Environment for Development

Discussion Paper Series

February 2016 ■ EfD DP 16-06

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Spillover Effects from a Social Information Campaign

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Abstract

We investigate whether a social information campaign aimed at reducing water use causes a spillover effect on the use of electricity. On average, water use decreased by 6 percent for a treatment group for whom we conducted a social information campaign on their use of water, compared with that of a control group. We identify a spillover effect on electricity use among households that had efficient use of water before the campaign. The effect is sizeable; this group has almost 9 percent lower use of electricity after the campaign compared with the control group. Other types of households also decrease their water use, without a spillover effect. We argue that these results are consistent with a model of cognitive dissonance where the efficient households infer information about electricity use from the water use information.

Key Words: social information, spillover effects

JEL Codes: C93, Q50

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1. Introduction

There is now ample evidence that non-price conservation programs such as providing social information can affect the consumption choices households make in areas such as water use (Ferraro and Price 2013; Ferraro et al. 2011) and energy use (Ito et al., 2015; Costa and Kahn, 2013; Ayres et al., 2013; Allcott, 2011). The provision of social information could, for instance, take the form of appeals to pro-social preferences or provision of social comparisons, including normative messages. For example, in Allcott (2011), consumers were sent letters comparing their electricity use to that of their neighbors and were categorized based on the social approval of their actions; an average treatment effect of 2% was found. Similar effects were found in both Costa and Kahn (2013) and Ayres et al., (2013). In the water domain, Ferraro and Price (2013) show that, while pro-social messages decrease water use by nearly 3%, average treatment effects are larger when households are provided with normative messages (4.8%). There is also evidence that these types of interventions result in persistent changes in behavior, even after the treatment has ended. This suggests that cost-effectiveness assessments have underestimated the economic benefits of these programs (Allcott and Rogers 2014; Bernedo et al. 2014).

Given that social information does affect behavior and consumption choices for a particular good, an interesting question is whether this provision of information

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Financial support from the MISTRA COMMONS program, LACEEP, and Sida (through the Environmental Economics Unit at the University of Gothenburg) is gratefully acknowledged. We have received valuable comments from Anne Boschini, Runar Brännlund, Jessica Coria, Jorge Dresdner, Paul Ferraro, Marc Jeuland, Joe Cook, Andreas Lange, Olof Johansson-Stenman, Peter Martinsson, Amrish Patel, Subhrendu Pattanayak, Dale Whittington, and seminar participants at LACEEP, the University of Gothenburg, University of Hamburg, University of Heidelberg, and Umeå University.

spills over to other consumption decisions. In this paper, we investigate whether an information campaign aimed at encouraging residential water savings had spillover effects on electricity use. In 2013, we conducted a randomized field experiment in a Colombian town. We provided monthly consumption reports including normative messages to a treatment group for one year. The average household targeted by the campaign decreased its water use by 6.8% (Jaime and Carlsson 2016). During the same time period, we collected electricity use data in the same households. The goal was to ascertain whether the water-savings information campaign not only had an effect on water use, but also had a spillover effect on electricity use.

The remainder of the paper is organized as follows. In Section 2, we discuss behavioral spillovers across consumption domains and, in Section 3, we present the basics of the experimental design. In Section 4, we present the empirical strategy. Sections 5 and 6 present the results and a number of robustness checks. Section 7 concludes the paper.

2. Spillover Effects and Pro-social Behavior

In this section, we will discuss a number of theories explaining why there could be spillover effects across consumption domains when one particular domain is targeted by a social information campaign. Before doing so, it is important to understand the reasons for expecting a direct effect of providing social information about an individual’s consumption in relation to others. There is by now extensive evidence that people do care about their status or relative consumption; see, e.g., Clark and Senik (2010), Frank (1985a, b), Johansson-Stenman et al. (2002), and Solnick and Hemenway (1998). People also experience disutility by acting in ways that are at odds with their own identity (Akerlof and Kranton 2000, 2005; Bénabou and Tirole 2011). Levitt and List (2007) distinguish between wealth and moral arguments of the utility function. The campaign discussed in Jaime and Carlsson (2016) provides information about the moral cost/benefit of using a particular amount of water compared with others in society (i.e., it is good to conserve water, and a number of individuals with similar characteristics use water more efficiently). In addition, households can sense a feeling of being observed by an outsider (in this case, the water utility). Therefore, we would expect a reduction in average water use of households that were targeted by the campaign compared with the control group. Clearly, not all households will reduce their water use in the treatment group. For example, aspects such as how strongly they care about the moral costs and benefits of resource use, their current level of water use, and how credible they find the information are likely to affect their reaction to the information. What we do know from the literature is that, in many circumstances, providing social information will

have a direct effect on behavior in a substantial fraction of the households (Ferraro and Price 2013; Ferraro et al. 2011; Allcott 2011).

Why would an information campaign in one domain affect behavior in another domain? As discussed by Frey (1993), there could be motivation spillovers between different goods/domains, in particular if individuals exhibit similar types of inner motivations, such as environmental or moral concerns, that affect behavior for both goods. Similarly, Dolan and Galizzi (2015) argue that two important prerequisites for behavioral spillovers are that the process has to involve a certain sequence of events, and that the two subsequent behaviors are linked by some underlying motive. Whether a behavioral spillover is positive or negative, Frey argues, depends on a number of factors, such as the similarities between the goods, the motivations of the individuals and the strength of the social norms. Perhaps one of the most important reasons that behavior in different domains is correlated is the desire to be consistent in beliefs and behaviors (Cialdini 1984). According to the theory of cognitive dissonance, people wish to avoid holding contradictory beliefs, and suffer from being inconsistent (Festinger 1957). A number of empirical studies on environmentally responsible behavior suggest that there is indeed a correlation in behavior across goods/domains (see, e.g., Kaida and Kaida 2015; Thogersen 2004; Thogersen and Olander 2003; Thogersen 1999; Berger 1997; Stern et al. 1986). For instance, individuals who changed their weekday travel mode due to the introduction of congestion charges also exhibited positive changes in resource and energy use (Kaida and Kaida 2015). Similarly, Thogersen (1999) found that individuals who recycle at home were more likely to decrease packaging waste when shopping.

There is also a literature on measurement of pro-social behavior using experiments, which provides evidence that social preferences are partly stable over different domains (see, e.g., Blanco et al. 2011; Benz and Meier 2008; Karlan 2005) and over time (see, e.g., Carlsson et al. 2014; Volk et al. 2012; Brosig et al. 2007), although the extent of the stability varies among studies. However, another set of studies suggests that a variation of the strength of social preferences is to be expected due to moral licensing (Monin and Miller 2001). Moral licensing suggests that people receive an implicit license to behave selfishly in one setting by acting pro-socially in another setting. For example, Mazar and Zhong (2010) found that people became less altruistic after purchasing environmentally-friendly products than after purchasing conventional products. A study by Kouchacki (2011) showed that people were more willing to express prejudiced attitudes when their group members’ past behavior had established non-prejudiced credentials.

There are three important things to point out. First, there are two distinct but related ways in which a spillover effect can occur. The first is a direct spillover from the campaign itself. For example, raising environmental awareness in one area could raise awareness in other areas as well. The second is an indirect effect, working through underlying motivations/attitudes, which in turn gives rise to a change in behavior in the secondary area. Thus, the change in behavior in the secondary area will depend on individuals’ motivations/attitudes. We will not be able to isolate these effects from each other in a clean way in this study, but we can investigate the behavior in different groups. In particular, we can compare households with different characteristics before the start of the campaign, and can analyze the behavior of households that react in different ways. A second point is that it is not clear whether we should expect a positive spillover effect (i.e., a reduction in electricity use) or a negative spillover effect (i.e., an increase in electricity use). As discussed, there are some reasons for expecting a positive spillover, for example, because of stability of social preferences across domains and the generalizability of norms. On the other hand, moral licensing suggests that there could be a negative spillover effect. Third, the likelihood of a spillover will depend on the size of the moral cost/benefit in the two domains.

We will now discuss the role of both cognitive dissonance and moral licensing, seeing them as conscious utility-maximizing decisions made by the individual. Moral licensing is then a decision made by the individual to disregard the moral cost of an act because the individual did something praiseworthy before. Cognitive dissonance, on the other hand, is a decision to ignore or take information into consideration and change behavior in accordance with the new circumstances; this is in line with, for example, the model of cognitive dissonance in Oxoby (2003, 2004); for other applications in economics, see, e.g., Akerlof and Dickens (1982) and Rabin (1994).

In order to make it simple, let us assume that, before the information is received, no one cares about the moral cost/benefit of consumption, either because the individual was not aware of it, or because she was not aware of her consumption relative to others. Because of the campaign, the individual receives information about the negative consequences of her water use, and gets to know her relative position in society. The probable direct effect is a reduction in water use because the individual will experience a moral cost of high consumption, or a moral benefit of low consumption. What is the role of cognitive dissonance and moral licensing in explaining transmission of behavior from water use to electricity use?

2.1 Cognitive Dissonance

We are primarily interested in two mechanisms through which an individual could exert cognitive dissonance. Let us keep in mind that an individual could experience conflict between beliefs and behavior by being exposed to new information, and this is what the information campaign exogenously does. Because cognitive dissonance implies that an individual strives for consistency, she could search for harmony either by denying the cognitions that are in conflict or changing the cognition that generated the conflict in the first place. The choice of action will depend on the extent of moral costs/benefits in the primary area and on the cognitive costs of changing behavior in both the primary and secondary area.

