The Lightbulb Paradox: Consumer Behavior and Public Policy in the U.S. Electricity Market

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Sector(s): Environment & Energy

Location: United States of America

Sample: 2,620 survey participants

Target group: Urban population

Outcome of interest: Technology adoption Energy conservation

Intervention type: Digital and mobile Information Pricing and fees

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Energy-efficient technologies, such as compact fluorescent lightbulbs (CFLs), have the potential to save consumers money, but their adoption remains low. Researchers evaluated the impact of information and price on demand for CFLs in two contexts: an online survey platform and a typical retail setting. Information and subsidies increased consumers' willingness to purchase CFLs. Researchers estimate that CFL subsidies and information may be more beneficial than bans on incandescent lightbulbs.

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Energy-efficient technologies have the potential to save consumers money, but the adoption of many energy-efficient products remains low, a phenomenon termed the "Energy Paradox." Although an energy-efficient technology may cost more to purchase, energy cost savings may outweigh the higher purchase cost. However, if consumers don't know or ignore these costs, they may favor energy-inefficient products.

To encourage adoption of energy-efficient technology, policymakers often implement subsidies or standards. For example, in the United States, electric utilities spent US$252 million in 2010 to promote compact fluorescent lightbulbs (CFLs), an alternative technology to incandescents, largely through subsidies of US$1-2 per bulb. Additionally, the Energy Independence and Security Act of 2007 sets minimum efficiency standards that effectively ban traditional incandescent bulbs. Despite these efforts, incandescents still occupied 72 percent of all US residential sockets in 2010—equivalent to a US$15 billion cost in additional energy consumption from using incandescents instead of CFLs.[1] Can cost-savings information increase consumer demand for energy-efficient technologies?

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Researchers conducted two related evaluations using two samples of light-bulb consumers: participants of an online survey platform and customers at a typical retail store setting.

Researchers used online survey platform Time-Sharing Experiments for the Social Sciences (TESS) to survey a nationally representative sample group. TESS randomly selects potential participants from a U.S. Postal Service database and then actively recruits these individuals through mail and telephone.

For their in-store evaluation, researchers partnered with a large home improvement retailer across four stores located in Boston, New York City, and Washington, D.C . Of the consumers approached within the stores, two-thirds were male and the average age was 44 years. The most prevalent ethnic group was Caucasian (66 percent), though African-American (16 percent), Asian (6 percent), Hispanic (7 percent), and Middle Eastern individuals (1 percent) were also surveyed.

Person changes home lightbulb in the United States.

Photo credit: Shutterstock.com

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Researchers measured the impact of information and prices on demand for CFLs through two evaluations.

Online Evaluation: In a series of survey rounds, participants chose to purchase either one CFL or four incandescent lightbulbs that were as comparable as possible, except for the technology. Participants were given US$10 seach round, and the prices of the packages varied from US$0 to US$10.

Researchers randomly assigned participants to a treatment group that viewed screens comparing CFLs and incandescents or a comparison group. Researchers created four screens in total and varied the number that participants saw. The treatment group

viewed one or two informative screens that presented the price, energy costs, warm-up time, and proper disposal methods for CFLs and incandescents. The comparison group viewed two screens that presented the number of installed lightbulbs and sales trends in the U.S.

To measure the various effects of these informative screens, researchers examined the lightbulb packages that the participants selected and the prices they were willing to pay for CFLs versus incandescents.

In-Store Evaluation: Between July and November 2011, research assistants approached 1,561 customers in stores' lighting sections. In exchange for answering a series of questions about important factors in their lightbulb decisions, as well as their anticipated purchases and usage, customers received a discount on lighting products.

The 1,087 consumers who completed the survey were randomly assigned to one of four groups:

- Standard Coupon Group: Customers received a standard coupon for 10 percent off all lightbulbs purchased.
- Rebate + Standard Coupon Group: Customers received the standard coupon plus a rebate coupon valid for an additional 20 percent off all CFLs.
- Standard Coupon + Information Group: In addition to the standard coupon, customers viewed estimates of energy and total user costs for CFL versus incandescents based on the usage information they provided.
- Rebate Coupon + Information Group: Customers received both the standard and rebate coupons and viewed the same information shown to the Standard Coupon + Information Group.

To determine the effect of information and prices on purchase decisions, researchers collected store data on customers' coupon redemptions.

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Researchers found that information and subsidies increased consumers' willingness to purchase CFLs over incandescents.

Market Share: The proportion of participants that preferred CFLs increased among both samples. In the online evaluation, information boosted CFL market share at retail prices by 12 percentage points above the 65 percent share for the comparison group. In the in-store evaluation, 77 percent of survey participants redeemed coupons. Receiving the rebate coupon increased CFL market share by 10 percentage points. Providing information alongside a coupon did not increase its effectiveness.

Willingness-to-Pay: In the online evaluation, information increased the amount that participants were willing to pay for CFLs by US$2.30 relative to the comparison group.

Researchers used the evaluation results to calculate an estimated CFL subsidy that would generate the greatest benefits. The "optimal subsidy" equaled US$3 per bulb, which exceeds the typical subsidy provided by electric utilities. Since many participants in both evaluations preferred incandescents even after the information treatments, banning incandescents altogether would impose losses that would outweigh the gains of universal adoption of CFLs. Overall, the results suggest that subsidies for CFLs, coupled with information, may be more beneficial than bans on incandescents.

Allcott, Hunt and Dmitry Taubinsky. "Evaluating Behaviorally-Motivated Policy: Experimental Evidence from the Lightbulb Market." Working Paper, February 2015.

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1. DOE (U.S. Department of Energy). "Energy Star CFL Market Profile: Data Trends and MarketInsights." 2010. http://www.energystar.gov/ia/products/downloads/CFL Market Profile 2010.pdf.