the impact of policy issue severity on municipal policy, with some research finding that issue severity leads to more stringent municipal policy adoption in a given policy space (Hopkins, 2010; Mullin, 2008; Teodoro, 2010), while other research finds mixed evidence (Hughes et al., 2018; Krause, 2012; Krause et al., 2019). To this point, these literatures have developed mostly separately from each other, without giving much attention to the possibility of a more complex relationship among resident ideolgoical preferences, issue severity, and municipal policy. It is possible that some of the mixed findings in both sets of literature can be explained by a conditional relationship between resident ideological preferences and issue severity.

In this paper, I argue for a contextual understanding of municipal government policy responsiveness. I argue that the effects of resident preferences and issue severity are interactive. Strong municipal policy in a given policy space is more likely when the issue is severe and the residents being served are ideologically predisposed toward policy action. This theoretical argument leads to two testable hypotheses. First, that governments are more responsive to the ideological preferences of residents for a given policy area when the issue is severe; second, that governments are more responsive to issue severity when it aligns with residents' ideological preferences.

I test the developed hypotheses related to municipal responsiveness empirically by looking at municipal water conservation policy. Municipal water conservation policy is an area of growing importance. Climate change, aging infrastructure, and shifting populations have put increasing strain on urban water resources in the United States. This will require policy action. Water policy is also a useful context for exploring municipal responsiveness since water issues vary in severity across the United States and resident ideological differences will likely influence policy choice. I test my hypotheses using an original dataset of municipal water rates, making use of a new continuous measure of water rate progressivity that improves on previous binary approaches (Switzer, 2019b). Importantly, I find that there is a strong interactive relationship between resident ideology and water scarcity. Resident ideological preferences have the greatest impact on municipal water rate policy when water scarcity is high and the effect of water scarcity matters most when residents are more liberal. The results are supported even when the assumption of a linear interactive relationship is relaxed and a non-linear binning estimator is considered. These findings hold important implications for our understanding of municipal policy responsiveness and water policy in the United States.

Municipal Responsiveness to Residents

For a long time, it was assumed that local governments were relatively unresponsive to the ideological and partisan preferences of their residents. While city governments

might respond to particular interest groups within cities when it came to policymaking, their ability to respond to ideological concerns was assumed to be limited. Specifically, scholars believed that the numerous constitutional and legislative constraints on local governments mean that local politics are often subject to state-level political decisions (Burns & Gamm, 1997; Frug, 1980). The hierarchical nature of the relationship between local governments and states means cities may not have a great deal of discretion when it comes to their ability to respond to resident partisan preferences (Gamm & Kousser, 2013; Gerber & Hopkins, 2011; Vigdor, 2004). Additionally, horizontal competition for the provision of services means that cities may be limited in their responsiveness to resident partisanship and ideology. Competition between cities means that they may converge on policy regardless of resident ideology (Peterson, 1981) and the Tiebout (1956) model suggests that resident ideology may matter little in local government policy since residents will sort themselves into the cities that provide the specific package of public services they desire.

Recent work, however, suggests that the long-held conventional wisdom was wrong and that cities are often responsive to the ideology and partisanship of the residents they serve. A number of articles have found that local governments may be more responsive to resident ideological preferences than previously thought (Einstein & Kogan, 2016; Gerber, 2013; Palus, 2010; Switzer, 2019a; Tausanovitch & Warshaw, 2014). Einstein and Kogan (2016) developed a dataset of municipal level partisanship using precinct-level election data from the 2008 election in order to investigate the effect of local resident partisanship on municipal policy. They found that Democratic vote share had an impact on both city spending and revenues, with cities in higher Democratic voting areas having higher revenues and higher spending. Similarly, Tausanovitch and Warshaw (2014) found that cities with more conservative residents had more conservative policies overall, a higher share of taxes from sales tax, and lower expenditures and taxes per capita. A number of other studies have looked at ideology and partisanship in the context of environmental policy, largely finding evidence that local governments are responsive to the ideological preferences of the residents they serve (Deslatte & Feiock, 2019; Gerber, 2013; Krause, 2011; Switzer, 2019a).

Other recent work, however, has found that ideology does not always have a consistent influence on local policy (Hughes et al., 2018; Krause et al., 2019; Lubell, Feiock, Edgar, et al., 2009; Sances, 2019). Interestingly, Sances (2019) and Hughes et al. (2018) both find that local government responsiveness is dependent on the policy area being investigated. These mixed findings provide an impetus for further research into the dynamics that determine when local governments are responsive to the preferences of their residents. Sances (2019) specifically suggests that scholars of local government should continue to explore the ways in which local government responsiveness may be constrained. While he is primarily concerned with state level constraints on policy, his argument can apply to other constraints as well, including whether responsiveness to resident ideology depends on issue severity.

Municipal Responsiveness to Issue Severity

Parallel to the literature on municipal policy responsiveness to residents, a growing body of research in urban politics has investigated the impact of local issue severity

on municipal policy. Since local decision makers are limited in terms of the attention they give to specific policy issues in a multidimensional policy space, it makes sense that the problems that are most salient will be the most likely to receive policy attention (Mullin, 2008).