The first mechanism is to decide whether or not to let the new information affect water use. This then suggests that it is more likely that individuals who have either a high or medium level of water use relative to others will disregard the information. This is because caring about relative consumption implies a higher cost to the individual. This does not imply that all individuals with a high level of water use would disregard the information, because the act of not taking the information into consideration is probably costly. Moreover, the effect of the information provision is likely heterogeneous, so this mechanism does not imply that all individuals with a low level of water use will change their behavior because of the information.

The second mechanism concerns the possibility of a positive spillover. Let us assume that the individual takes the information into account and reduces water use. If the individual believes that water and electricity use now share the same underlying motives, it is natural to think of the negative impacts of electricity use, and one's relative electricity use, as well. Again, it is more likely that individuals with a high or medium level of electricity use disregard the link between water and electricity use, because taking this into consideration implies a cost or no benefit for the individual. This in turn also implies that the direct effect on water use depends on the electricity use, since the costs and benefits of changing behavior depend on use in both domains. However, the individual does not have direct information about how her own electricity use compares with others' use. Therefore, the net effect will depend on her beliefs regarding the relative use of electricity with respect to others. On the one hand, it is likely that individuals believe that they are in a similar position regarding their water use; consequently, an individual with a relatively low level of water use would be expected to have a relatively low level of electricity use as well and therefore is more likely to take the new information into account when making decisions on electricity use. On the other hand, if individuals believe they exhibit higher water usage compared to others' use, it is more likely that they will ignore the information.

This in turn implies that it is more likely that we will observe a spillover effect among households with a low level of water use. At the same time, once an individual decides to take the information into account and change electricity use, the effect on electricity use could be higher in households with high expected electricity use.

2.2 Moral Licensing

A set of experimental papers have found that people actually might not act consistently over different domains, and that people might perceive that they receive an implicit license to behave selfishly in one setting by acting pro-socially in another setting (Mazar and Zhong 2010; Monin and Miller 2001). The role of moral licensing is often related to the timing of actions. In our case, the sequence of events is that, first, there is a decision about water use, and then potentially about electricity use. If moral licensing drives the individual's behavior, we would expect an increase in electricity usage in households where there is a decrease in water use. In those households, their behavior in the water domain would thus be seen as a license to instead increase electricity use. This is then more likely to occur for individuals with a high level of electricity use because their current use implies a moral cost that the household would like to avoid. At the same time, individuals do not have good information about their own electricity use relative to others' use.

To summarize, we expect that the direct effect of providing social information is a reduction in water, and this is more likely to occur in households with a high level of water use. A spillover effect can be observed if the use of water and electricity share the same underlying motives. The theory of cognitive dissonance suggests that we will observe a positive spillover (decreased electricity use), and the likelihood of a spillover effect is higher in households with a low level of water use before the information campaign. The theory of moral licensing suggests that we will observe a negative spillover (increased electricity use), and the likelihood of spillover effects is higher in households with a low level of water use and higher level of electricity use before the information campaign

3. Experimental Design

3.1 Description of the Sample

The randomized field experiment was conducted in the town of Jericó, a small town situated in the southwestern region of Antioquia in Colombia. In this town, there

were 2558 registered residential accounts with the local water utility. We include all active urban residential accounts whose meters fulfilled the technical requirements[1] (i.e., 1857 households), and households whose addresses were verified in the field and answered an *ex-ante* survey aimed at gathering pre-treatment information (i.e., 1311 households). Interviewed households were randomly allocated to either a treatment group or a control group, with 656 households in the treatment group and 655 in the control group. Of the households that participated in the experimental study, we obtained records of monthly electricity consumption for 1012 households from the local electricity utility (502 receiving treatment and 510 in the control group).

Although the sample of households in the water experiment was randomly selected from the customer's records, households participating in this study account for 77.2% of those in the water experiment. Electricity records were observed for the totality of households; however, we could not identify all of them due to technical reasons. First, water and electricity are provided by two different utilities in Jericó, making it difficult to match the addresses/customer numbers from both registers. Second, in the Colombian context is quite likely that one member of the household is registered at the water utility while another member is registered at the electricity utility, making it difficult to compare billing records. Moreover, some addresses were written differently in both records, making the process of matching the accounts even more difficult. Consequently, as a general criterion, we include only households whose addresses were clearly identified.[2]

Information on households' characteristics before and after the experiment was collected through a two-wave survey. The *ex-ante* survey took place in December 2012 and collected information regarding socio-economics, water and electricity saving facilities, behavioral actions toward water/energy conservation, personal values and perceptions regarding water conservation, social norms, and social

[1]The manager of Empresas Públicas de Jericó (EPJ) informed us that some meters suffer from technical problems and would be replaced in the coming months. After analyzing their performance in the five months preceding the campaign, we defined all meters working perfectly for a period of at least three months as technically suitable. This criterion allows us to control for potential intentional manipulation by consumers.

[2] To compare the characteristics of the observations included in the analysis with the ones we had to drop, we used two procedures: the standard difference in means and normalized differences. The latter is a scale-free measure of the difference in the distributions, suggested by Imbens and Wooldridge (2009). Although we find statistically significant differences in a few cases, the normalized differences are very small compared to the threshold value of 0.25. This suggests that there are no significant differences between the distributions of both groups that could affect the validity of our estimates. Results are available upon request from the authors.

networks. The *ex-post* survey took place in April 2014 and included the same set of questions, but added some follow-up questions regarding the information campaign.

3.2 The Information Campaign

The households participating in the experiment were randomly allocated between treatment and control groups. The treatment group received personalized consumption reports in connection with the monthly water bill, while the control group did not receive any reports. The reports were sent out every month, starting in January 2013 and ending in January 2014. Following Allcott (2011), the consumption reports had three main components. The first component contained information about water use, and households were compared to the mean and the 25th percentile of their comparison group.[3] In addition, they were provided with an injunctive categorization regarding their consumption level compared with other households: "Excellent," "Average" or "Room to Improve." These categories correspond to efficient, intermediate and inefficient use of water in the current month. The second component contained information about the environmental implications of being part of a specific category. Furthermore, they were provided information regarding the number of households that joined the most efficient group, also in the current month. Finally, the third component included an option for households to stop receiving consumption reports. Figure 1 provides an example of a consumption report. Further details regarding the experimental design can be found in Jaime and Carlsson (2016).

3.3 Baseline Characteristics

In order to monitor water and electricity use throughout the year, the local water and electricity utilities gave us access to monthly consumption data from July 2012. Because consumption reports were first sent in January 2013, the months preceding the experiment are considered pre-treatment, while the periods after January 2013 are post-treatment. Table 1 presents the average pre- and post-treatment water and electricity use for the treatment and control groups. As expected, there are no statistically significant differences between treatment and control households in terms of water use and electricity use before the start of the campaign (*t*-tests; *p*-values are 0.814 and 0.698, respectively). Furthermore, there are no statistically

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[3] The comparison groups were defined as "households with similar characteristics." In order to capture this, we used information on the household size and age composition of household members to compute adult equivalent units. Based on this, we divided households into three groups: small, medium and large households.

significant differences with respect to household characteristics between the treatment and control groups.

Because both water and electricity use depend on household size, they are correlated with each other (the correlation coefficient is 0.33). However, we do not expect reductions or increases in water use to be directly related to electricity use to any large extent. First, due to the absence of seasonal variation in Colombia, there is no need for household heating. Second, the only appliance that directly links water and electricity use is the washing machine. Drying machines are not used, and most showers work with gas. Third, the correlation between water and electricity use within the households is considerably smaller, 0.173, and not statistically significant.[4] The self-reported primary actions taken by households to reduce water use were: closing taps while brushing teeth, washing dishes and showering; watering the garden and plants at night; reusing water; and placing an object in the toilet tank. In contrast, to reduce electricity use, the primary actions taken by households were turning off lights and appliances when they are not in use and unplugging appliances when leaving the house. Both *t*-tests and normalized differences indicate that there are no statistically significant differences between households in the treatment and control groups. This also holds if we divide the households by efficient, intermediate and inefficient water consumption (before the start of the experiment).[5] As discussed later on, we will investigate whether there are differences in behavior between these three different groups. Because water use is highly correlated across time (the piece-wise correlation is 0.83), households belonging to a given subgroup most likely exhibited similar water use in the past. A summary of households' water and electricity infrastructure at home, and the actions undertaken in order to save water and electricity, is shown in Tables A1-A2.

Table 2 presents households' characteristics and attitudes prior to the campaign for treatment and control groups, for households with efficient, intermediate and inefficient use of water. The normalized differences reveal that there are only a few cases where there is a statistically significant difference in households' characteristics. Specifically, control households with intermediate use of water have slightly more education than those in the treatment group, whereas treated households

[4] In order to measure the technical correlation between water and electricity use, we estimate a fixed effects model in which electricity use (before the start of the campaign) is regressed on water use and a vector of month-by-year dummies.

