

The Persistence of Treatment Effects with Norm-Based Policy Instruments: Evidence from a Randomized Environmental Policy Experiment

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During a 1977 fireside chat, President Jimmy Carter famously appealed to American homeowners to set their thermostats at 65 degrees to help conserve supplies of natural gas and fuel oil. Norm-based strategies are commonly used to influence a range of private behaviors with public consequences, including alcohol and drug use, gambling, and resource consumption. In the last decade, these strategies increasingly emphasize the use of social comparisons to motivate behavioral changes. Efforts to use such comparisons build upon Leon Festinger's (1954) social comparison theory, which posits that individuals validate the appropriateness of an action or thought through comparison to others.

A subsequent literature in social psychology argues that strategies based on this theory provide an effective means to promote environmental conservation (see, e.g., Tim Kurz, Ngaire Donaghue, and Ian Walker 2005; P. Wesley Schultz et al. 2007; Noah J. Goldstein, Robert B. Cialdini, and Vidas Griskevicius 2008; Jessica M. Nolan et al. 2008). In this literature, the work by Schultz et al. (2007) has proven most influential and forms the basis of OPOWER's well-cited, social comparison approach for

promoting residential energy conservation in US cities.¹ Studies evaluating its programs have become the cornerstone of a growing research agenda in economics exploring the effect of social comparisons on conservation efforts (Ian Ayres, Sophie Raseman, and Alice Shih 2009; Hunt Allcott 2010). Results from these studies suggest that providing households with Home Energy Reports that include social comparisons leads to significant reductions in average monthly energy use.

Despite the apparent success of norm-based messages as a means to affect demand, the existing literature has focused exclusively on short-run effects. Yet, from a policy perspective, the long-run impacts of such initiatives are of equal concern. Before one can advance such strategies as viable options to fight climate change or rebuild water stocks, it is critical to understand whether and how they influence demand in *both* the short and long run. In this regard, it is important to assess whether norm-based strategies promote long-run conservation efforts or affect little more than short-lived behavioral adjustments.

The goal of our study is to examine how different norm-based strategies influence long-run patterns of residential water use. In 2007, a water utility in metropolitan Atlanta, Georgia implemented a natural field experiment that randomized households into four treatments: a control group, a group that received technical advice, a group that received both technical advice and an appeal to prosocial preferences, and a group that received both technical advice and an appeal to prosocial preferences that included a social comparison (see Ferraro and Price 2009). For our purposes, the most important findings from Ferraro and Price (2009) are that (i) technical advice has a negligible impact on behavior

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¹ For more information on OPOWER, see <http://www.opower.com>.

but (ii) augmenting such messages to include normative appeals and social comparisons leads to significant reductions in average water use in the four months after treatment assignment.

With knowledge of the initial treatment assignment and subsequent patterns of water use, we examine post-treatment residential water demand over the period 2007–2009. The empirical results are striking. While appeals to prosocial preferences and social comparisons affect short-term patterns of water use, only messages augmented with social comparisons have a lasting impact on water demand. Within a year of treatment assignment, we are unable to detect meaningful differences in use across households who received an appeal to prosocial preferences and counterparts in the control group. In contrast, impacts from the social comparison treatment can be detected more than two years after the message was sent.

I. Experimental Design

The Cobb County Water System (CCWS), an agency of the Cobb County Government, distributes treated surface water to about 170,000 customers.² About 150,000 are residential customers that reside in single-family dwellings. CCWS obtains water from surface supplies that have been affected by periodic drought conditions since 1998. To reduce water use among its residential customers, the CCWS agreed to initiate a targeted, mail-based conservation education program in 2007 through a randomized experimental design.³

Treatment 1, the technical advice treatment, provided households with an “information-only” message: a two-sided “tip sheet” listing ways to most effectively reduce water use and whom to contact for more information. The information contained in the “tip sheet” was widely available prior to our intervention, but households may have been unaware of *all* the strategies highlighted in the message.

Treatment 2, the weak social norm treatment, augmented Treatment 1 by including a personally addressed letter to the household on official

CCWS stationary. In addition to information found on the customer’s month bill (and the tip sheet), the letter includes the following norm-based appeal:

Cobb County residents consume almost one of out every ten gallons of Georgia’s public water supply. As a result, our water use has a large impact on the ability of Georgia’s waterways to protect wild-life and dilute pollutants that threaten human health. ... We need your help. Act on the tips listed in the enclosed tip sheet. We all have to do our part to protect Cobb County’s precious water resources. Reducing our water consumption today is important for preserving our environment and our economy for future generations. Please don’t waste water. Remember: every drop counts!