While a large number of studies have found that increasing issue severity leads to municipal policy action, the literature is not consistent in this finding. Studies in numerous policy areas, such as disaster response (McGuire & Silvia, 2010), social policy (Hughes et al., 2018), and immigration policy (Hopkins, 2010; Walker & Leitner, 2011) have found that higher levels of issue severity lead to more municipal policy action. In other areas, however, the results are mixed. Early work on local government climate policy found that increasing climate risk greatly increased the probability of climate action (Brody, Zahran, Vedlitz, & Grover, 2008; Zahran, Brody, Vedlitz, Grover, & Miller, 2008), but more recent work has found little evidence that risk from climate change leads to additional climate change policy (Hughes et al., 2018; Krause, 2012; Sharp, Daley, & Lynch, 2011). Similarly, in the case of water policy, the results have been inconsistent. Many studies have found that local governments in drier and hotter regions are more likely to pursue conservation policies (Kwon & Bailey, 2019; Mullin, 2008; Teodoro, 2010), but others have not found a significant relationship between scarcity and policy (Hughes et al., 2018; Krause et al., 2019; Switzer & Teodoro, 2019). The findings for land use policy are similarly mixed (Krause et al., 2019; Lubell, Feiock, & Handy, 2009). While much of the research does point to a relationship, severity does not influence policy in all cases. As will be argued, it is possible that this is because the influence of issue severity may depend on the ideological preferences of the public.

Contextual Responsiveness and Municipal Policy

For the most part, the literatures on municipal policy responsiveness to resident preferences and issue severity have not considered the possibility that issue severity and resident preferences have a more complex relationship. There are, however, good reasons to expect that resident ideology and issue severity have an interactive relationship when it comes to the adoption of municipal policy. Here, I develop a contextual theory of municipal responsiveness, suggesting this interactive relationship. Two newly testable hypotheses follow from this contextual theory. First, that the effect of resident ideological preferences will be greatest when issue severity is high; second, that the effect of issue severity will have the largest impact when resident preferences are ideologically compatible with concern over an issue and with potential policy solutions.

Local elected officials and the residents they serve ultimately operate in a multidimensional policy space. This means that both residents and politicians will be limited in terms of the amount of attention and support they can devote to any given policy issue. Elected officials face strong incentives to create policy in a manner most likely to ensure them reelection, devoting attention to issues that are likely to garner them political support (Mullin, 2008). The specific policies that will be most favorable for politicians seeking reelection will depend on where residents place their attention. Resident attention, and therefore the decisions of local government politicians, will depend on the relationship between resident ideological preferences and issue severity. I argue that where issues are severe *and* resident ideology aligns with policy to deal

with the emergent problems, municipalities are likely to take action. Where a policy issue is not severe or resident ideology does not support action on a policy issue, strong policy action is unlikely to take place. It is only when issues are salient *and* policy solutions are congruent with resident ideology that we should expect policy in line with that ideology.

Objective issue severity has been found to be a consistent determinant of policy issue concern among the public (Bishop, 2013; Hopkins, 2010; Spence, Poortinga, Butler, & Pidgeon, 2011). It is the issues that are most severe that tend to be the most salient to residents. Since local politicians have to spread their attention across multiple policy areas, it is in policy areas where issues are most severe that they will feel the need to most closely match policy to the ideological preferences of residents. Failing to respond to the ideological preferences of residents for emergent issues that have captured the attention of the public could be seen as electorally threatening. Therefore, we should expect resident policy preferences to matter most for policy when issues are severe. As suggested by Mullin (2008), however, when issue severity is low, and resident attention is elsewhere, local government policy may reflect other considerations such as personal preferences or special interests. For example, even if a municipality's residents have a latent preference for pro-immigration policy, elected officials may not feel the need to address that preference with pro-immigration policy unless the city is in an area that has experienced or will experience a large amount of immigration. Policy attention will naturally go to other, more pressing, issues.

In any theory that posits interactive relationships, it is important to theorize about both sides of the relationship, since a failure to do so can ignore important empirical evidence for or against the theory (Berry, Golder, & Milton, 2012). With that in mind, it is crucial to recognize that this contextual theory does not only suggest that the effect of ideology will be conditional on issue severity, but that the effect of issue severity on municipal policy will also be conditional on the ideological preferences of residents. Literature in political science has long shown that attention to policy issues varies depending on whether the issues accord with prior ideological beliefs (Zaller, 1992). Across a number of studies in a variety of policy areas, research has shown that risk perceptions and issue importance depend on ideology (Bishop, 2013; Egan & Mullin, 2017; Leiserowitz, 2006; Wildavsky & Dake, 1990). Residents can only focus on so many issues at a given time, and ideology is a large factor in where they place their attention. Indeed, ideology is often a lens through which individuals interpret the facts of the world around them, as shown by the literature on motivated reasoning (Fischle, 2000; Hartman & Newmark, 2012; Lebo & Cassino, 2007; Taber & Lodge, 2006). Given this, if a municipality serves residents who are not ideologically predisposed to have an interest in a particular issue area, then the level of issue severity may not be meaningful, as elected officials will not have a strong incentive to focus on the policy area. In contrast, if it is already an issue that residents are ideologically predisposed to pay attention to, then issue severity should matter even more. Additionally, resident ideological preferences may limit the policy options available to local governments. If the potential policy solutions are not in line with the preferences of the residents, it may not matter how severe the issue gets, as the municipal government may not be able to respond due to incongruence with the ideological preferences of voters.

All of this suggests that municipal policy action is most likely when ideological preferences and issue severity align. When issue severity is low or when ideological

preferences are not in line with policy action, policy response is likely to be limited. This is similar to the argument made by Mullin (2008) in developing her theory about the relative responsiveness of general-purpose governments (including municipalities) and special districts. Mullin's underlying theoretical mechanism is that general-purpose governments will be more responsive to resident preferences when issue severity is high, and that policy may reflect other considerations when severity is low, while special districts will be equally responsive regardless of severity. She uses this argument to develop a theory of the conditional effect of specialized government on policy adoption, but the core mechanism deals with the relative responsiveness of general-purpose governments, including municipalities, to resident policy preferences under differing levels of severity. Still, while her argument is similar to the one proposed here, her empirical analysis does not focus on testing this mechanism directly and instead assumes that in her policy area of choice, the adoption of increasing block water rates, the preferences of the median voter are uniform (Mullin, 2008). This assumption does not hold in many policy areas, however, and perhaps not even in water conservation policy. Median voter preferences vary across municipalities, and this paper will be, to my knowledge, the first to empirically test the interactive relationship between issue severity and resident ideological preferences.