[5] The classification is based on the injunctive classification they were given, or would have been given, in the first report.

with inefficient water use have more family members than do households in the control group. In both cases, however, the normalized differences are below the threshold value of 0.25, indicating that differences in the distribution of the covariates are minor and, thus, cannot affect statistical inference (Imbens and Woodridge 2009). Moreover, there are no statistically significant differences in terms of motivations for saving water, perceptions regarding water scarcity, and keeping track of water and electricity use. Table A3 confines the analysis to households in each subgroup, regardless of the treatment status. There are a few socio-economic characteristics that are different across the three groups. In particular, households with inefficient use of water have older household heads and live in larger houses. When it comes to motivations for saving water, however, there are essentially no observable differences between the three groups.[6] This demonstrates that, overall, there are no systematic differences within or between the subgroups before the start of the campaign.

4. Empirical Strategy

4.1 Homogeneous Treatment Effects

To begin with, we investigate whether the consumption reports on water use have an overall effect on electricity use. We estimate the following difference-in-differences model:

$$y_{jt} = \delta T_j P_{jt} + \beta P_{jt} + \mu_t + v_j + \varepsilon_{jt} \tag{1}$$

where y_{jt} denotes household j's electricity use in period t, T_j is a treatment group indicator, P_{jt} is a post-treatment indicator, μ_t denotes month-by-year dummy variables, v_{jt} are household fixed effects, and ε_{jt} is the error term. Due to randomization, the direct effect of the campaign is estimated by the parameter δ. A negative estimate of δ would indicate that electricity use in treated households is lower than in the control households after the information campaign, and there would thus be a positive spillover effect of the information campaign. This equation is estimated by using the standard fixed effects estimator (OLS) and standard errors are clustered at the household level.

[6] Out of twelve comparisons, we find a statistically significant difference in only one case. This could very well be due to chance. If we made a simple Bonferroni-correction (Benjamini and Hochberg 1995) for multiple comparisons by multiplying the observed *p*-values by the number of comparisons, we would no longer observe any statistically significant difference in motivations for water savings across the three groups.

It should be noted that the treatment effect is estimated by δ given a number of assumptions, in particular, that there is no spillover between treated and control households. In our particular case, there is some evidence of spillover effects on water use between these two sets of households, as shown by Jaime and Carlsson (2016). Unfortunately, we do not have information about electricity consumption in the control town, so we are unable to assess the potential spillover effects on electricity use between households in the treated town, as Jaime and Carlsson (2016) were able to do with regard to spillover of water information from treated to untreated households. Even with spillover information regarding water use, Jaime and Carlsson (2016) are not able to explain which types of households are likely to experience information spillover from one to another, which means that we really cannot include any variables to control for this. For these reasons, our estimates of the average treatment effects are lower bound estimates.

4.2 Heterogeneous Treatment Effects

We next investigate whether there are spillover effects for particular groups of households. To begin with, we focus on the households with different levels of water use. We do this in two ways.

First, we investigate whether there are differences in electricity use between households that had efficient and inefficient use of water before the start of the campaign. The primary reason is that both the direct and spillover effects of the information campaign can, as we discussed in Section 2, depend on the level of water use before the campaign. In particular, both cognitive dissonance and moral licensing suggest that it is in households that reduce their water use that we will observe a spillover effect. Jaime and Carlsson (2016) found that the effect of the information campaign on water use was primarily among households that were high users of water prior to the campaign (i.e., households whose water use exceeded the 50^{th} percentile). On the other hand, the theory of cognitive dissonance suggests that we are more likely to observe a change in behavior among households with a low level of water use.

We account for differences in pre-treatment water usage by dividing the households into three categories: efficient use, intermediate use, and inefficient use of water compared with their reference group. As previously mentioned, this corresponds to the injunctive categorization that households were given in the first

report.[7] For each of these three groups, we estimate treatment effects of the information campaign on water and electricity use, respectively. This is done by estimating Equation (1) for each category, both for water and electricity.

Finally, we also address heterogeneous treatment effects by distinguishing between households that increased or decreased their water use after the information campaign. A change in water use is evidence of a change in the household's moral concern, which is the main mechanism giving rise to spillovers based on our conceptual framework. We therefore compute the individual treatment effects on water use. This allows us to separate households that decreased water use from those that increased water use or retained the same level. We then group treated households that decreased/increased water use with control households with the same water usage prior to the campaign.[8] We then estimate treatment effects of the campaign on electricity use for each of the six groups by means of the specification in Equation (1).

5. Results

5.1 Homogeneous Treatment Effects

To begin with, we investigate the average treatment effects on both water and electricity use. We estimate models for four time periods: 3, 6, 9 and 11 months after the campaign started. Estimates are based on the sample of households whose meters worked throughout the study period.[9] Focusing on this particular sample allows us to control for meter malfunctions that are unintended (e.g., leakages and stopped and reversed meters) and intended (e.g., covered meters that cannot be read) and also increases the reliability of our estimates. Results are presented in Table 3.

As reported in Jaime and Carlsson (2016), the information campaign had an overall effect on water use, and this effect lasted throughout the whole campaign. The average treatment effect on water use corresponds to about a 6.2% reduction in water

[7] For households in the treatment group, we use the injunctive classification they were given in the first report. Similarly, we use the injunctive classification that households in the control group would have received if they had been treated.

[8] Households that did not change water use were excluded from the analysis. Although it would have been interesting to include them as a separate group, there were only four treated households that did not change their behavior, which makes it impossible to conduct any formal analysis.

[9] The water utility provided us with monthly information regarding meters' performance. This allowed us to distinguish meters that always worked from those with permanent or temporary failure.

use.[10] However, at the aggregate level, there is no indication of a positive or negative spillover effect on electricity use from the information campaign.[11] Thus, at the aggregate level, we do not find support for a positive or negative spillover effect.

5.2 Heterogeneous Treatment Effects

Let us now look at the treatment effects for the three categories of households based on their water use – compared with their reference group – before the treatment. The results are presented in Table 4 and Figure 2.

Let us begin with the differences in water use between treatment and control groups. Among the households with inefficient use of water before the information campaign, there is a sizeable and statistically significant difference between treatment and control groups: water use is 8.3% lower in the treatment group eleven months after the start of the campaign. Although the difference is slightly higher in the beginning of the time period, it remains large throughout the whole year, as shown in the lower panel in Figure 2. For households with an intermediate level of water use before the information campaign, there is no difference between the treatment and control groups. Finally, for households with efficient use of water before the campaign, there is some evidence of a treatment effect in the long run, i.e., at the end of the information campaign. What these results suggest is that the direct effect of the information campaign is primarily among households that experience either a relatively large cost or benefit from the relative comparisons, compared to households with average usage. Furthermore, our conjecture that the direct effect could be weaker among households with a high level of consumption of water because of cognitive dissonance is not supported by the results.[12]

What about spillover effects on electricity use? For the first two groups – inefficient and intermediate users of water – there is no statistically significant difference between treatment and control groups, apart from one case. Thus, for these

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[10] Note that the average treatment effect on water use found in this paper is not the same as that found in Jaime and Carlsson (2016) because here we include only a subset of all households, specifically, those households for which we also have information on their electricity use.

[11] The results are similar if we include all observations, i.e., even those without well-functioning meters. The treatment effect on water use is then around 6%, and there is still no evidence of spillover effects on electricity use. According to Jaime and Carlsson (2016), during April 2013, a well-defined shock affecting water use took place in Jericó. Results are also robust to the exclusion of this particular month.

[12] There are, of course, a number of other factors that are correlated with water use that can affect this result. In particular, the possibilities to actually reduce water use are more and less costly in households with a high level of water use.

two groups, we can conclude that, on average, there is no spillover effect. However, for the third group – efficient water users – the difference in electricity use between treatment and control is negative (i.e., electricity usage is reduced) and statistically significant. The difference is sizeable as well: electricity use is 9.1% lower in the water use treatment group 11 months after the start of the campaign. Although the effect is not statistically significant in the first two months after the start of the campaign, it remains large and significant throughout the whole year, as shown in the upper panel in Figure 2.

Thus, we have some evidence of a positive spillover effect of the water use information campaign on electricity use – positive in the sense of reduced use of electricity as well – but the effect is primarily among households with a low level of water use before the information campaign began. The average treatment effect on water for this group is negative as well, as we have seen, although statistically significant only at the end of the information campaign. Thus, the results suggest that there is not only a direct effect of the information campaign but also a correlation in behavior between the two consumption areas.[13] The findings are consistent with a theory of underlying motives for water and electricity use and a desire to be consistent, i.e., cognitive dissonance. In particular, this model predicts a positive spillover among households that had a low level of water consumption before the information campaign. Note that we find no evidence to support moral licensing, although of course moral licensing could still exist. However, a model of cognitive dissonance also predicts that, if households with a high or intermediate level of consumption reduce water use, there could be spillover effects as well. This is not what we find; instead, we find that water use is reduced among households with a high level of water use, but there is no effect on electricity use.

We therefore also classify the households based on whether they increased or decreased their use of water because of the information campaign. As explained in Section 4, we compare treated households that increased/decreased water use with control households with similar water usage before the information campaign. In Table 5, the treatment effects on electricity use are estimated for the six different groups of households.

There are no differences between treatment and control groups for households with inefficient use of water before the campaign, even when we allow for differences between those that increased and those that decreased their water use in the treatment

[13] Results are robust to both the inclusion of all observations and the exclusion of April 2013.

group. Among these groups there is thus no evidence of a spillover effect of the information campaign. However, households that had intermediate use of water before the campaign exhibit important differences: while treated households that decreased their water use did not change electricity use compared with the control group, those that increased water use also increased electricity use by around 11.9%, compared with the control group. However, the effect is statistically significant only at the end of the treatment. We do not know why some of the intermediate households increased their water use after the information campaign. The spillover effect is consistent with a model of cognitive dissonance, where individuals wish to be consistent across the two domains.