Treatment 3, the strong social norm treatment, augmented Treatment 2 with a comparison of the household’s water use to the median county household use for period June to October 2006, and indicated the percentile in which the household fell during this period. This comparison read:

As we enter the summer months, we thought that you might be interested in the following information about your water consumption last year:

Your own total consumption June to October 2006: 52,000 gallons

Your neighbors’ average (median) consumption June to October 2006: 35,000 gallons

You consumed more water than 73 percent of your Cobb County neighbors.

Based on prior work from social psychology (see, e.g., Schultz et al. 2007), the percentile text was framed in a negative way emphasizing how many people do *not* engage in the targeted (undesirable) behavior.

Before we proceed to the results section, a few key features of the experimental design should be highlighted. First, the three treatment mailings were sent out on the same day during the week of 21 May 2007. All mailings were sent via first-class mail in official CCWS envelopes to maximize the likelihood that they would be opened by customers and to clearly

² Information about Cobb County can be viewed at <http://quickfacts.census.gov/qfd/states/13/130671k.html>.

³ The experimental design description follows Ferraro and Price (2009), who examine the short-run treatment effects.

associate the messages with CCWS. Our single treatment “dose” contrasts with the OPOWER treatments, which are sent monthly without cessation. Second, the social comparison treatment required the communication of baseline water use for summer 2006. Although the water system billed 156,326 residential customers in April 2007, this requirement limits the set of households that were eligible for treatment assignment to 139,693 households whose customer billing names had not changed between May 2006 and March 2007.

Third, under a nonrandomized conservation program, CCWS would not send messages to households that consume fewer than 4,000 gallons/month or use zero gallons for most of the summer water season. Households that met these criteria for May through September 2006 were excluded from the experiment. The final sample included 11,699 households assigned to Treatment 1, 11,695 households assigned to Treatment 2, 11,699 households assigned to Treatment 3, and 71,779 households assigned to the control condition.⁴ Finally, monthly pre- and postexperiment water use data for the empirical analysis come from the CCWS billing department.

II. Experimental Results

We begin by examining the effect of our experimental treatments on household water use for June through September 2007. We regress summer 2007 water use for the i th household (Y_{i2007}) on three dummy variables representing the three treatments (T_1 = Technical Advice; T_2 = Weak Social Norms; T_3 = Strong Social Norms):

$$(1) \quad Y_{i2007} = \alpha + \beta_1 \times T_1 + \beta_2 \times T_2 \\ + \beta_3 \times T_3 + \beta_4 \times Y_{i2006} \\ + \beta_5 \times Y_{iSpring} + \varepsilon_i.$$

To increase the precision of our estimates, we include as covariates aggregate household water use for May through October 2006 (Y_{i2006}) and

for March and April 2007 ($Y_{iSpring}$). This latter variable aims to capture any home or landscaping changes since 2006 but before the experiment began. Given evidence of heteroskedasticity, we estimate robust standard errors.

Empirical estimates (in thousands of gallons) are contained in Model A of Table 1 and are consonant with results from Ferraro and Price (2009). Norm-based messages provide an effective means to promote short-run conservation efforts. While technical advice has a small, and statistically insignificant, impact on water use, augmenting technical advice to include appeals to prosocial preferences or a social comparison generates substantially larger reductions.⁵ For example, households assigned to our weak social norm treatment consume approximately 2.7 percent (990 gallons) less during the 2007 summer than those in the control group. Including a social comparison, as in the strong social norm treatment, leads to further reductions—approximately 4.8 percent (1,740 gallons). Importantly, both of these differences are significant at the $p < 0.01$ level and are robust to including route-specific dummy variables designed to capture unobserved neighborhood specific characteristics that may influence water consumption.