Out of this contextual theory of municipal responsiveness, I develop the following four hypotheses for evaluation:

> *H1: Municipal policy will be more liberal when residents are more liberal and more conservative when residents are more conservative.*

This hypothesis states the simple relationship between policy choice and resident preferences and follows directly from the growing literature on local government responsiveness to resident preferences.

> *H2: Municipal policy in a policy space will be stronger when issues in that policy area are more severe.*

This hypothesis states the simple relationship between policy choice and resident preferences coming out of the parallel literature on responsiveness to issue severity.

> *H3: The effect of resident preferences on municipal policy will be stronger when issue severity is high.*

This hypothesis reflects the argument that municipal governments will face strong incentives to adopt policies in line with resident preferences when issues are most severe, but may focus on other influences when issues are not as severe.

> *H4: The effect of issue severity on municipal policy will be stronger when resident preferences are ideologically compatible with the policy issue and solution.*

This hypothesis follows from the argument that even if an issue is severe, it is only when residents are ideologically compatible with the policy issue and solutions that municipal governments will face strong incentives to adopt policy to solve the problem.

Water Conservation Policy in the United States

The empirical subject of this paper is municipal water conservation policy. Water policy is an area of growing importance for municipal governments in the United

States. As the population of the United States has more than doubled since 1950 and shifted from rural to urban areas, water supplies in many areas have become strained (Kenny et al., 2009). Aging water infrastructure and increasing regulatory costs have put an additional strain on water resources (Griffin, 2001). Water utilities are facing increasing challenges of water scarcity, and the looming threat of climate change will only exacerbate this issue in the future (Levin et al., 2002). These changing conditions can be seen most starkly in the recent California drought, which was the most severe drought in the area in the previous 1,200 years according to tree ring data (Griffin & Anchikaitis, 2014). These challenges call for a strong policy response.

One of the most powerful tools that local governments have to encourage conservation is the water rate structure, the specific policy tool investigated in this study. The rate structure that a utility adopts has major implications for water conservation, as well as potential redistributive effects (Berry, 1979; Mullin, 2008). Pursuing conservation through rate design is potentially attractive for utilities since it is a way of sending signals about the value of water without the administrative costs that comes with a regulatory approach (Chesnutt & Beecher, 1998). Since demand for water is price sensitive, adopting rates that charge high marginal prices for water, especially for high volume users, is considered an economically efficient way for utilities to reduce water use (Griffin, 2001; Gurung & Martinez-Espineira, 2019).

Importantly, however, rate adoption in the United States is an inextricably political process, carrying political and financial risks for utilities. In the case of municipal governments, the subject of the present study, elected political officials ultimately make rate structure decisions, which can be politically risky due to potential resident backlash (Levin et al., 2002; Teodoro, 2010). Politicians may delay or even halt rate changes due to the political risks (Honey-Roses & Pareja, 2019). Additionally, although revenue does not necessarily depend on rate structures if rates are designed carefully, the adoption of conservation rates increase financial uncertainty for utilities (Jordan & Albani, 1999). This means that pursuing conservation through rate design may be financially risky, in addition to being politically risky (Teodoro, Zhang, & Switzer, 2019). Given the growing importance of water conservation in the United States, understanding the circumstances in which local governments are likely to pursue this economically efficient but politically and financially risk policy is an important pursuit.

Beyond its importance as an area of study, rate policy is an excellent policy area to examine the interactive relationship between ideology and issue severity for a number of reasons. First, water is a policy issue in municipalities across the United States. While not all municipalities provide water services, municipalities are the most common provider of drinking water in the United States. Importantly, while water is a common policy area for municipalities throughout the country, water conditions vary greatly in severity. While some regions have plentiful water and water scarcity is not a huge concern, others are extremely dry and water conservation may be more of a policy priority. Additionally, there are clear ideological differences in terms of support for water policy. Recent studies have found that ideology is a major correlate of support for water conservation policy (Bishop, 2013; Switzer & Vedlitz, 2017). In general, individuals that are more liberal are supportive of policies to mitigate drought and water scarcity.

There are many varieties of rate structures, and the specific choice of rate structure determines how the costs of water services are distributed, but they can most easily be grouped into four basic types (Mullin, 2008; Teodoro, 2010). Flat rates charge the same price to all customers over a fixed period, regardless of the amount of water consumed. Uniform rates charge the same marginal price for all units of water regardless of the level of consumption. Declining block rates charge higher marginal prices at low volumes of use, but as usage increases, the marginal price decreases. These bear a similarity to regressive tax rate structures. Much like a regressive tax rate would charge those with low incomes higher rates than those with high incomes, declining block rates assign the highest marginal prices to the lowest volume users. Finally, increasing block rates charge higher marginal prices for high volume users, while charging lower prices per unit for low volume users. This is similar to a progressive tax rate, as the marginal price goes up with consumption.

Studies have usually focused on increasing block rates as a policy of interest, since these are considered the most conservation-oriented rates, specifically because they charge higher volume users higher prices per unit of water consumed (Mullin, 2008; Teodoro, 2010). Importantly, for most utilities, mean customer consumption is higher than median customer consumption (Chesnutt et al., 1997). This means that the median customer should usually benefit from an increasing block rate structure, since high consumption customers will bear the burden of the increased price per unit for use above a certain level (Teodoro, 2010). Previous studies of water rates in the United States have measured rates policy dichotomously, looking at whether or not a utility uses increasing block rates or not (Boyer, Adams, Borisova, & Clark, 2012; Mullin, 2008, 2009; Teodoro, 2009, 2010).