The most interesting case is the households that already had efficient use of water before the campaign. Among these, the households that managed to further decrease water use due to the information campaign are most different from the control group: households in the treatment group that decreased water use after the campaign also decreased electricity use by 14.9% compared with the control group. Households in the treatment group that increased their water use during the campaign did not have a change in their use of electricity that was different from the control group.[14] Overall, these results suggest the existence of a positive spillover in the group of efficient households and some evidence of correlation in behavior among households that increased water usage in response to the information campaign.

6. Robustness Checks

In this section, we investigate how sensitive our main results are to the classification of efficient and inefficient households. Finally, we evaluate the robustness of our results in light of the relatively small sample sizes of the subgroups of households.

6.1 Redefining the Sample of Efficient and Inefficient Households

During the campaign, households whose water use was higher than the 25th percentile but lower than the mean were categorized as "intermediate." Households with water use below/above these cut-offs were categorized as efficient/inefficient. Although previous studies have used similar classifications (Ayres et al. 2013; Allcott 2011), the choice of the cut-offs is somewhat arbitrary. In order to investigate whether

[14] Except for a few cases, results remain the same when including all observations and excluding April 2013.

our results are sensitive to this choice, we estimate two additional sets of models. In the first set, households with water/electricity use lower than the 30th percentile are classified as efficient. Similarly, households with water/electricity use higher than the 70th percentile are classified as inefficient. In the second set, we use the percentiles 25th and 75th as cut-offs instead. We then estimate the treatment effects of the campaign (shown in Table 4) using these two sets instead. Results are summarized in Tables A4. As can be seen, results remain basically the same.

6.2 Statistical Inference with Bootstrapped Standard Errors

Due to difficulties in identifying households from the electricity records, the data used for estimating the average treatment effects is a subsample of that in Jaime and Carlsson (2016). Because our empirical strategy relies on the comparison of subgroups with rather small samples, there could be some concerns about the ability of the model to identify an effect. In order to evaluate whether our subsamples are sufficient for a straightforward statistical inference, we use sampling techniques to re-estimate the models in Tables 3-5. Statistical inference is then conducted based on bootstrapped standard errors, including N=1000 repetitions. Results are displayed in Tables A5-A7. As can be seen, results are robust to the use of bootstrap techniques.

7. Discussion

Does targeted social information in one area affect behavior in other areas? Are individuals who are affected by such information more or less likely to change their behavior in other areas not directly related to the information provided? These are the two broad questions we have addressed in this paper. There are reasons to expect that there is indeed a positive spillover from one area to another. In particular, we argue that a correlation between behaviors might be due not only to underlying similarities in the domains but also to shared underlying motives and cognitive dissonance, i.e., individuals strive to be consistent. Alternatively, this could be due to moral licensing, i.e., individuals think they receive an implicit license to behave selfishly in one setting by acting pro-socially in another setting.

What we find is some evidence of a positive spillover effect of the social information campaign, but only for a particular group of individuals. The information campaign on water use decreased water use for two groups of households: those with inefficient use of water before the information campaign and those with efficient use before the campaign. However, it is only for the households with efficient use of water that we observe a positive spillover effect on electricity. The effect is sizeable; this group has around 9% lower use of electricity compared with the control group 11 months into the information campaign. The spillover effect is primarily among

efficient households that decreased their water use as well. Interestingly, there are no observable differences between efficient and inefficient users of water with respect to stated reasons for saving water or regarding their perceptions of water scarcity. Thus, these cannot be the explanations for the difference in spillover effect of the campaign.

Our findings for the efficient households are consistent with theories of cognitive dissonance and shared underlying motives for water and electricity use. Although the same model predicts a similar effect for inefficient and intermediate households that decrease their water use because of the information campaign, this is not what we find.

The types of households where we observe a positive spillover effect are those that, before the campaign, already had both efficient use of water and inefficient use of electricity. As for the households with efficient water and electricity use, we find a reinforcement effect of the campaign in the primary area. These findings are consistent with our model of moral concern and cognitive dissonance. This model predicts that a positive spillover effect is to be expected among households that, before the information campaign, already had an efficient level of water use. Among these households, the information campaign might have triggered increased moral concern and a desire to reduce dissonance by decreasing consumption of both water and electricity. However, we find no support for moral licensing behavior in our sample.

Overall, our findings provide evidence of the existence of ancillary benefits in social information campaigns, which are important elements not only for policy evaluation but also for the design of behavioral interventions.

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Tables

Table 1. Water and electricity use by comparison groups (m^3/month and kWh/month)

	Pre-treatment				*Post-treatment*			
	Water		Electricity		Water		Electricity	
	Treat.	Control	Treat.	Control	Treat.	Control	Treat.	Control
All households	14.67	14.54	119.88	121.74	13.78	14.50	118.68	121.13
	(9.18)	(9.28)	(71.59)	(80.13)	(8.56)	(9.32)	(73.62)	(81.21)
Small households	11.52	9.16	97.91	88.27	10.66	9.67	97.43	89.23
	(10.76)	(7.74)	(64.40)	(64.45)	(8.68)	(7.91)	(62.22)	(64.69)
Medium households	14.82	15.37	122.30	127.57	14.04	15.19	120.88	125.90
	(9.36)	(10.45)	(71.60)	(80.08)	(9.32)	(10.01)	(75.59)	(78.41)
Large households	21.92	21.51	153.23	158.84	19.55	21.35	152.55	164.24
	(13.72)	(11.38)	(115.04)	(129.53)	(11.12)	(13.79)	(129.86)	(149.75)

Note: Pre-treatment corresponds to the period Jul. 2012 - Jan. 2013. Post-treatment corresponds to the period Feb. 2013 - Dec. 2013. Standard deviations in parentheses.

Table 2. Socio-economic characteristics and attitudes and perceptions regarding water scarcity (Injunctive classification)

	Efficient users				*Intermediate users*				*Inefficient users*			
	Control	Treatment	Norm-diff	*p*-value	Control	Treatment	Norm-diff	*p*-value	Control	Treatment	Norm-diff	*p*-value
					Socio-economics and dwelling characteristics							
Water use [m^3*/month*]	7.37	8.35	0.155	0.148	12.42	11.7	-0.110	0.204	20.68	22.01	0.098	0.205
Electricity use [*kWh/month*]	92.48	107.3	0.170	0.112	121.6	110.5	-0.136	0.117	139.5	143	0.031	0.692
Male household head	0.232	0.230	-0.003	0.978	0.264	0.303	0.061	0.490	0.270	0.221	-0.080	0.305
Age [*Household head*]	51.20	49.62	-0.067	0.541	50.98	50.43	-0.024	0.787	55.30	52.85	-0.110	0.159
Education [*No. years – Househ. head*]	7.28	8.34	0.152	0.158	8.87	7.75	-0.176	0.043	8.29	7.70	-0.086	0.269
Household size [*No. family members*]	3.31	3.36	0.022	0.839	3.45	3.22	-0.088	0.317	3.13	3.48	0.142	0.067
Adult equivalent units	2.20	2.45	0.164	0.126	2.5	2.3	-0.120	0.165	2.52	2.50	-0.011	0.884
Household income [*1000 COP/Month*]	469.1	517.4	0.061	0.575	485.9	550.9	0.084	0.342	533.1	485.7	-0.054	0.490
No. rooms	7.23	6.99	-0.074	0.494	7.25	7.53	0.088	0.316	7.95	7.56	-0.116	0.136
House age [*No. years*]	29.19	30.57	0.058	0.594	27.01	28.01	0.044	0.619	30.67	30.7	0.001	0.985
					Motivations for saving water							
Civic duty [%]	0.250	0.236	-0.023	0.831	0.258	0.215	-0.071	0.414	0.258	0.212	-0.075	0.331
Important [%]	0.441	0.517	0.107	0.318	0.398	0.496	0.138	0.112	0.407	0.473	0.093	0.230
Pay less [%]	0.226	0.135	-0.166	0.119	0.227	0.222	-0.007	0.933	0.281	0.242	-0.062	0.421
Social esteem [%]	0.060	0.079	0.053	0.623	0.063	0.052	-0.032	0.711	0.042	0.073	0.093	0.228
					Perceptions regarding water scarcity							
Water scarcity [*At present - %*]	0.049	0.093	0.121	0.268	0.025	0.038	0.052	0.561	0.067	0.098	0.079	0.309
Water scarcity [*Future - %*]	0.768	0.759	-0.016	0.883	0.752	0.737	-0.025	0.782	0.764	0.744	-0.032	0.679
					Water and electricity use							
Keep track water use [%]	0.476	0.517	0.057	0.595	0.547	0.526	-0.030	0.735	0.569	0.515	-0.076	0.328
Keep track electricity use [%]	0.464	0.539	0.105	0.327	0.539	0.511	-0.039	0.652	0.557	0.503	-0.076	0.327
Keep track water and electricity [%]	0.464	0.506	0.058	0.589	0.539	0.511	-0.039	0.652	0.551	0.503	-0.068	0.384
No of obs.	84	89			128	135			167	165		

Note: Figures are based on the *ex-ante* survey and correspond to the subsample of households with continually working meters.