We now turn to evaluate the persistence of the three treatments over a two-year period following treatment assignment. Changing the dependent variable of equation (1), we regress water use for the 2008 and 2009 summers on our treatment dummies and household measures of preintervention water use. We again estimate robust standard errors. The final two columns of Table 1 present the empirical estimates, which suggest that the strong social norm treatment significantly affects water consumption in the two summers following treatment assignment. For example, as noted in column B, during the 2008 summer households assigned to the strong social norm treatment consumed approximately 638 gallons (or 2.6 percent) less, on average, than counterparts

⁴ Ferraro and Price (2009) present evidence that the randomization was effective in terms of balancing baseline water consumption and observable covariate distributions across groups.

⁵ Households in our technical advice treatment consume approximately 240 gallons or a half-percent less, on average, than counterparts in the control. To better understand the magnitude of such difference consider that the average shower uses approximately 15–24 gallons of water and the average top load washing machine uses approximately 40–45 gallons of water per load.

TABLE 1—AVERAGE TREATMENT EFFECT FOR SUMMER 2007, SUMMER 2008, SUMMER 2009
LINEAR REGRESSION MODEL

	Summer 2007 (A)	Summer 2008 (B)	Summer 2009 (C)
Treatment 1 (Technical advice)	-0.237 (0.193)	-0.0702 (0.167)	0.238 (0.170)
Treatment 2 (Weak social norm)	-0.990*** (0.175)	-0.189 (0.185)	-0.0587 (0.169)
Treatment 3 (Strong social norm)	-1.739*** (0.169)	-0.638*** (0.163)	-0.349** (0.163)
Water use from June–November 2006	0.372*** (0.0120)	0.128*** (0.00912)	0.185*** (0.0102)
Water use from April–May 2007	0.793*** (0.0419)	0.426*** (0.0239)	0.435*** (0.0244)
Constant	2.185*** (0.427)	11.29*** (0.468)	9.762*** (0.558)
Observations	106,669	106,669	106,669
R^2	0.618	0.229	0.318

Note: All water consumption variables are in thousands of gallons. Robust standard errors in parentheses.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

in the control group ($p < 0.01$). We observe similar, albeit less pronounced, effects during the summer 2009 season. As noted in Model C, households initially assigned to this treatment consume approximately 340 gallons (or 1.3 percent) less, on average, than counterparts in the control group ($p < 0.05$). In contrast, neither the weak social norm treatment nor the technical advice letter has an economically relevant or statistically significant impact on consumption in the 2008 or the 2009 summer seasons.

Viewed in their totality, our data suggest an important difference in the potential channels through which normative appeals and social comparisons affect water consumption. The fact that the weak social norm treatment effect is short-lived suggests that such messages do little more than induce behavioral adjustments (e.g., watering outdoors less frequently or washing full loads of laundry). In contrast, social comparisons have a more persistent effect on use, suggesting that such messages may promote both behavioral adjustments and durable conservation investments (e.g., fixing leaks, adopting water saving technologies).

III. Conclusions

Economists have only recently started to explore the effects of norm-based strategies, such as appeals to prosocial behavior or the use of social comparisons, as a means to promote prosocial behaviors. To date, this literature has focused exclusively on short-run effects. This study seeks to advance our understanding of such strategies by exploring whether and how they influence demand in *both* the short and long run. We do so by investigating the effectiveness of information transfers and prosocial messages in a large-scale, natural field experiment carried out in conjunction with a water utility system in metropolitan Atlanta.

Empirical results are striking and suggest a difference in the long-run impacts of prosocial appeals and social comparisons. While both strategies affect short-run water use, only messages augmented with social comparisons have a lasting impact on use. Within a year of the intervention, we are unable to detect a meaningful treatment effect for households that received an appeal to prosocial preferences but no social comparison. In contrast, impacts from the social

comparison treatment can be detected more than two years after the message was sent. From a policy perspective such differences are noteworthy and suggest that social comparisons hold greater promise for situations where the policymaker is interested in affecting behavioral change in both the short and long run.

The persistence of the social comparison treatment is also suggestive of different treatment mechanisms. In the context of energy and water consumption, users can adjust behaviors which require vigilance to maintain over time, or they can invest in durable technologies which require higher up-front fixed costs but lower variable costs. Our results are suggestive that simple appeals to prosocial preferences affect consumption through behavioral adjustments only, whereas social comparisons may affect behavior through both channels. Future research should focus on identifying the types of changes households undertake to better assess the long-run impacts of different norm-based strategies. Future research should also elucidate the short-run and long-run welfare implications of using norm-based strategies, a topic which is currently absent in the literature, but one which economists are well placed to address.

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