As mentioned, a major advantage of the current study is that it does not depend on Mullin's (2008) assumption of consistent median voter preferences across municipalities. In her study, Mullin argues for a conservative assumption that the median voter should usually prefer increasing block water rates due to the right-skewed nature of consumption. The median voter should usually benefit under rate structures that charge higher rates for high volume use, Mullin (2008) argues, because it shifts costs to those who use the most water, and most voters will save on their water bill. While reasonable, this assumption is not certain to hold in reality. As mentioned, studies of public opinion have shown that ideology is a major factor in support for water conservation policy generally (Bishop, 2013; Switzer & Vedlitz, 2017). And of course, across a number of policy areas, ideology often trumps self-interest, with people voting against policies that would be of economic benefit for themselves for ideological reasons (Caplan, 2008; Feldman, 1982; Graetz & Shapiro, 2006; Sears, Lau, Tyler, & Allen, 1980). While it is possible that residents are economically rational in their support for increasing block rates, this is an assumption at least worth testing.

Additionally, even if Mullin's assumption is correct and the median local voter would prefer increasing block rates to alternative rate structures, the median voter across localities will likely differ on their preferences for the overall progressivity of the rates. Not all progressive tax rates are created equal, and neither are all increasing block rate structures. Much like tax rates can differ in terms of how regressive and progressive they are, increasing block rate structures can differ in progressivity as well. More progressive increasing block rate structures charge significantly higher rates in

upper blocks, while others only charge slightly more for high volume use. While it is defensible for the purposes of analysis to assume that the median voter should usually prefer increasing block rates, this assumption likely does not hold for how progressive the rate structure is, given different ideological preferences for conservation and redistribution.

Using the adoption of increasing block rates as a measure of water conservation policy also has a major flaw as a measure of local commitment to conservation policy more generally. Most crucially, classifying rate choice as a dichotomous variable masks the incredible variation within different rate structure choices. Again, the level of increase (or decrease in the case of declining block rates) in marginal prices is going to differ greatly across municipalities. One of the major reasons for adopting increasing block structures is to send a signal to consumers to decrease water consumption through an increase in the marginal cost of water (Whitcomb, 2005). If the increase in price is minimal, however, the conservation signal is minimal as well. When the price escalates rapidly, however, the expected change in conservation behavior would be larger. A more accurate measure of water rates should take this variation into account instead of treating all increasing block rates the same.

Measuring Water Rate Progressivity

In order to better measure conservation policy in water rates adopted across the United States, I make use of a recently developed measure of residential water rate progressivity (Switzer, 2019b). This alternative measure allows for a broad comparison of the conservation orientation of water utility rates that extends beyond just the type of rate structure used and explores how the marginal price of water fluctuates with consumption. This progressivity measure reflects the average change in the marginal price of one thousand gallons of water (kgal) resulting from a one kgal increase in consumption across the first 13 kgals consumed. The choice of 13 kgals reflects what DeOreo, Mayer, Dziegielewski, and Kiefer (2016) found was approximately two standard deviations above mean water consumption in their study of the residential end uses of water.[1]

A positive progressivity value means that high volume users are paying a higher marginal price for water than low volume users, while a negative value means higher consumption users actually pay a lower marginal price per unit of water, which is typical of declining block rates. A value of 0 means that consumption has no effect on the price per unit of water, which is the case for uniform rate structures.[2] The value of progressivity measures how the marginal price changes as consumption increases. For example, the city of San Antonio, Texas, has a progressivity value of 0.17. This means that on average, a one kgal increase in consumption is associated with a 17-cent increase in price per kgal. A six kgal increase in consumption, or approximately a two standard deviation increase in consumption, is associated with over a dollar increase in the marginal price of one kgal of water. This can be compared to a city like Fullerton, California, which, while also having an increasing block rate structure, only has a progressivity value of 0.03. This means a one kgal increase in consumption only leads to an average of a three-cent increase in price across the first 13 kgals consumed. While the dichotomous approach used in previous studies would have treated these

rates the same, the progressivity measure used here is not just a measure of whether or not a city's rates are progressive, but show in a continuous fashion how progressive (or regressive) they are (Switzer, 2019b).[3]

Data

In order to test the hypotheses relating to resident preferences and issue severity, I collected data on a number of variables for U.S. cities with populations of 20,000 or more.[4]

As discussed above, the dependent variable for the analysis is a new measure of water rate progressivity. Using city websites, I was able to collect detailed water rates data for 852 municipalities that run their own water utilities.[5] There is a good deal of variation in the progressivity of rate structures across the United States. The average rate progressivity for the cities included here is 0.096. This means that for every thousand gallons in increased consumption, the price charged per thousand gallons increases by about 10 cents. Put differently, increased consumption of 3,000 gallons, or about one standard deviation in household consumption according to DeOreo et al. (2016), would lead to an average 30-cent increase in the price charged per thousand gallons. The geographic distribution of water rate progressivity across the United States is displayed in Figure 1. Not surprisingly, the more progressive rate structures tend to be in the South, West, and Southwest, where water issues are the most severe.[6]

In order to measure resident policy preferences, I used Tausanovitch and Warshaw's (2014) measure of citizen policy conservatism. Tausanovitch and Warshaw (2014) developed the data using a series of seven large-N surveys in the United States that asked a number of policy questions across various policy areas. Using multilevel regression and postratification, they were able to develop a measure of citizen policy conservatism for municipalities in the United States with more than 20,000 residents. Only those municipalities that operate their own water utility are analyzed here. I reverse coded the measure so that it is a measure of city policy liberalism in order to avoid confusion between the concepts of conservatism and conservation. For the municipalities included in this analysis, the policy liberalism variable has an average