Table 3. Homogeneous treatment effects on water and electricity use

	Water use				*Electricity use*			
VARIABLES	After 3 months	After 6 months	After 9 months	After 11 months	After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	-5.694***	-4.898**	-5.914***	-6.157***	-0.613	0.446	0.329	0.264
	(2.139)	(2.114)	(2.126)	(2.126)	(1.802)	(1.889)	(2.030)	(2.098)
Post-treatment	-0.110	-0.542	-17.81***	-15.13***	-4.316***	-4.861***	2.368	-5.519***
	(2.112)	(2.143)	(2.202)	(1.948)	(1.482)	(1.538)	(1.788)	(1.909)
Constant	118.7***	119.9***	118.5***	118.2***	103.4***	103.5***	103.1***	103.6***
	(1.322)	(1.372)	(1.398)	(1.411)	(0.702)	(0.747)	(0.820)	(0.873)
No. Obs.	7,680	9,984	12,288	13,824	7,680	9,984	12,288	13,824
No. Households	768	768	768	768	768	768	768	768
R-squared	0.073	0.060	0.050	0.046	0.022	0.019	0.016	0.015

Note: Results based on subsample of households whose meters worked throughout the study period. Estimates correspond to the period Jul. 2012 - Dec. 2013. Month-by-year dummy variables included. Clustered standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4. Treatment effects on water use and electricity use for households classified according to water use before information campaign

A. Households with inefficient use of water ("Room to improve")

VARIABLES	*Water use* After 3 months	After 6 months	After 9 months	After 11 months	*Electricity use* After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	-9.708**	-8.318**	-8.836**	-8.349**	2.227	1.911	1.382	2.000
	(3.779)	(3.851)	(3.895)	(3.867)	(3.233)	(3.092)	(3.169)	(3.265)
Post-treatment	-12.47***	-33.34***	-41.43***	-42.62***	-7.679***	-2.504	0.930	5.272**
	(3.894)	(4.209)	(3.824)	(3.424)	(2.431)	(2.758)	(2.774)	(2.594)
Constant	178.9***	180.6***	178.5***	178.1***	119.2***	119.4***	118.9***	119.4***
	(2.350)	(2.454)	(2.505)	(2.521)	(1.175)	(1.208)	(1.279)	(1.351)
No. Obs.	3,320	4,316	5,312	5,976	3,320	4,316	5,312	5,976
No. Households	332	332	332	332	332	332	332	332
R-squared	0.141	0.113	0.095	0.088	0.028	0.027	0.023	0.024

B. Households with intermediate use of water ("Average")

VARIABLES	*Water use* After 3 months	After 6 months	After 9 months	After 11 months	*Electricity use* After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	-0.272	-0.604	-1.855	-2.452	1.363	4.760*	4.792	4.230
	(2.929)	(2.825)	(2.816)	(2.839)	(2.296)	(2.755)	(3.157)	(3.301)
Post-treatment	4.643*	-15.99***	-8.009***	-7.179***	-2.842	-5.598***	1.428	-5.508*
	(2.737)	(2.258)	(2.537)	(2.081)	(2.119)	(1.977)	(3.045)	(2.878)
Constant	89.68***	90.54***	89.48***	89.28***	95.42***	95.58***	95.17***	95.59***
	(1.292)	(1.334)	(1.330)	(1.341)	(1.133)	(1.223)	(1.375)	(1.462)
No. Obs.	2,630	3,419	4,208	4,734	2,630	3,419	4,208	4,734
No. Households	263	263	263	263	263	263	263	263
R-squared	0.058	0.049	0.041	0.038	0.025	0.021	0.018	0.016

C. Households with efficient use of water ("Excellent")

VARIABLES	*Water use* After 3 months	After 6 months	After 9 months	After 11 months	*Electricity use* After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	-6.631	-5.319	-7.017*	-8.168**	-8.811**	-8.820**	-8.395*	-9.089*
	(4.085)	(3.721)	(3.667)	(3.724)	(3.460)	(4.083)	(4.494)	(4.612)
Post-treatment	7.375*	3.343	12.80***	12.17***	-1.735	-4.666	6.561*	4.118
	(4.352)	(2.943)	(3.711)	(3.037)	(2.496)	(3.192)	(3.655)	(3.791)
Constant	47.45***	47.90***	47.34***	47.23***	85.07***	85.22***	84.85***	85.23***
	(1.836)	(1.790)	(1.815)	(1.841)	(1.293)	(1.475)	(1.700)	(1.837)
No. Obs.	1,730	2,249	2,768	3,114	1,730	2,249	2,768	3,114
No. Households	173	173	173	173	173	173	173	173
R-squared	0.047	0.037	0.036	0.039	0.041	0.031	0.024	0.022

Note: Results based on the sample of households with electricity data and working meters. Estimates correspond to the period Jul. 2012 - Dec. 2013. Month-by-year dummy variables included. Clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

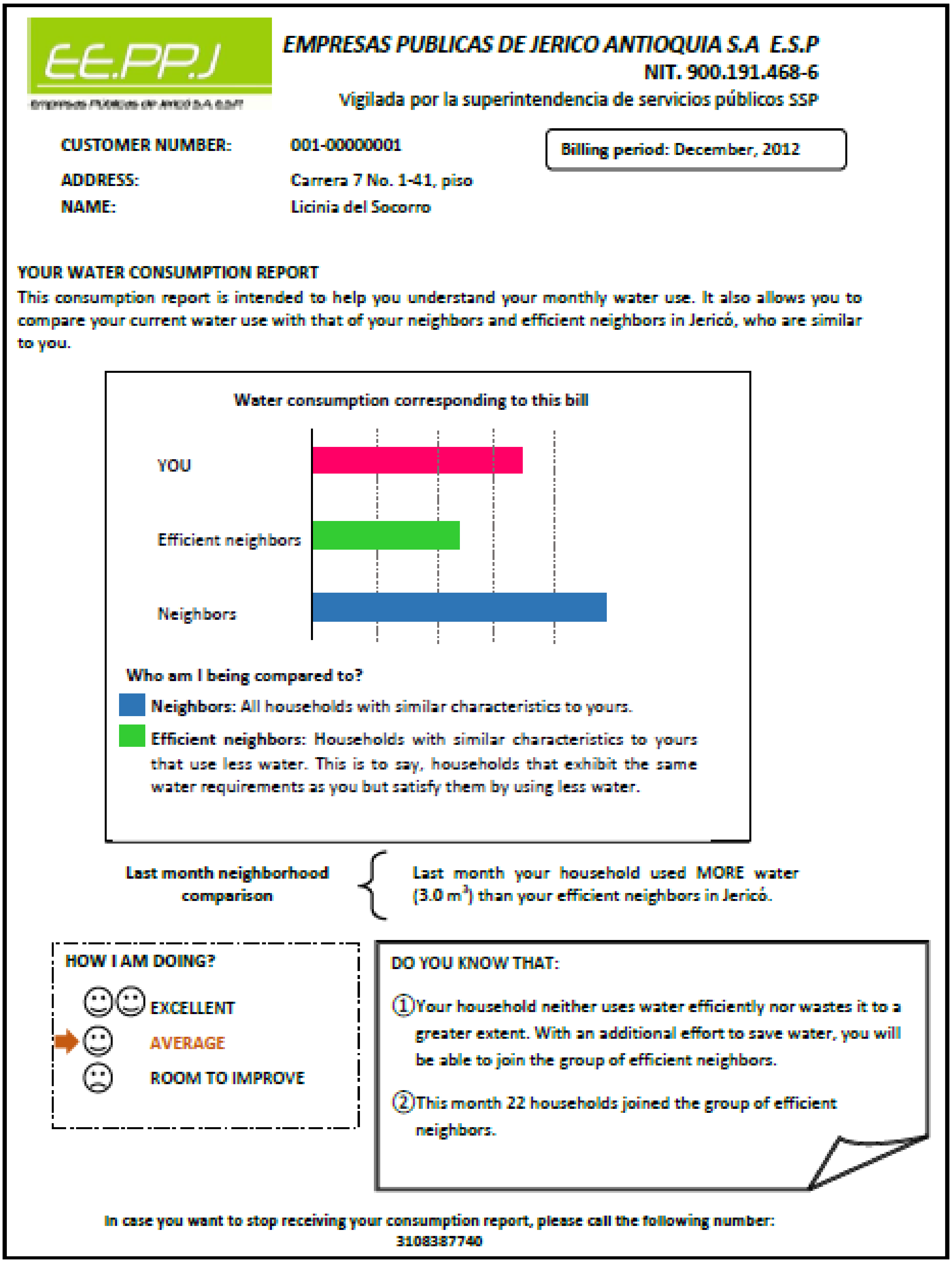
Table 5. Treatment effects on electricity use for households classified according to water use before the campaign and change in water use during campaign

