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Heterogeneous treatment effects and mechanisms in information-based environmental policies: Evidence from a large-scale field experiment☆

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ABSTRACT

Policymakers often rely on non-pecuniary, information-based programs to achieve social objectives. Using data from a water conservation information campaign implemented as a randomized controlled trial, we estimate heterogeneous household responses. Understanding such heterogeneity is important for improving the cost-effectiveness of non-pecuniary programs, extending them to other populations and probing the mechanisms through which the treatment effects arise. We find little evidence of heterogeneous responses to purely technical information or to traditional conservation messages that combine technical information and moral suasion. In contrast, norm-based messages that combine technical information, moral suasion and social comparisons exhibit strong heterogeneity: households that are wealthier, owner-occupied and use more water are more responsive. These subgroups tend to be least responsive to pecuniary incentives. We find no evidence that any subgroup increases their water use in response to the messages. By targeting the messages to subgroups known to be most

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responsive, program costs could be reduced by over 50% with only a 20% reduction in the treatment effect. Combining theory and data, we also shed light on the mechanisms through which the treatment effects arise, which has implications for program design and future research on the program's welfare effects.

1. Introduction

Non-pecuniary, information-based environmental policy strategies have long been used to influence individual decision-making (e.g., Smith et al., 1990; Smith and Desvousges, 1990) and are growing in popularity in all social policy fields (Thaler and Sustein, 2008; House of Lords, 2011). Such strategies include norm-based persuasive messages, commitment devices, changes to default options and the provision of technical information to lower transaction costs of information acquisition. Under standard economic assumptions of perfectly informed, rational, self-interested agents, these strategies should be ineffective. However, under behavioral theories that include other-regarding preferences or bounded rationality, they may be effective. A growing empirical literature in economics and psychology suggests that such strategies can indeed affect policy-relevant behaviors (e.g., Bui and Mayer, 2003; Duflo and Saez, 2003; Jin and Leslie, 2003; Bjørner et al., 2004; Schultz et al., 2007; Goldstein et al., 2008; Bennear and Olmstead, 2008; Allcott and Mullainathan, 2010a,b; Habyarimana and Jack, 2011).

In the context of environmental policies and programs, the conceptual and empirical foundations of such strategies remain under-researched (Shogren and Taylor, 2008). A new literature uses randomized controlled trials, which are rare in environmental economics (Greenstone and Gayer, 2009), to test the impacts of non-pecuniary, norm-based messages on environmental outcomes such as energy use (e.g., Ayres et al., 2009; Yoeli, 2009; Allcott, 2012; Costa and Kahn, 2013) and water use (e.g., Ferraro and Price, 2013; Ferraro et al., 2011). These studies find that sending pro-social messages and social comparisons that contrast own consumption to peer-group consumption can reduce, on average, water and energy consumption. Moving beyond estimating average effects, however, is important. Ideally, one would want to also understand the heterogeneity of responses across households (i.e., which subgroups are most responsive) and the mechanisms through which the messages affect behavior.

Understanding the heterogeneous treatment effects of information-based programs yields at least three policy and research-relevant insights. First, policy makers can use this information to more cost-effectively target the treatments to subgroups that are most responsive (Heckman et al., 1997; Djebbari and Smith, 2008). By targeting the subgroups that are most responsive, policy makers avoid wasting money (and political capital) sending information to non-responsive subgroups or subgroups that may react in ways contrary to the policy objective. This tailoring of messages to specific subgroups also helps avoid information overload that can affect decision-making as these information-based approaches grow in scope.[1] Second, understanding heterogeneous responses helps strengthen the generalizability and external validity of randomized controlled trials to different target populations (Angrist, 2004; Manski, 2004; Hotz et al., 2005; Allcott and Mullainathan, 2010a,b; Imai and Ratkovic, 2013). The mean effects of the same experimental design could be different when applied in other populations with different distributions of observable characteristics. Third, by combining theory and information on heterogeneous response, one can explore potential mechanisms through which the causal effects are generated. As Deaton (2010) noted in his critique of the way in which randomized controlled trials are done in economics, we need to move from determining *whether* a treatment is effective to determining

[1] We thank Associate Editor McKee for pointing this out.