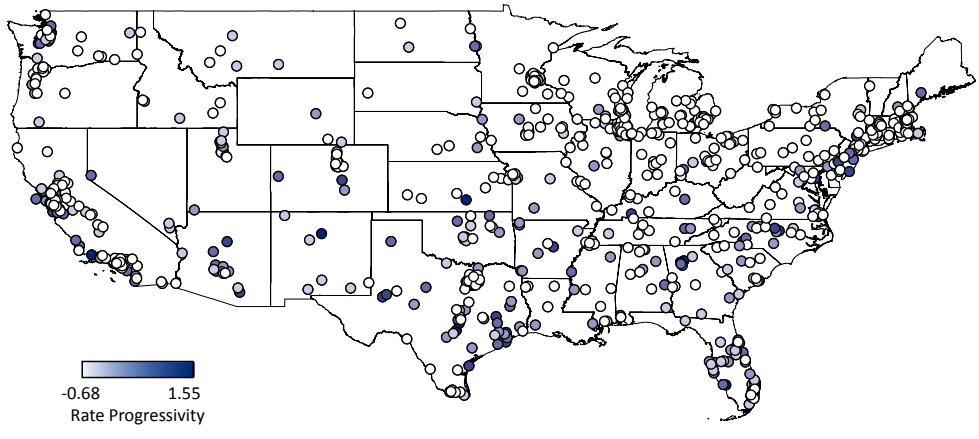

Figure 1. Water Rate Progressivity across the United States.

Table 1. Descriptive Statistics

	Percentage	Mean	Stand Dev	Min	Max
Binary variables					
Groundwater supply	24.531				
Purchased water supply	31.455				
Continuous variables					
Rate progressivity		0.096	0.178	−0.683	1.549
City policy liberalism		0.053	0.272	−0.647	1.0
Water scarcity		0.141	1.500	−2.797	3.630
Logged population		11.161	0.813	10.014	15.951
Percent change in population 2000–16		17.167	27.275	−28.155	332.005
Population density (residents/mile^2)		3514.543	2841.315	47.094	28,172.54
% Black		13.300	16.482	0.124	90.666
% Hispanic		18.464	19.066	0.696	97.98
% w/high school degree		86.256	8.227	40	98.3
% w/bachelor's degree		30.825	14.446	5.6	81.4
% Below poverty		17.052	8.600	3	50.2
Median household income (1,000 s)		54.382	19.763	23.09	159.167
Socioeconomic status		0	1	−2.323	3.710

Note: $N = 852$.

value of 0.05 and ranges from 1.00 in San Francisco, California, to −0.65 in Orem, Utah. Descriptive statistics for policy liberalism and other variables included in the analysis can be seen in Table 1.

In the case of water utility policy, issue severity is best captured by water scarcity. In order to measure water scarcity, I use the Palmer Drought Severity Index (PDSI), the most commonly used measure of regional moisture. The PDSI assigns values to the monthly level of water supply/demand in a region (Palmer, 1965). The index ranges from dry to moist, with a value of −4 or below suggesting that an area is in extreme drought, while a value of 4 or above means that an area is extremely wet. I matched each municipality in the dataset to an NOAA climate division. I then calculated the average monthly PDSI for the 10-year period from 2007 to 2016 to create a measure of water scarcity. Over the period examined here, 10-year average PDSI ranges from −3.63, meaning the climate region containing the municipality averaged a moderate drought, to 2.80, meaning an average of moderately wet. For ease of interpretation, I have reversed the coding of this variable so higher values of the measure correspond to higher water scarcity. I expect to find an interactive relationship between resident ideology and water scarcity.[7]

I also collected data on a number of control variables. First, data on water source came from the Safe Drinking Water Information System. Groundwater may be less affected by scarcity and utilities that purchase their water through wholesalers that may have less incentive to adopt conservation rates (Teodoro, 2010). In order to control for these possibilities, I included dummy variables for whether a utility uses groundwater and purchased water.

Population characteristics may influence rate conservation policy as well. Larger utilities may be more likely to adopt progressive rates since implementation of complex rate structures may require technical sophistication that small utilities lack (Teodoro, 2010). Smaller utilities may also lack the administrative capacity to implement more complex rate structures (Mullin & Rubado, 2016). Population density may also affect the need for conservation rates. More densely populated cities may

lower peak water demand, due to less lawn space, making conservation less necessary. Finally, increasing population may put a strain on a utility's resources. To control for these possibilities, I used data from the 2016 American Community Survey 5-year estimates and the 2000 Decennial Census, including measures of the natural log of population and the residents per square mile in 2016, as well as the percent population change from the 2000 decennial census to the 2016 ACS.

Municipal demographics may also play a significant role in rate progressivity. The urban politics literature has long identified race and ethnicity as powerful variables in the dynamics of municipal political systems, so it is possible that they will influence water conservation policy as well. I included variables for percentage of the population in the municipality that was black and Hispanic in 2016. Additionally, since water rates have major redistributive impacts, and water consumption is likely to be correlated with socioeconomic status (SES), it is also possible that SES could influence conservation policy. To control for socioeconomic status, rather than use any single measure to represent SES, I created a variable using factor analysis that incorporates median household income, percent high-school educated, percent with a bachelor's degree, and percent below poverty. This is a strategy that has been used in recent articles to capture socioeconomic status (Konisky & Reenock, 2013; Liang, 2016). The factor analysis of the four variables revealed a single factor with an eigenvalue of 2.63, with both of the education variables and median household income loading positively on the first factor and poverty rate loading negatively. This factor variable more fully represents SES than any single measure of income, education, or poverty.[8]

