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Analysis

Does environmental concern change the tragedy of the commons? Factors affecting energy saving behaviors and electricity usage

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ABSTRACT

Electricity consumption produces private goods, such as heat for homes, but fossil fuel consumption impacts the public goods of clean air and water. While self interests can increase usage, social interests, such as global climate change, can impact an individual's attitude toward energy consumption. This paper examines the tragedy of the commons using household data, and compares the impact of self and social interests in predicting electricity consumption. Using both stated and observed behavioral data, the results show that self interests have a greater impact on energy saving behaviors and electricity use. We extend the analysis to control for an individual's environmental concern and perceived behavioral impact, finding similar results, and supporting the notion that the tragedy of the commons occurs regardless of a person's perception or environmental concern. These findings may explain why pro-environmental attitudes do not necessarily lead to pro-environmental behaviors, and it contributes to our understanding of the motivating factors for energy savings and electricity use by examining both stated and observed behaviors. Policies aimed at electricity reduction may have a greater impact if they focus on private interests, such as pricing, rebates, subsidies, and taxes, rather than social interests alone.

1. Introduction

A large body of environmental literature has emerged examining the factors that impact an individual's energy saving behaviors and electricity use. Several studies find that environmental concern motivates energy saving behaviors (Ek and Söderholm, 2010; Sardianou, 2007; Lindén et al., 2006; Viklund, 2004; Brandon and Lewis, 1999). Gadenne et al. (2011) find that environmental beliefs and attitudes influence energy saving behavior, and Kotchen and Moore (2007) reports that environmental concern and altruism shape an individual's behavior regarding the provision of public goods, such as green electricity.

On the other hand, several studies have found evidence that pro-environmental attitudes do not necessarily lead to pro-environmental behaviors in regards to energy conservation. For example, Wang et al. (2011) find no evidence that environmental awareness induces energy saving behaviors, but perceived inconvenience does from households in Beijing. Holden and Linnerud (2010) demonstrate that despite having positive environmental attitudes, households in Norway do not always use less energy. Finally, Gaspar and Antunes (2011) find that environmental attitude is negatively correlated with consumers choosing an appliance based on energy consumption or that the appliance is energy efficient, contrary to intuition.[1]

In this paper, we contribute to the literature on energy saving behaviors and energy use by examining stated and observed behaviors in the context of self and social interests. Self-interests are motivated by the production and consumption of private goods, such as concern over comfort or electricity costs. Social interests are motivated by common and public goods, such as clean air and climate change mitigation.

The distinction between self and social interests explains why individuals with pro-environmental attitudes may not exhibit pro-environmental behaviors. The consumer's interest of energy consumption can be motivated by both self and social interests: decreasing energy use to reduce monthly bills and/or decreasing energy use to protect the planet, reduce pollution, or lessen other negative externalities. Due to the tragedy of the commons, individuals will fail to reduce electricity use to the socially efficient level because the costs are paid by the individual but the social benefits of energy reduction accrue to everyone. By focusing on the self and social interests in electricity use, we can examine the hypothesis that providing a public good, such as improved environmental quality, does not significantly motivate people to reduce electricity or exhibit energy saving behaviors.

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[1] Gaspar and Antunes (2011) use an index for environmental attitude based on several statements that are public good oriented such as reducing energy and water consumption but covers several public goods.

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Self and social interests have been studied in the environmental literature through behaviors surrounding farming practices, electricity use, and long distance travel, among others. Most applicable to our research, Chouinard et al. (2008) examine the potential for self and social interests to impact stewardly farming practices. Mzoughi (2011) also finds that social and moral concerns impact the likelihood a farmer adopts organic farming practices. In regards to energy use, Wang et al. (2011) find that self-interest and economic factors can alter the impact that environmental attitudes have on behavior. Ek and Söderholm (2010) report that most Swiss electricity customers find it difficult to develop behaviors in everyday life that reduce electricity use. Holden and Linnerud (2010) show that self-interest prevents people from reducing energy use in long distance leisure travel, despite having positive environmental attitudes. Martinsson et al. (2011) show that socio-economic characteristics have a greater impact on energy saving behaviors than environmental attitude. Finally, Sauer and Fischer (2010) highlight the notion that there is a trade-off between values. Individuals can make a decision in their self-interest, social-interest, or some combination.

Using survey data from a major midwest electric utility, we formally test for the impact of self and social interests on observed energy use. Two econometric models are presented. A probit model is used to predict stated energy saving behaviors, such as turning down the heat and unplugging charged batteries.[2] A log–log model of annual electricity usage is used to examine observed household electricity use. Both models control for socio-demographic items (gender, ethnicity, education, employment status, age, income) and household characteristics (homeownership, number of individuals in the household, years in the house, housing geography). The electricity usage model also controls for dwelling characteristics (size of house, primary heating fuel, use of central AC and/or furnace). The survey respondents answer several questions regarding typical energy saving behaviors and attitudes toward energy use and the environment. We categorize these attitudes into private and social interests. The results fail to find evidence to suggest that social interests significantly impact stated energy saving behaviors or observed electricity use. Self interests have a much greater impact on the likelihood an individual uses a power-strip, unplugs charged appliances, and lowers the water heater temperature.

We contribute to the environmental literature by extending the analysis in two important ways. First, we consider the effect of an individual's perceived behavioral impact (PBI) and environmental concern on their self and social interests. PBI captures whether they believe their behaviors significantly change the environment or their energy bills. Holden and Linnerud (2010) demonstrate that if individuals do not perceive their behavior as having any impact, then they do not use less energy, even with positive environmental attitudes. Other studies support the notion that PBI can alter an individual's energy saving behavior (Abrahamse and Steg, 2009; Gadenne et al., 2011). Our results show that individuals with a strong PBI are not motivated differently than individuals with a weak PBI. Furthermore, when examining respondents with a strong PBI, we find some evidence that a strong social interest to limit electricity use leads to a greater use of electricity. This suggests that participants in this survey may be experiencing moral self-licensing or the rebound effect. This result supports Holden and Linnerud (2010), who show that individuals who are concerned about the appearance of projecting an environmentally friendly image do not use less energy in the home than their less friendly counterparts.

In considering the impact of environmental concern, Abrahamse and Steg (2009) note that awarenesss of environmental consequence and ascription of responsibility contributes to energy saving behaviors. Gadenne et al. (2011) show that awareness of environmental problems together with social norms and community influence is associated with pro-environmental behaviors.[3] Our results report that despite a concern for global climate change, individuals are not significantly motivated by social-interest factors to reduce electricity use.

These findings suggest that energy policies will have a greater impact if they motivate self interests rather than social interests. Self interest policies, such as increasing retail electricity rates or offering appliance rebates, may encourage more energy conservation than policies aimed to increase social responsibility and environmental concern. For example, a policy that demonstrates to individuals ways to reduce their electricity bill would focus on the customer's self interests, whereas a policy that educates individuals on the social costs of climate change focuses on social interests.

A second contribution of the paper pertains to the estimation of electricity usage and income elasticities. We provide an estimation of income elasticities when only categorical incomes are provided by survey respondents. Following Hsiao and Mountain (1985), we estimate income as a function of the individual's characteristics. These estimates are then used in the demand estimation to calculate income elasticities over varying income levels. The results suggest that as income increases, income elasticities grow in magnitude.

The paper proceeds with a discussion of the data and econometric models for energy saving behaviors and for electricity use in Section 2. We describe the survey, socio-demographic characteristics of the participants, and the questions that elicit self and social interests. Section 3 presents results for the probit and OLS models. Section 4 concludes.

Table 1
Comparison of survey respondents to residential customers.

Usage	Percent of customers	Percent of survey respondents
Up to 7,000 kWh	21.4%	14.29%
7001–10,000 kWh	18.1%	12.70%
10,001–14,000 kWh	21.5%	29.58%
14,001–20,000 kWh	19.1%	14.00%
Above 20,000 kWh	19.9%	29.29%

2. Data and Econometric Models

In 2009, AmerenUE, a large midwest electric utility in Missouri, implemented a study on the interest in residential energy efficiency rebates. The survey collected household data on general attitudes about energy use, energy efficiency, environmental concerns, saving money, and comfort, as well as customer demographics, household and home characteristics, heating, cooling, and water heating equipment. The survey respondents were then matched with their household electricity use.

Thirty-three thousand customers were surveyed with a response rate of 3.4%.[4] In order to qualify for the survey, respondents must have primary or shared responsibility for making energy-related decisions, be at least 18 years old, and must not have worked for an electric utility company. Customers were sent a postcard using the address from the AmerenUE billing database. The postcard with a unique code invited

[2] Ek and Söderholm (2010) also use a probit model to examine the impact of environmental concern on behaviors such as using energy efficient light bulbs, lowering the indoor temperature 1 °C, and reducing the maximum temperature of hot water heaters.

[3] Gadenne et al. (2011) terms the awareness of environmental problems as intrinsic and extrinsic environmental drivers.

[4] One thousand one hundred twenty-two surveys were completed online and four were collected from the paper version. We note the small response rate is likely due to a lack of follow-up postcards. AmerenUE's target was to collect 1000 completed surveys, and thus did not follow-up with additional requests. Thus, survey respondents are likely somewhat biased toward a sample of individuals that are more concerned about energy efficiency issues. This strengthens our results that environmental concern has little impact on the tragedy of the commons. On the other hand, the monetary incentive may bias the sample in the opposite direction, inviting participants that are more concerned with pecuniary or self interests. The low response rate suggests that readers should proceed with caution in drawing general conclusions from the sample.