Journal of Environmental Economics and Management 92 (2018) 194–221

Contents lists available at ScienceDirect

Journal of Environmental Economics and Management

journal homepage: www.elsevier.com/locate/jeem

Flexible fuel vehicles, less flexible minded consumers: Price information experiments at the pump☆

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ARTICLE INFO

Article history:
Received 3 November 2017
Revised 1 June 2018
Accepted 28 August 2018
Available online 24 September 2018

JEL classification:
D12
D83
L62
L71
M38
Q21
Q42
Q48

Keywords:
Product differentiation
Limited information
Limited attention
Price comparisons
Information disclosure
Gasoline
Alternative fuels
Biofuels
Flexible fuel vehicles
Discrete-choice models

ABSTRACT

Among Brazil's gasoline-ethanol vehicle users, it is common to observe the purchase of the fuel that yields the less miles per dollar of spending. In a large-scale set of experiments with 10,400 subjects, I inform energy consumers at the pump of the effective price difference across fuels. The largest treatment effect finds one-tenth of consumers, who absent the intervention would have chosen expensive gasoline, instead choosing cheaper ethanol. This shift is small compared with the higher likelihood that the cheaper fuel is chosen among college-educated relative to less schooled subjects. I estimate the consumer welfare gain from providing accessible price comparisons to be equivalent to a 1–3% general reduction in fuel prices, depending on the relative price point.

☆ I gratefully acknowledge João Alberto Abreu, Marcos Lutz, Carlos Resende and, in particular, Fábio Henkes, from Raízen (Shell-Cosan), as well as their numerous sales executives, for arranging access to fueling stations operating under the firm's brands, and their customers. I acknowledge comments from Hunt Allcott, Alcir Bandeira, Angela Lee, Teresa Meirelles, Luiz Perez, Florian Zettelmeyer, and audiences at the American Economic Association meeting, Energy Camp at UC Berkeley, Frontiers of Behavioral Economics (USC/NUS), and NUS. I am grateful to David Austen-Smith at the Dean's Office, Kellogg School of Management for partly supporting the field experiments. I thank Elizabeth Lehman, Fernando Luco and Guillermo Marshall for excellent research assistance. Northwestern University's Institutional Review Board determined that this study qualified for Exemption under 45 CFR 46.101(b). The data and code replicating all of the results in this article will be posted at https://goo.gl/CJQiVL.

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https://doi.org/10.1016/j.jeem.2018.08.016
0095-0696/

1. Introduction

Several policies to displace consumption of gasoline and diesel, the standard road vehicle fuels worldwide, emphasize the supply side, seeking to raise the distribution of alternative power sources and vehicles. A prominent example is given by the Corporate Average Fuel Economy regulations in the United States, by which the sale of bi-fuel gasoline-ethanol vehicles—known as "flexible fuel vehicles"—helps carmakers meet their average fleet mileage standards irrespective of whether these vehicles end up utilizing the alternative fuel during their lifetime (Anderson and Sallee, 2011). A common assumption on the demand side is that consumers will view alternative energies as close substitutes to gasoline, each product offering homogeneous vehicle miles traveled. By this assumption, consumers will be quick and eager to adopt the alternative energy and vehicle when this alternative reaches the market at a monetary price per mile traveled that is similar to that offered by gasoline (Holland et al., 2009; Salvo and Huse, 2010).

In a unique market setting where a majority share of car owners already enjoy an established alternative to gasoline when they shop for fuel, Salvo and Huse (2013) showed that Brazil's consumers substitute between gasoline and sugarcane ethanol over a very wide range of relative price variation. From a sample of 2160 bi-fuel vehicle motorists making choices at the pump, Salvo and Huse found that when gasoline was priced 20% above ethanol in $/mile,[1] about 20% of consumers chose gasoline. Ethanol was not only available at the station, it was typically only one nozzle away from gasoline at the same pump. Similarly, when ethanol was priced 20% above gasoline, 20% of consumers chose ethanol.[2] Examining substitution between gasoline and corn ethanol in the US midwest, Anderson (2012) similarly identified households who were paying a premium for ethanol.