Models

In order to test my hypotheses about the relationships among issue severity, resident policy preferences, and municipal policy, I estimated a series of hierarchical linear models (HLM). HLM is appropriate because the individual municipalities are nested within 207 NOAA climate regions, the geographic level at which the PDSI data are available. The variation in water scarcity exists at the climate region level and not the municipal level, so OLS would be inappropriate since errors would be correlated across observations within the same NOAA climate region. Since H3 suggest that the effect of policy liberalism will depend on scarcity, which is measured at a higher level, I estimate the effect of policy liberalism using a random slopes model, allowing the effect to vary across climate regions. In order to evaluate H1 and H2, and establish a baseline that municipalities are responsive to both issue severity and resident ideology, I estimated the model first without an interaction between policy liberalism and water scarcity. To test H3 and H4, I included a linear interaction between policy liberalism and scarcity.[9] Additionally, recent work has shown that linear interactive models may lead to biased estimates of conditional effects since they assume that the effect of a variable included in the interaction change at a linear rate across the values of the variable it is interacted with (Hainmueller, Mummolo, & Xu, 2019). For this reason, I also estimate the models using a binning estimator, which allows for a Wald test of whether the linear interactive model is biased and for the estimation of unbiased marginal effects for the variable of interest across low, medium, and high values of the moderating variable (Hainmueller et al., 2019).[10]

Table 2. Hierarchical Linear Models Predicting Water Rate Progressivity

	(1)		(2)	
	Coefficient	*p*-Value	Coefficient	*p*-Value
City policy liberalism	0.095	.008	0.097	.003
	(0.035)		(0.033)	
Water scarcity	0.030	<.001	0.030	<.001
	(0.007)		(0.007)	
Policy liberalsim × water scarcity			0.061	.005
			(0.022)	
Groundwater supply	–0.000	.976	–0.003	.846
	(0.016)		(0.016)	
Purchased water supply	0.028	.083	0.028	.082
	(0.016)		(0.016)	
Logged population	0.015	.053	0.015	.060
	(0.008)		(0.008)	
Percent change in population	0.000	.285	0.000	.239
	(0.000)		(0.000)	
Population density	–0.000	.190	–0.000	.144
	(0.000)		(0.000)	
% Black	–0.000	.635	–0.000	.611
	(0.000)		(0.000)	
% Hispanic	–0.000	.871	–0.000	.853
	(0.000)		(0.000)	
Socioeconomic status	0.012	.194	0.012	.220
	(0.009)		(0.009)	
Constant	–0.078	.372	–0.070	.428
	(0.088)		(0.088)	
Observations	852		852	
NOAA climate divisions	207		207	
LR-test χ^2	7.06			
Prob > χ^2	.008			

Note: Standard errors in parentheses. *p*-Values the result of two-tailed tests, despite directional hypotheses. LR-test tests improvement of fit moving from non-interactive to interactive model.