	A. Households with efficient use of water ("Excellent")							
VARIABLES	*Decreased water use*				*Increased water use*			
	After 3 months	After 6 months	After 9 months	After 11 months	After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	-13.66***	-13.26***	-13.62**	-14.82**	-1.996	-2.574	-1.049	-1.032
	(4.035)	(5.022)	(5.867)	(6.031)	(3.990)	(4.480)	(4.893)	(5.184)
Post-treatment	1.575	6.607	5.347	3.689	-1.065	3.946	7.589*	2.997
	(3.499)	(4.653)	(3.739)	(3.732)	(3.579)	(4.531)	(3.969)	(3.986)
Constant	82.39***	82.53***	82.18***	82.54***	84.66***	84.81***	84.44***	84.82***
	(1.465)	(1.683)	(1.920)	(2.055)	(1.557)	(1.782)	(1.969)	(2.117)
Month-by-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	1,360	1,768	2,176	2,448	1,210	1,573	1,936	2,178
No. Households	136	136	136	136	121	121	121	121
R-squared	0.057	0.040	0.032	0.031	0.032	0.032	0.035	0.034
	B. Households with intermediate use of water ("Average")							
VARIABLES	*Decreased water use*				*Increased water use*			
	After 3 months	After 6 months	After 9 months	After 11 months	After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	0.631	0.683	-0.802	-1.619	2.085	9.990***	12.12***	11.88**
	(2.776)	(2.911)	(3.123)	(3.216)	(2.963)	(3.642)	(4.551)	(4.899)
Post-treatment	-3.943*	-3.965**	1.133	-5.690*	-1.124	-5.960***	3.993	-3.922
	(2.213)	(1.875)	(3.083)	(2.903)	(2.298)	(1.976)	(3.361)	(3.179)
Constant	95.75***	95.92***	95.51***	95.93***	97.91***	98.09***	97.66***	98.10***
	(1.229)	(1.291)	(1.382)	(1.448)	(1.406)	(1.515)	(1.718)	(1.836)
Month-by-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	2,040	2,652	3,264	3,672	1,860	2,418	2,976	3,348
No. Households	204	204	204	204	186	186	186	186
R-squared	0.031	0.030	0.029	0.028	0.022	0.026	0.029	0.025
	A. Households with inefficient use of water ("Room to improve")							
VARIABLES	*Decreased water use*				*Increased water use*			
	After 3 months	After 6 months	After 9 months	After 11 months	After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	3.388	0.831	-0.305	-0.0737	-0.297	4.258	5.048	6.506
	(3.345)	(3.195)	(3.298)	(3.393)	(4.323)	(4.135)	(4.187)	(4.383)
Post-treatment	-8.613***	-5.164**	0.0877	-4.800*	-6.469***	-7.008***	2.344	-10.10***
	(2.374)	(2.599)	(2.824)	(2.638)	(2.427)	(2.616)	(3.039)	(3.556)
Constant	119.5***	119.7***	119.2***	119.7***	118.1***	118.3***	117.8***	118.3***
	(1.295)	(1.318)	(1.389)	(1.462)	(1.522)	(1.538)	(1.601)	(1.688)
Month-by-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	2,800	3,640	4,480	5,040	2,190	2,847	3,504	3,942
No. Households	280	280	280	280	219	219	219	219
R-squared	0.031	0.030	0.025	0.028	0.017	0.020	0.019	0.020

Note: Results for the sample of households with electricity data and working meters. Estimates correspond to the period Jul. 2012 - Dec. 2013. Month-by-year dummy variables included. Clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Figures

Figure 1. Example of a consumption report



EE.PP.J

Empresas Públicas de Jericó S.A. E.S.P

EMPRESAS PUBLICAS DE JERICO ANTIOQUIA S.A E.S.P

NIT. 900.191.468-6

Vigilada por la superintendencia de servicios públicos SSP

CUSTOMER NUMBER: 001-00000001

Billing period: December, 2012

ADDRESS: Carrera 7 No. 1-41, piso

NAME: Licinia del Socorro

YOUR WATER CONSUMPTION REPORT

This consumption report is intended to help you understand your monthly water use. It also allows you to compare your current water use with that of your neighbors and efficient neighbors in Jericó, who are similar to you.

Water consumption corresponding to this bill

YOU

Efficient neighbors

Neighbors

Who am I being compared to?

Neighbors: All households with similar characteristics to yours.

Efficient neighbors: Households with similar characteristics to yours that use less water. This is to say, households that exhibit the same water requirements as you but satisfy them by using less water.

Last month neighborhood comparison

Last month your household used MORE water ($3.0\ m^3$) than your efficient neighbors in Jericó.

HOW I AM DOING?

EXCELLENT

AVERAGE

ROOM TO IMPROVE

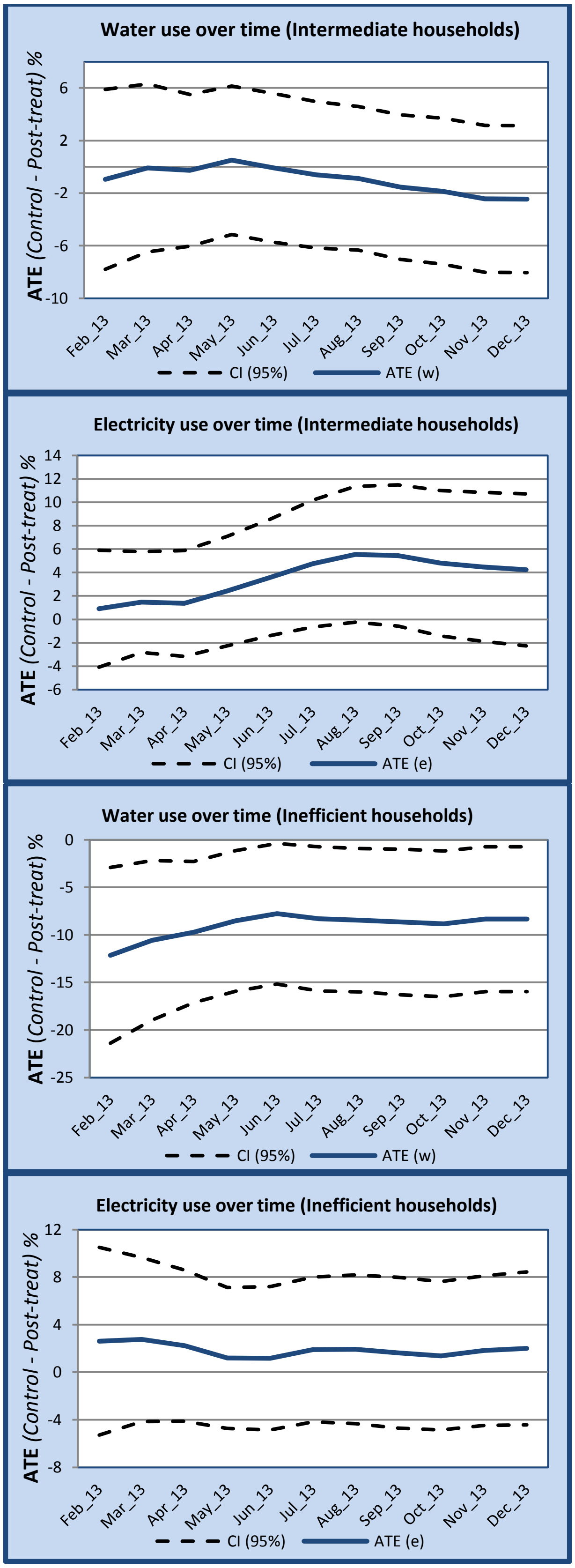
DO YOU KNOW THAT:

① Your household neither uses water efficiently nor wastes it to a greater extent. With an additional effort to save water, you will be able to join the group of efficient neighbors.

② This month 22 households joined the group of efficient neighbors.

In case you want to stop receiving your consumption report, please call the following number: 3108387740

Figure 2. Average treatment effects for water and electricity use for households classified according to water use before information campaign



Appendix.

Table A1(a). Water and electricity-saving infrastructure (Share of households)

	Treatment	Control	All
	Water-savings infrastructure		
Dual flush toilets	0.095	0.095	0.095
	(0.294)	(0.294)	(0.293)
Water-saving taps	0.072	0.084	0.078
	(0.259)	(0.278)	(0.269)
Water-saving showerheads	0.082	0.074	0.078
	(0.275)	(0.262)	(0.269)
Water-saving washing machine	0.093	0.098	0.095
	(0.290)	(0.297)	(0.293)
Rain-water collector tank	0.530	0.522	0.526
	(0.500)	(0.500)	(0.500)
	Electricity-savings infrastructure		
Other energy-saving appliances	0.097	0.108	0.102
	(0.296)	(0.311)	(0.303)
Energy-saving light bulbs	0.662	0.643	0.653
	(0.474)	(0.480)	(0.476)
No. Obs.	389	379	768

Note: Figures are based on the *ex-ante* survey and correspond to the subsample of households with working meters. Standard deviations in parentheses.

