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Consumer inattention and the demand for vehicle fuel cost savings

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ABSTRACT

Consumer undervaluation of energy cost savings is a common explanation for the energy efficiency gap, where markets fail to adopt fuel-saving technologies even though the value of the savings exceeds the costs. This paper presents empirical evidence on the relationship between a possible cause of empirical studies finding undervaluation – consumer inattention – and the demand for fuel cost savings in automobiles. Using survey data on respondents' attention to automobile fuel costs, attribute preferences, and discrete choice experiments, I find heterogeneity in inattention toward and willingness to pay for fuel cost savings. Estimates from discrete choice models suggest that inattentive consumers make choices as if they undervalue fuel cost savings and attentive consumers make choices as if they fully value these savings. The data show that respondent-specific characteristics that influence fuel costs, such as vehicle miles traveled, partly explain the degree of inattention, a finding that is consistent with models of rational inattention. The results imply that designing energy efficiency policies requires careful consideration of consumer inattention.

1. Introduction

How markets value energy efficiency is crucial for evaluating the costs and benefits of energy policies. In markets without economic distortions, the price of greater energy efficiency reflects its benefits: reductions in energy costs are capitalized in higher purchase prices. In this setting, imposing binding energy efficiency programs reduces private welfare. With distortions, however, markets may undervalue energy efficiency, which has become known as the "energy paradox" or the "energy efficiency gap." For certain market distortions, imposing binding energy efficiency programs can increase private welfare.[1] These gains can dominate costs, a possibility that promotes aggressive policies. Government analyses of recent federal energy efficiency policies, including regulations for new light-, medium-, and heavy-duty vehicles, find this result, implying that the regulations benefit consumers without considering external costs and benefits (NHTSA, 2012, 2016).

A substantial body of empirical evidence for a gap is in the form of consumer undervaluation of fuel cost savings in automobiles.[2] The evidence compares willingness to pay (WTP) for fuel cost savings and the lifetime value of the associated savings. Estimates of WTP that fall below the lifetime value suggest undervaluation. Recent economics literature has found conflicting evidence for undervaluation. Busse et al. (2013) and Sallee et al. (2016) identify WTP for fuel cost savings in new and used automobiles using

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[1] See Allcott and Greenstone (2012) for an overview of this subject.

[2] Other evidence not on automobiles includes estimates of consumer demand for energy cost savings in appliances, e.g., McFadden (1974) and Houde (2014). These studies find that buyers make choices that imply discount rates above average loan rates, implying undervaluation of energy cost savings.

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gasoline price variation and find that consumers fully value fuel cost savings. Allcott and Wozny (2014) find undervaluation, where consumers are willing to pay 76 cents for one dollar of fuel cost savings.[3] Grigolon et al. (2018) use fuel price variation in Europe and find modest undervaluation. Leard et al. (2017) identify how consumers value increases in fuel economy using variation in fuel-saving technology adoption caused by tightening fuel economy standards. Their estimates imply that consumers are willing to pay 52 cents for one dollar of fuel cost savings, suggesting undervaluation.

The conflicting evidence motivates an examination of underlying reasons why consumers may undervalue fuel cost savings. The literature provides several causes of a gap, including loss aversion (Greene, 2011; Greene et al., 2013), principal-agent issues (Davis, 2012), credit constraints (Golove and Eto, 1996), hyperbolic discounting (Heutel, 2015), self-control problems (Tsvetanov and Segerson, 2013), and consumer inattention (Allcott, 2011; Sallee, 2014; Turrentine and Kurani, 2007). Hardly any research tests these explanations with data. One exception is Bradford et al. (2014), who find a positive correlation between hyperbolic discounting and low demand for energy-efficient products.

I add to this literature by analyzing new survey data on consumer inattention and discrete choice experiments involving the purchase of a new vehicle.[4] Based on the discrete choice experiment data, I estimate random utility model preference parameters for vehicle price, fuel costs, and other attributes and use the estimated parameters to infer an implied willingness to pay for fuel cost savings. I then correlate respondent stated attention to fuel costs during their prior vehicle purchase to their valuation coefficient implied by their responses in the discrete choice experiments. This approach is related to an existing literature on the relationship between stated attention and implied WTP elicited from discrete choice experiments. Balcombe et al. (2015) find that stated attention diverges sharply from visual attention recorded from eye-tracking, but that stated attention is useful for incorporating into utility function estimation. I leverage this insight by estimating utility parameters as functions of stated attention. Another relevant paper in this literature is Cameron and DeShazo (2010), which provides a theoretical framework for how inattention to attributes may bias WTP toward zero and presents empirical evidence on the magnitude of this bias. While the survey data in the current paper are not rich enough to estimate how WTP may change if inattentive respondents become attentive, the data can reveal how estimated WTP for certain attributes are related to inattention. This is useful for understanding the role that inattention may play in empirical findings on the energy efficiency gap.

Based on the estimated coefficient estimates from the random utility models, I find that the average respondent undervalues fuel cost savings: he or she is willing to pay 45 cents to reduce present value lifetime fuel costs by one dollar. I find, however, that willingness to pay is strongly correlated with stated attention to fuel costs. Inattentive respondents make experimental choices as if they undervalue fuel costs, while attentive respondents make choices as if they fully value fuel costs.

This evidence suggests that the level of inattention may explain estimated undervaluation. The survey data also include information about factors influencing respondent-specific fuel costs, such as annual vehicle miles traveled. I find that these factors are correlated with the level of attention toward fuel costs, suggesting that the degree of inattention is a rational decision. Together these results motivate careful consideration of consumer inattention in the design of policies aiming to reduce fuel consumption from light-duty vehicles.

2. Evidence on the relationship between inattention and demand for fuel cost savings

2.1. Data

To analyze the relationship between consumer inattention and demand for energy efficiency, I leverage data from a Qualtrics survey administered during September and October 2014. The intent of the survey was to elicit willingness to pay for vehicle attributes including fuel costs, alternative levels of automation, and driving range and to analyze how the demand for these attributes varies by observed respondent characteristics. The survey asked respondents a series of questions about vehicle ownership, demographics, and preferences for vehicle attributes. The original sample included 1226 responses. After cleaning the data by dropping observations with missing responses to demographics and relevant preference questions, 1125 usable responses remain.[5]

Table 1 provides summary statistics of the sample. Based on observed household characteristics, the sample represents the entire U.S. population based on observed demographics.[6] Mean and median household incomes are $61,780 and $55,000, respectively, which are similar to estimates from the 2013 American Community Survey.[7] The sample's fraction of married adults is close to the U.S. marriage rate of around 50 percent. The unemployment rate of 5.15 percent is lower than but close to the reported national unemployment rate for September 2014 of 5.9 percent.[8]

The survey asked respondents to report information on the vehicle used most often by the respondent, including model year, make, model, series, and fuel type. I merge vehicle characteristics such as horsepower, weight, and city/highway fuel economy using

[3] This estimate is derived from the assumption that consumers form expectations of future fuel prices based on crude oil futures prices. The other two methods that they use, including a random walk and survey-based expectations, yield lower willingness to pay.

[4] Unfortunately, these data do not include questions that can be used to test other possible causes of undervaluation. I leave testing other causes for future research.

[5] I drop households that do not report demographic information including education level, gender, age, income, political affiliation, employment status, and state. I also drop households that do not report a response to Question 9 of the survey (see text).

[6] The original design of the survey was meant to represent the U.S. population of driver's license holders.

[7] source: http://www.census.gov/content/dam/Census/library/publications/2014/acs/acsbr13-02.pdf.

[8] source: http://data.bls.gov/timeseries/LNS14000000.