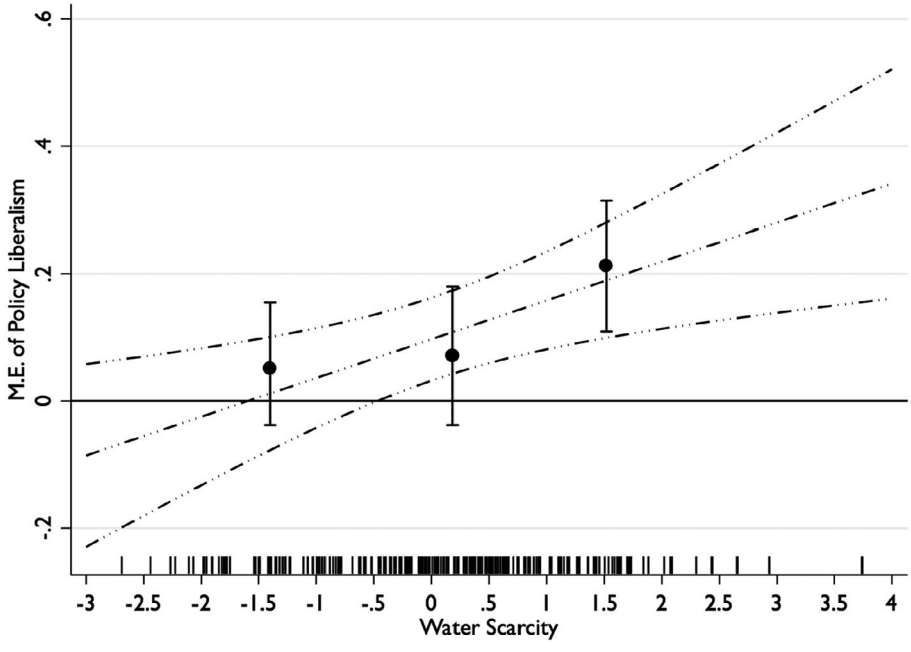

Figure 2. Marginal Effect of Policy Liberalism on Rate Progressivity

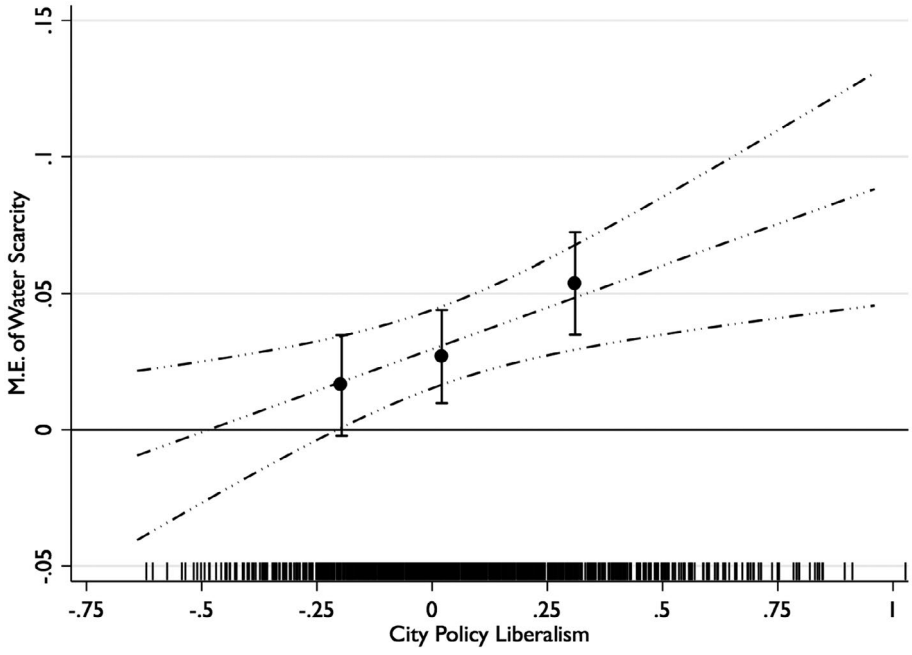

Figure 3. Marginal Effect of Water Scarcity on Rate Progressivity

Results

Results of the HLM models with and without the linear interactions are displayed in Table 2. Model 1 shows the results for the non-interactive models, and Model 2 shows the results for the model that interacts resident policy liberalism and water scarcity. Figures 2 and 3 show the marginal effects of policy liberalism and water scarcity, respectively.[11] The marginal effects resulting from the linear interaction models are in dashed lines, while the marginal effects from the binning estimators are presented with solid lines.

We can see in Model 1, the non-interactive model, that both ideology and water scarcity have substantively strong and statistically significant relationships with the level of rate progressivity, showing support for H1 and H2. Higher levels of city policy liberalism and higher levels of water scarcity are associated with more progressive rates. The results are not only statistically significant, but also substantively large. A two standard deviation increase in policy liberalism, or approximately the ideological equivalent of moving from College Station, Texas, to Los Angeles, California, is associated with a 0.05 increase in rate progressivity. This corresponds to a 5-cent increase in the average price change per kgal as consumption moves up a kgal block. A two standard deviation increase in scarcity, or approximately the equivalent of the difference between Buffalo, New York, and Phoenix, Arizona, leads to a .09 increase in slope progressivity, or about a 9-cent increase in average price change as consumption increases a kgal block. These results fit with what the literature would generally suggest about resident ideology and issue severity. Municipal policy appears to respond to both the ideology of residents and the severity of the policy issue.

Model 2 tests H3 and H4, which suggested that the effects of issue severity and ideology should be interactive. The models provide strong support for the conditional

hypotheses. The interaction between policy liberalism and scarcity is statistically significant at conventional levels. The dashed lines in Figure 2 shows the marginal effect of policy liberalism across values of water scarcity and 95% confidence intervals. As expected, and consistent with H3, the effect of policy liberalism depends on the level of issue severity. Resident preferences have the largest relationship with water rate progressivity when water is scarce. At low levels of water scarcity, the marginal effect of policy liberalism is statistically indistinguishable from zero. As scarcity increases, however, the effect of policy liberalism becomes positive and statistically significant. Resident ideology influences municipal policy, but issue severity conditions the effect.

The solid dots and lines in Figure 2 show the results of the binning estimator with resident liberalism as the treatment variable and scarcity as the moderator, an alternative approach to exploring the conditional effect of resident preferences. A standard Wald test of the equivalence of the binning estimator and the linear interactive model rejected the null of equivalence at the .05 level, suggesting that the multiplicative linear model may be biased and the binning estimator is appropriate. The results of the binning estimator are also consistent with H3. The binning estimator shows that the effect of resident policy liberalism is small, and not statistically significant, at the evaluation point in the lowest and middle bins of water scarcity and these marginal effects are not statistically significant from each other. In the highest bin, however, representing the top tercile of water scarcity, the marginal effect of resident liberalism on rate progressivity is statistically significant, positive, and large. The inference remains similar to that drawn from the linear interaction model: resident preferences matter, but primarily where the issue is most severe. Crucially, in addition to being significant and negative, the difference between the marginal effect of policy liberalism in the highest bin and the two lower bins is statistically significant.

The marginal effect of water scarcity resulting from the linear interaction model is displayed in the dashed lines of Figure 3. Consistent with H4, the effect of water scarcity on rate progressivity is highest when resident policy liberalism is high. At low levels of policy liberalism, the effect of scarcity is statistically indistinguishable from zero. As liberalism increases, however, the effect becomes more positive and becomes statistically significant at about −0.2, or just below one standard deviation below mean liberalism. This means that for most of the range of city policy liberalism, water scarcity matters for progressivity, but the size of the effect greatly depends on the level of liberalism. Issue severity matters for municipal policy, but it is conditional on residents with ideological preferences in line with the policy issue and policy choice.

The results of the binning estimator testing the marginal effect of water scarcity across binned values of resident policy liberalism, displayed in the solid lines of Figure 3, provide similar inferences. In this case, however, the Wald test was unable to reject the null of equivalence between the binning estimator and the linear interaction model. This provides evidence that the linear interaction model may be unbiased and the binning estimator is inefficient. Still, even with the loss of efficiency, the results are still consistent with H4 and the linear interaction model. In the lowest bin of resident policy liberalism, where residents are the most conservative, the marginal effect of scarcity on water rate progressivity is small and is not statistically significant. In the middle bin, the effect is larger and statistically significant, although not statistically different from the effect in the lowest bin. At the median value in the highest bin, where resident preferences are most liberal, the effect of water scarcity is much

larger and statistically significant from zero and the effects in the other two bins. The binning estimator shows that it is where residents hold the most liberal preferences that scarcity matters the most.[12]

Conclusion

These results provide strong evidence in support of the proposed contextual theory of municipal policy. This theory suggested that municipal policy is most responsive when resident ideology and issue severity are compatible. Statistical tests in the context of municipal water conservation policy find strong support for this interactive relationship, even after relaxing the assumption of a linear interactive relationship. This provides a more nuanced understanding of the nature of municipal policy and its relationship to the ideological preferences of the residents served. Cities are responsive, but context matters.