Such findings matter for policy design. It may be difficult to find an alternative as close to gasoline as ethanol when it comes to distribution, physical properties, engine technology and performance, and so on. Yet if consumers with a real choice between gasoline and ethanol exhibit strong and heterogeneous tastes over real or perceived non-price attributes, it then follows that substitution to less similar energies and technologies, such as natural gas and electricity, is likely to be, at best, gradual and limited. Unless, of course, policymakers are prepared and able to spend heavily and successfully on public campaigns that seek to shift preferences or perceptions.

Consider Brazilian drivers who pick the more expensive fuel among gasoline and ethanol at the pump when in principle they can "flexibly" substitute to the lower priced fuel. Are these drivers doing so because they value the fuels' non-price attributes, as they perceive them? These attributes might include: (i) extra range on a full tank, which favors gasoline, (ii) varying engine performance—concern for this attribute pushes some consumers to gasoline, others to ethanol, and (iii) externalities such as environmental damage and local jobs, with typical perceptions favoring ethanol (Salvo and Huse, 2013).

Alternatively, consumers may pick the expensive fuel from a choice of gasoline and ethanol not because they value different non-price attributes but because price differences are not well understood or salient. A gallon of ethanol, a partially oxidized hydrocarbon, provides a lower yield in terms of miles traveled than a gallon of gasoline. Both in Brazil and in the US, these liquid fuels are priced to the end consumer per unit of volume. There is little guidance at the point of sale on which fuel yields most miles per dollar purchase. Given the local composition of fuels,[3] the rule of thumb which Brazil's motorists are constantly exposed to on the radio and other media is that when a liter of ethanol is priced at or below 70% relative to a liter of gasoline, then ethanol offers the lower energy-adjusted price, in $/km terms.[4] Observing consumers not realize savings per fuel km purchased could then reveal an inability or unwillingness to do the cost conversion or process the available information. Such limited information, limited attention, or bounded rationality would have very different policy implications to taste heterogeneity (Goeree, 2008; Clerides and Courty, 2017; DellaVigna, 2009).

Since unobserved taste heterogeneity can be challenging to establish directly over alternative explanations, I follow an indirect approach. Via a field experiment, the research design is to "shock" consumers at the point of sale with increased relative price salience, and measure the extent to which choice shifts to the lower $/km fuel, away from the alternative with the highest monetary cost. Assuming the intervention succeeds in making the effective price difference more accessible, a low treatment effect would reveal strong taste heterogeneity over fuels. On the other hand, if treatment raises the price elasticity of demand for one fuel relative to the other, this would indicate a role for policies to inform consumers about energy-adjusted prices, or to raise their salience.

This study is the first to conduct a real-world experiment to provide consumers with information on price differences across alternative energies.[5] As bi-fuel vehicle motorists pulled up at the pump and before placing their order with the station atten-

[1] This is equal to the fuel's monetary price at the pump, in $/gallon, divided by the consumer's vehicle mileage in miles/gallon.

[2] The quick transition by carmakers in Brazil, starting in 2003, from offering single-fuel engines to *only* bi-fuel engines on the vast majority of models, makes consumer selection into owning vehicles with dual gasoline-ethanol capability less of a concern (Salvo and Huse, 2013).

[3] Ethanol retailed in Brazil is E100, pure but "hydrated," containing up to 4% of water. In the sample period, gasoline retailed in Brazil was either a 25% ethanol blend or, after November 2011, a 20% ethanol blend. I refer throughout to E25/E20 and E100 as "gasoline" and "ethanol," respectively. For comparison, gasoline and ethanol available in the US are typically E5/E10 and E85, respectively.

[4] The following example aired on a leading São Paulo radio channel, *CBN Notícias*, on March 24, 2011, during the sample period: (Reporter) "So it's not worth fueling with ethanol?" (A Station Attendant) "No way, you end up spending more …" (Reporter) "For the consumer it makes sense to fuel with ethanol if its price is less than or equal to 70% of the price of gasoline. For example, here in the state capital this Thursday … 1 L of gasoline retails for about 2.60 Reais. Ethanol should be priced at 1.80 to be worth it. As ethanol is being sold for 2.20, this calculation shows that gasoline is favorably priced. The calculation is simple. You take the price of gasoline and multiply by 0.7 …" (A Consumer) "I used to fuel with ethanol and now only gasoline …"

[5] Dranove and Jin (2010) review the empirical literature on information (quality) disclosure.