Table A1(b). Water and electricity-saving infrastructure by injunctive classification (Share of households)

	Efficient users				*Intermediate users*				*Inefficient users*			
	Control	Treatment	Norm-diff	*p*-value	Control	Treatment	Norm-diff	*p*-value	Control	Treatment	Norm-diff	*p*-value
					Water-savings infrastructure							
Dual flush toilets	0.071	0.045	-0.079	0.459	0.094	0.111	0.040	0.644	0.108	0.109	0.003	0.970
Water-saving taps	0.071	0.067	-0.011	0.918	0.063	0.059	-0.010	0.913	0.108	0.085	-0.055	0.480
Water-saving showerheads	0.071	0.079	0.019	0.858	0.086	0.081	-0.011	0.897	0.066	0.085	0.051	0.514
Water-saving washing machine	0.107	0.090	-0.041	0.705	0.086	0.126	0.091	0.295	0.102	0.067	-0.089	0.251
Rain-water collector tank	0.571	0.539	-0.045	0.673	0.461	0.496	0.050	0.568	0.545	0.552	0.009	0.904
					Electricity-savings infrastructure							
Other energy-saving appliances	0.134	0.068	-0.153	0.154	0.089	0.092	0.005	0.952	0.109	0.117	0.017	0.831
Energy-saving light bulbs	0.659	0.614	-0.066	0.546	0.602	0.664	0.091	0.303	0.667	0.687	0.031	0.693
No of obs.	84	89			128	135			167	165		

Note: Figures are based on the *ex-ante* survey and correspond to the subsample of households with continually working meters.

Table A2(a). Actions to save water and electricity (Share of households)

	Treatment	Control	All
	Water-savings actions		
Close the tap while brushing my teeth	0.951	0.971	0.961
	(0.216)	(0.168)	(0.194)
Close the tap while I soap up in the shower	0.951	0.955	0.953
	(0.216)	(0.207)	(0.212)
Close the tap while washing the dishes	0.964	0.966	0.965
	(0.187)	(0.182)	(0.184)
Close the tap while I do laundry	0.941	0.921	0.931
	(0.236)	(0.270)	(0.254)
Watering the garden and plants at night	0.411	0.435	0.423
	(0.493)	(0.496)	(0.494)
Reuse water and/or collecting rainwater	0.409	0.414	0.411
	(0.492)	(0.493)	(0.492)
Element in the toilet tank	0.092	0.133	0.112
	(0.315)	(0.340)	(0.328)
	Electricity-saving actions		
Turn off the light when leaving the room/house	0.969	0.966	0.967
	(0.173)	(0.182)	(0.178)
Turn off appliances when not being directly used	0.954	0.953	0.953
	(0.210)	(0.213)	(0.212)
Unplug appliances when not in use	0.848	0.844	0.846
	(0.359)	(0.363)	(0.361)
No. Obs.	389	379	768

Note: Figures are based on the *ex-ante* survey and correspond to the subsample of households with working meters. Standard deviations in parentheses.

Table A2(b). Actions to save water and electricity by injunctive classification (Share of households)

	Efficient users				*Intermediate users*				*Inefficient users*			
	Control	Treatment	Norm-diff	*p*-value	Control	Treatment	Norm-diff	*p*-value	Control	Treatment	Norm-diff	*p*-value
					Water-savings actions							
Close the tap while brushing my teeth	0.976	0.966	-0.042	0.700	0.969	0.948	-0.073	0.406	0.970	0.946	-0.086	0.266
Close the tap while I soap up in the shower	0.988	0.933	-0.198	0.065	0.977	0.978	0.006	0.948	0.922	0.939	0.048	0.538
Close the tap while washing the dishes	0.976	0.978	0.006	0.954	0.961	0.956	-0.019	0.828	0.964	0.964	-0.002	0.983
Close the tap while I do laundry	0.905	0.933	0.071	0.505	0.945	0.941	-0.014	0.874	0.910	0.946	0.096	0.216
Watering the garden and plants at night	0.441	0.371	-0.100	0.354	0.414	0.393	-0.031	0.724	0.449	0.449	-0.001	0.991
Reuse water and/or collecting rainwater	0.441	0.416	-0.035	0.744	0.406	0.400	-0.009	0.918	0.407	0.412	0.007	0.927
Element in the toilet tank	0.146	0.091	-0.120	0.265	0.139	0.122	-0.033	0.713	0.121	0.067	-0.129	0.096
					Electricity-saving actions							
Turn off the light when leaving the room/house	0.964	0.989	0.113	0.287	0.984	0.956	-0.119	0.175	0.952	0.970	0.064	0.410
Turn off appliances when not being directly used	0.988	0.978	-0.057	0.597	0.945	0.956	0.033	0.703	0.940	0.939	-0.002	0.978
Unplug appliances when not in use	0.857	0.876	0.040	0.711	0.867	0.837	-0.060	0.494	0.820	0.842	0.042	0.593
No of obs.	84	89			128	135			167	165		

Note: Figures are based on the *ex-ante* survey and correspond to the subsample of households with continually working meters.

Table A3. Socio-economic characteristics and attitudes and perceptions regarding water scarcity

	Efficient users	Intermediate users	Inefficient users	*p-value* (eff-int)	*p-value* (eff-ineff)	*p-value* (ineff-eff)
			Socio-economics and dwelling characteristics			
Gender [*Household head*]	0.231	0.284	0.245	0.218	0.716	0.289
	(0.423)	(0.452)	(0.431)			
Age [*Household head*]	50.38	50.70	54.08	0.843	0.014	0.011
	(16.65)	(16.33)	(15.67)			
Education [*No. years – Househ. head*]	7.83	8.29	7.99	0.312	0.727	0.440
	(4.89)	(4.47)	(4.88)			
Household size [*No. family members*]	3.34	3.33	3.31	0.956	0.857	0.891
	(1.87)	(1.82)	(1.72)			
Household income [*1000 COP/Month*]	494	520	509	0.637	0.785	0.834
	(560)	(547)	(621)			
No. rooms	7.11	7.39	7.76	0.203	0.003	0.051
	(2.31)	(2.20)	(2.37)			
House age [*No. years*]	29.90	27.53	30.68	0.138	0.617	0.019
	(16.80)	(15.98)	(16.50)			
			Motivations for saving water			
Civic duty [%]	0.243	0.236	0.235	0.865	0.843	0.982
	(0.429)	(0.424)	(0.424)			
Important [%]	0.480	0.449	0.440	0.524	0.392	0.828
	(0.500)	(0.497)	(0.496)			
Pay less [%]	0.179	0.224	0.262	0.255	0.037	0.289
	(0.384)	(0.417)	(0.440)			
Social esteem [%]	0.069	0.057	0.057	0.599	0.588	0.992
	(0.254)	(0.232)	(0.232)			
			Perceptions regarding water scarcity			
Water scarcity [*At present - %*]	0.071	0.031	0.082	0.054	0.671	0.009
	(0.258)	(0.174)	(0.274)			
Water scarcity [*Future - %*]	0.763	0.741	0.754	0.602	0.813	0.725
	(0.425)	(0.438)	(0.431)			
			Water and electricity use			
Keep track water use [%]	0.497	0.536	0.542	0.426	0.336	0.882
	(0.501)	(0.500)	(0.499)			
Keep track electricity use [%]	0.503	0.525	0.530	0.657	0.500	0.896
	(0.501)	(0.500)	(0.5000)			
Keep track water and electricity [%]	0.486	0.525	0.527	0.424	0.376	0.954
	(0.501)	(0.500)	(0.500)			
No of obs.	173	263	332			

Note: Figures are based on the *ex-ante* survey and correspond to the subsample of households with continually working meters. Standard deviations in parentheses.

Table A4. Heterogeneous treatment effects on water and electricity for households classified according to water use before information campaign; robustness check with respect to definition of efficient and inefficient households

A. Efficient water use

VARIABLES	Percentiles 30th and 70th				Percentiles 25th and 75th			
	Water use		*Electricity use*		*Water use*		*Electricity use*	
	After 6 months	After 11 months	After 6 months	After 11 months	After 6 months	After 11 months	After 6 months	After 11 months
Post × Treated	-4.278	-6.530**	-5.616*	-5.086	-5.319	-8.168**	-8.820**	-9.089*
	(2.960)	(3.047)	(3.215)	(3.809)	(3.721)	(3.724)	(4.083)	(4.612)
Post-treatment	1.927	10.47***	-4.524*	2.830	3.343	12.17***	-4.666	4.118
	(2.422)	(2.539)	(2.372)	(3.147)	(2.943)	(3.037)	(3.192)	(3.791)
Constant	50.81***	50.10***	85.75***	85.76***	47.90***	47.23***	85.22***	85.23***
	(1.469)	(1.515)	(1.278)	(1.652)	(1.790)	(1.841)	(1.475)	(1.837)
No. Obs.	3,042	4,212	3,042	4,212	2,249	3,114	2,249	3,114
No. Households	234	234	234	234	173	173	173	173
R-squared	0.037	0.038	0.028	0.020	0.037	0.039	0.031	0.022

Panel B. Inefficient water use

VARIABLES	Percentiles 30th and 70th				Percentiles 25th and 75th			
	Water use		*Electricity use*		*Water use*		*Electricity use*	
	After 6 months	After 11 months	After 6 months	After 11 months	After 6 months	After 11 months	After 6 months	After 11 months
Post × Treated	-11.55**	-12.01***	2.076	2.082	-13.42**	-14.27***	1.207	1.433
	(4.495)	(4.576)	(3.525)	(3.735)	(5.232)	(5.221)	(4.016)	(4.273)
Post-treatment	-53.45***	-40.87***	-6.747**	-11.92***	-57.83***	-44.87***	-6.297**	-12.05***
	(4.439)	(4.188)	(2.904)	(3.635)	(5.179)	(4.908)	(3.170)	(4.161)
Constant	199.3***	196.5***	126.1***	126.1***	211.9***	209.0***	129.9***	129.9***
	(2.896)	(2.976)	(1.419)	(1.593)	(3.341)	(3.411)	(1.577)	(1.773)
No. Obs.	3,445	4,770	3,445	4,770	2,834	3,924	2,834	3,924
No. Households	265	265	265	265	218	218	218	218
R-squared	0.129	0.102	0.032	0.028	0.147	0.120	0.035	0.030

Note: Results for the subsample of households whose meters worked throughout the study period. Estimates correspond to the period Jul. 2012 - Dec. 2013. Month-by-year dummy variables included. Clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A5. Homogeneous treatment effects on water and electricity use

	Water use				*Electricity use*			
VARIABLES	After 3 months	After 6 months	After 9 months	After 11 months	After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	-5.694***	-4.898**	-5.914***	-6.157***	-0.613	0.446	0.329	0.264
	(2.172)	(2.105)	(2.188)	(2.187)	(1.751)	(1.903)	(1.972)	(2.072)
Post-treatment	-0.110	-15.09***	-17.81***	-15.13***	-4.316***	0.479	2.368	-5.519***
	(2.121)	(2.204)	(2.118)	(1.895)	(1.465)	(1.914)	(1.848)	(1.844)
Constant	118.7***	119.9***	118.5***	118.2***	103.4***	103.5***	103.1***	103.6***
	(2.614)	(2.695)	(2.598)	(2.639)	(2.209)	(2.192)	(2.287)	(2.168)
No. Obs.	7,680	9,984	12,288	13,824	7,680	9,984	12,288	13,824
No. Households	768	768	768	768	768	768	768	768
R-squared	0.073	0.060	0.050	0.046	0.022	0.019	0.016	0.015

Note: Results for the subsample of households whose meters worked throughout the study period. Estimates correspond to the period Jul. 2012 - Dec. 2013. Month-by-year dummy variables included. Bootstrapped standard errors in parentheses (Replications = 1000). *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A6. Treatment effects on water use and electricity use for households classified according to water use before information campaign

	A. Households with inefficient use of water ("Room to improve")							
VARIABLES	*Water use*				*Electricity use*			
	After 3 months	After 6 months	After 9 months	After 11 months	After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	-9.708**	-8.318**	-8.836**	-8.349**	2.227	1.911	1.382	2.000
	(3.858)	(3.866)	(3.909)	(3.782)	(3.360)	(3.120)	(3.228)	(3.282)
Post-treatment	-12.47***	-33.34***	-41.43***	-35.53***	-7.679***	-2.504	0.930	-10.52***
	(3.918)	(4.160)	(3.749)	(3.473)	(2.443)	(2.820)	(2.750)	(3.201)
Constant	178.9***	180.6***	178.5***	178.1***	119.2***	119.4***	118.9***	119.4***
	(3.778)	(3.695)	(3.919)	(3.761)	(3.896)	(3.736)	(3.778)	(3.874)
No. Obs.	3,320	4,316	5,312	5,976	3,320	4,316	5,312	5,976
No. Households	332	332	332	332	332	332	332	332
R-squared	0.141	0.113	0.095	0.088	0.028	0.027	0.023	0.024

	B. Households with intermediate use of water ("Average")							
VARIABLES	*Water use*				*Electricity use*			
	After 3 months	After 6 months	After 9 months	After 11 months	After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	-0.272	-0.604	-1.855	-2.452	1.363	4.760*	4.792	4.230
	(2.815)	(2.840)	(2.786)	(2.858)	(2.330)	(2.753)	(3.141)	(3.288)
Post-treatment	4.643*	-8.917***	-8.009***	-7.179***	-2.842	0.322	1.428	-5.508*
	(2.749)	(2.558)	(2.503)	(2.091)	(2.084)	(3.296)	(3.105)	(2.896)
Constant	89.68***	90.54***	89.48***	89.28***	95.42***	95.58***	95.17***	95.59***
	(1.926)	(1.947)	(1.888)	(2.033)	(3.084)	(3.170)	(3.268)	(3.170)
No. Obs.	2,630	3,419	4,208	4,734	2,630	3,419	4,208	4,734
No. Households	263	263	263	263	263	263	263	263
R-squared	0.058	0.049	0.041	0.038	0.025	0.021	0.018	0.016

	C. Households with efficient use of water ("Excellent")							
VARIABLES	*Water use*				*Electricity use*			
	After 3 months	After 6 months	After 9 months	After 11 months	After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	-6.631	-5.319	-7.017*	-8.168**	-8.811**	-8.820**	-8.395*	-9.089**
	(4.076)	(3.810)	(3.680)	(3.725)	(3.510)	(4.116)	(4.445)	(4.573)
Post-treatment	16.46***	10.66***	12.80***	12.17***	-0.135	6.446	6.561*	4.118
	(3.348)	(3.317)	(3.790)	(3.081)	(3.301)	(4.211)	(3.752)	(3.652)
Constant	47.45***	47.90***	47.34***	47.23***	85.07***	85.22***	84.85***	85.23***
	(1.784)	(1.806)	(1.767)	(1.788)	(4.036)	(4.115)	(4.105)	(4.106)
No. Obs.	1,730	2,249	2,768	3,114	1,730	2,249	2,768	3,114
No. Households	173	173	173	173	173	173	173	173
R-squared	0.047	0.037	0.036	0.039	0.041	0.031	0.024	0.022

Note: Results for the sample of households with electricity data and working meters. Estimates correspond to the period Jul. 2012 - Dec. 2013. Month-by-year dummy variables included. Bootstrapped standard errors in parentheses (Replications = 1000). *** p<0.01, ** p<0.05, * p<0.1

Table A7. Treatment effects on electricity use for households classified according to water use before the campaign and change in water use during campaign

VARIABLES	After 3 months	After 6 months	After 9 months	After 11 months	After 3 months	After 6 months	After 9 months	After 11 months
	A. Households with efficient use of water ("Excellent")							
	Decreased water use				*Increased water use*			
Post × Treated	-13.66***	-13.26***	-13.62**	-14.82**	-1.996	-2.574	-1.049	-1.032
	(3.998)	(4.924)	(5.768)	(6.109)	(3.862)	(4.507)	(4.837)	(5.128)
Post-treatment	1.575	6.607	5.347	4.429	-1.065	3.946	7.589*	4.621
	(3.484)	(4.598)	(3.747)	(3.960)	(3.497)	(4.379)	(3.956)	(4.069)
Constant	82.39***	82.53***	82.18***	82.54***	84.66***	84.81***	84.44***	84.82***
	(4.530)	(4.377)	(4.378)	(4.366)	(5.167)	(5.040)	(5.181)	(5.073)
Month-by-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	1,360	1,768	2,176	2,448	1,210	1,573	1,936	2,178
No. Households	136	136	136	136	121	121	121	121
R-squared	0.057	0.040	0.032	0.031	0.032	0.032	0.035	0.034
	B. Households with intermediate use of water ("Average")							
	Decreased water use				*Increased water use*			
VARIABLES	After 3 months	After 6 months	After 9 months	After 11 months	After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	0.631	0.683	-0.802	-1.619	2.085	9.990***	12.12***	11.88**
	(2.711)	(2.982)	(3.207)	(3.150)	(2.982)	(3.589)	(4.472)	(4.768)
Post-treatment	-3.943*	-3.580	1.133	-5.690**	-1.124	2.947	3.993	-3.922
	(2.182)	(2.944)	(3.088)	(2.889)	(2.331)	(3.865)	(3.429)	(3.121)
Constant	95.75***	95.92***	95.51***	95.93***	97.91***	98.09***	97.66***	98.10***
	(3.519)	(3.573)	(3.469)	(3.640)	(3.700)	(3.880)	(3.827)	(3.973)
Month-by-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	2,040	2,652	3,264	3,672	1,860	2,418	2,976	3,348
No. Households	204	204	204	204	186	186	186	186
R-squared	0.031	0.030	0.029	0.028	0.022	0.026	0.029	0.025
	A. Households with inefficient use of water ("Room to improve")							
	Decreased water use				*Increased water use*			
VARIABLES	After 3 months	After 6 months	After 9 months	After 11 months	After 3 months	After 6 months	After 9 months	After 11 months
Post × Treated	3.388	0.831	-0.305	-0.0737	-0.297	4.258	5.048	6.506
	(3.287)	(3.278)	(3.325)	(3.402)	(4.447)	(4.182)	(4.278)	(4.418)
Post-treatment	-8.613***	-4.038	0.0877	-11.68***	-6.469***	-2.353	2.344	-10.10***
	(2.341)	(2.824)	(2.804)	(3.186)	(2.454)	(3.003)	(2.972)	(3.511)
Constant	119.5***	119.7***	119.2***	119.7***	118.1***	118.3***	117.8***	118.3***
	(4.282)	(4.418)	(4.173)	(4.291)	(4.464)	(4.377)	(4.474)	(4.291)
Month-by-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	2,800	3,640	4,480	5,040	2,190	2,847	3,504	3,942
No. Households	280	280	280	280	219	219	219	219
R-squared	0.031	0.030	0.025	0.028	0.017	0.020	0.019	0.020

Note: Results for the sample of households with electricity data and working meters. Estimates correspond to the period Jul. 2012 - Dec. 2013. Month-by-year dummy variables included. Bootstrapped standard errors in parentheses (Replications = 1000). *** $p<0.01$, ** $p<0.05$, * $p<0.1$