The theory developed here is flexible and could potentially export beyond the case of U.S. water policy. Future research should investigate whether this conditional relationship between resident ideology and issue severity applies to other policy areas, such as climate change, immigration, and criminal justice. Sances (2019) and Hughes et al. (2018) have shown that municipal responsiveness often depends on the policy area being investigated. It is possible that this theory applies better to some policy areas than others. In addition to exploring the contextual responsiveness of local government in contexts other than water scarcity, it may be useful to understand the differential responsiveness of different forms of local governments. The most obvious extension would be to look at special districts with the assumption of consistent median voter preferences across governments relaxed. Mullin's (2008) argument suggests that special districts would respond in potentially different ways to the interaction between ideology and severity. The theory should also be exportable outside of the context of United States local governments as well. Exploring questions related to the contextual nature of local government responsiveness to issue severity and resident preferences in other countries could provide insights into how representation differs across national contexts.

This study also holds important implications for municipal water conservation policy in the United States. It suggests that while some municipalities are well situated to respond to the increasing challenges presented by water scarcity, others are not. While it is the utilities that face the greatest challenge from scarcity that are responding with conservation-oriented rate design, this is not universally true. Ideology appears to be a strong barrier to adoption of conservation-oriented rates, even when they are most necessary. These findings suggest that one of the great challenges to water conservation will not be technical, but rather political.

While this study points to strong relationships between ideological preferences and policy at the local level, the relationship between policy preferences and policy choice is often modeled as a dynamic process (Erikson, MacKuen, & Stimson, 2002; Wlezien, 1995). Resident policy preferences, issue severity, and policy are all changing over time and space. The cross-sectional nature of the analysis here does not allow for a look at the potential dynamic relationship among preferences, issue severity, and policy. The limitations of local government data in the United States makes it difficult to imagine a dynamic approach for large N data set of the type used here. It may be

possible, however, to explore the dynamics in a more limited fashion focused on a few cities, similar to Einstein and Kogan's (2016) approach with respect to city fiscal policy.

Overall, this paper provides a new understanding of how responsiveness to emergent issues and ideological residents influences policy choice at the local level. Municipal policy is not the result of independent effects of policy preferences or issue severity, but rather comes about through a more complicated interactive relationship between the two.

Notes

1 The measure is analytically equivalent to the slope of a regression line through the rate structure, where X represents one kgal consumption blocks from one to 13 and Y represents the marginal price of one kgal at each consumption block. Using the same measure but with different end points did not change the results.

2 Water rates often include both fixed prices and volumetric prices. Only the volumetric component is directly relevant to conservation, but the fixed portion can be relevant for redistribution. The slope-based measure used here doesn't include fixed costs, but by design more progressive rates should generally be more equitable as well (Teodoro, 2005).

3 Switzer (2019b) found that the different variables explained variation in the dichotomous and continuous measures of rate progressivity, specifically finding that citizen ideology does not matter for the adoption of conservation rates but does for how progressive those rates are.

4 The choice of 20,000 as the population measure is due to data availability. The policy ideology data from Tausanovitch and Warshaw (2014) used in the analysis is only available for cities with populations of 20,000 individuals or more.

5 Rates data were collected between June and July of 2017. Fifty-three municipalities with more than 20,000 people did not list their rate structures online so were not included in the analysis. Twelve utilities use water budgets, which are a type of rate structure that determines the price per unit based on prior levels of usage or property size. They do not assign prices to blocks and thus are unable to be included in the analysis here. The dataset only contains rates for cities in the 48 contiguous states. Hawaii and Alaska are not included in the NOAA climate divisions, making the usage of the water scarcity data for these states impossible.

6 Alternative dependent variables yielded similar results and are displayed in the supporting information (A19). Using a different measure of rate progressivity, the difference between marginal price for indoor use versus two standard deviations above average use, I found nearly identical results. Additionally, using a completely different measure of water conservation policy, available for a subset of the municipalities investigated here, the results were similar.

7 Testing the models with a number of alternative measures of scarcity, including a simple measure of average monthly precipitation, did not yield different results. Results also do not depend on time frame of the PDSI variable (see supporting information page A11).

8 The factor analysis can be seen in the supporting information (page A3).

9 The supporting information appendix contains a number of alternative models. They include models that test the sensitivity to changes in the measures of scarcity (A11), as well as models that control for state variation (A14) and municipal institutions (A9). The supporting information appendix also contains a model with a minimal specification (A18). None of the models substantively change the results of the analysis.

10 Further explanation of the binning estimator can be found in the supporting information appendix (A3). Also, the cross-sectional nature of the analysis means the possibility of simultaneity should be acknowledged. There is little reason to think simultaneity is a large concern in this analysis. Water rates can't change the climate of a region over a relevant time frame (and likely has little overall effect), so it is exceedingly unlikely that the choice of water rate progressivity influences water scarcity. Political ideology is an extremely complex construct and while it is possible that annoyance at too progressive or not progressive enough water rates may make someone reevaluate their ideological preferences slightly, it strains reason to suggest that the progressivity of water rates at the city level drives general city-level policy preferences. Additionally, the supporting information appendix includes models in which I use

entropy-balancing weighting to adjust the data for the potential non-random assignment of liberalism and scarcity (A7). These models reflect the same dynamics as the models presented here.

11 The full binning estimator models can be seen in the supporting information appendix (A6).

12 Hainmueller, Mummolo and Xu (2019) also recommend a kernel estimator for evaluating interactions. The results of kernel smoothing estimators can be seen in the statistical appendix (A4). They do not greatly differ from the results presented here.

About the Authors

David Switzer is an Assistant Professor in the Truman School of Public Affairs, University of Missouri, Columbia, MO, USA.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site: