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Contrasting self-reported willingness to pay and demonstrated purchase behavior for energy-saving technologies in a small island developing state

Travis Reynolds [a,*], Byron T. Murray [b], Jane Kolodinsky [b], Jillian Howell [a]

[a] Environmental Studies Program, Colby College, Waterville, ME 04901, USA
[b] Department of Community Development and Applied Economics, University of Vermont, Burlington, VT 05405-0148, USA

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ABSTRACT

Sustainable development in small island developing countries often hinges upon the successful adoption and diffusion of energy technologies developed abroad. To guide investments and policies seeking to promote new energy efficiency technologies academic and marketing studies often rely upon consumer self-reports of willingness to pay (WTP) for the environmental and economic benefits such technologies may provide. But marketing research has long reported disparities between consumer self-reports of willingness to pay and the actual amounts consumers will pay when making a purchase decision. This study uses the results of a survey and associated coupon distribution in Saint Lucia to contrast self-reported willingness to pay for energy-efficient compact fluorescent light bulbs (CFLs) with actual consumer behavior in a developing country context. Survey responses suggested that more than 94% of urban consumers in Saint Lucia were willing to pay some price premium for a high quality CFL bulb. However, when given a coupon allowing them to purchase a CFL bulb at a price equal to or below their self-reported willingness to pay, only one-third of the consumers actually purchased the product. High income respondents, low income respondents, and younger respondents were among those most likely to not purchase a CFL bulb when offered the chance to do so at or below their self-reported willingness to pay. The presence of systematic discrepancies between self-reported willingness to pay and observed consumer behavior in CFL markets has important implications for energy efficiency market research, coupon-based incentive programs and energy policy in Saint Lucia and other developing nations.

Introduction

Recent estimates suggest that the adoption of already-available energy-efficient technologies in Latin America and the Caribbean could cut electricity consumption by as much as 10% over the next decade, potentially saving the region up to USD $36 billion in investments that would otherwise be needed to expand power generation capacity (IDB, 2013). Energy efficiency improvements also offer significant opportunities for reducing costs for individual businesses and household consumers: retail electricity rates in the Caribbean average $0.35/kWh (CARILEC, 2010), putting them among the most expensive rates in the world. Recognition of these potential savings has prompted a variety of ambitious international energy efficiency investments alongside major domestic energy policy reforms promoting energy efficiency (Nogueira et al., 2015; Meza et al., 2014; Shirley and Kammen, 2013; Belizza and Claudia, 2010). Many such investments and policies target commercial energy users (IDB, 2013; Altomonte et al., 2003). However across the Caribbean major efficiency gains remain to be realized at the household level, where relatively low-efficiency appliances and lighting are still widely used.

Consumer surveys eliciting self-reported willingness to pay (WTP) for new and improved technologies are often used in both marketing research and in public policymaking, including in the process of developing and expanding markets for energy efficient products (Hogarth, 2012; Adkins et al., 2010; Banfi et al., 2008; Poortinga et al., 2003; de Jannuzzi and dos Santos, 1996; Dutt and Mills, 1994; Pye and Nadel, 1994). However marketing research has revealed a significant disparity between self-reports of willingness to pay for a given product and the actual amounts consumers will agree to pay when making a purchase decision (Sun and Morwitz, 2010; Verhoef and Franses, 2002; Carson et al., 2001). Particularly in the case of survey research, where self-reports of willingness to pay typically entail no obligation that respondents actually purchase the product at the stated price, consumers often report a willingness to pay that is too high (Zarnikau, 2003). In other words, though an individual may claim that he or she will purchase a new product if it is offered at price *P*, when the opportunity to obtain that product at price *P* arises, many (and in some cases, most) consumers will decline to make a purchase. This finding has led some to question when and whether self-reports of willingness to pay may be of practical use in conducting market research, in predicting

* Corresponding author. Tel.: +1 207 859 5364.
E-mail addresses: twreynol@colby.edu (T. Reynolds), bmurry@uvmhillel.edu (B.T. Murray), jkolodin@uvm.edu (J. Kolodinsky), jfhowell@colby.edu (J. Howell).

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consumer behavior, and in devising policies to promote new efficiency technologies and other pro-environmental consumer goods (Barber et al., 2014).

This study uses the results of a consumer survey and associated coupon distribution to explore the degree to which self-reports of willingness to pay for improved energy technologies are representative of the amount that consumers will actually pay in the market for compact fluorescent light bulbs (CFLs) in the Caribbean island nation of Saint Lucia. CFLs were selected as a focus for the study because they represent a relatively well-studied energy efficiency technology (more than 4 times as efficient at producing a given quantity of light as traditional incandescent bulbs (DoE, 2012)) and because expanded use of CFLs has been explicitly identified by the Government of Saint Lucia as a tool for promoting national energy security and reducing dependency on fossil fuel imports for electricity generation (CARILEC, 2010). CFLs have also been available in small quantities in Saint Lucia for several years, increasing the chances that consumers will have had the opportunity to develop informed assessments of their willingness to pay for the product (Reynolds et al., 2012). Finally, CFLs represent an energy-efficient product that is potentially attainable by almost all consumers: they require no new lighting fixtures, are easy to use, and are substantially less costly than other energy-efficient technologies such as household appliances. CFLs thus represent a technology where self-reports of willingness to pay might reasonably be assumed to reflect actual consumer behaviors in response to price changes (e.g., energy efficiency promotional programs that lower the purchase price) in the marketplace. Inversely, if self-reported WTP does not accurately predict consumer behavior in the market for CFLs we may then ask: (i) What variables explain discrepancies between consumer self-reports and observed behavior? and (ii) How might WTP measures be more effectively utilized for informing policy in markets for efficient lighting and other improved consumer energy technologies?

The remainder of the paper is structured as follows. The Conceptual model of energy efficient technology adoption in small island developing states (SIDS) section describes the theoretical model linking consumer demographics, energy efficiency knowledge, and willingness to pay with purchase behavior in developing markets for energy efficiency products. The Survey method and data analysisS section then summarizes the study design and statistical approach, followed by the Description of the sample and Results sections. The Contrasting self-reported WTP and observed behavior in CFL markets section discusses the findings from Saint Lucian CFL markets. The concluding section summarizes the study's contributions and policy implications.

Conceptual model of energy efficient technology adoption in SIDS

Small island developing states (SIDS) offer a particularly valuable reference point for the study of public policy and consumer behavior vis à vis energy efficient technologies. First, islands offer small, isolated, and thus relatively straightforward case studies for developing, testing, and evaluating promotional programs for new energy products (Weisser, 2004). Second, because of their small size, the impacts of energy efficiency programs – and related government policies such as public education and product subsidies – can be observed over a relatively short period of time (Shirley and Kammen, 2013). Finally, and perhaps most importantly, consumer behavior research is particularly useful and informative in small island developing countries because so much of island nations' economies depend upon the successful adoption and diffusion of technologies developed abroad. With limited resources for research and development activities, small island developing states rely heavily on imported innovations to increase production (or efficiency) and promote economic development (CARILEC, 2010; Nexant, 2010; Loy, 2007; Domah, 2002). Those developing countries that are best able to undertake and accurately interpret consumer research at home thus position themselves to take maximum advantage of technological innovations produced elsewhere (Peter, 2006).

The conceptual model for the current study assumes that a combination of socio-economic factors, awareness and knowledge of energy efficiency and energy-saving technologies, and past purchase behavior leads to the development of a preference for compact fluorescent lighting technology, which in turn translates into a given willingness to pay for CFL bulbs and, ultimately, purchase (Howarth and Rosenow, 2014; Min et al., 2014; Mills and Schleich, 2012; Wall and Crosbie, 2009). This general framework is in keeping with the well-established "hierarchy of effects" model of consumer behavior as formalized by Lavidge and Steiner (1961), also referred to as the "cognitive–affective–conative sequence of psychological states" (O'Brien, 1971). The hierarchy of effects model in its simplest form suggests that consumer behavior is ultimately the product of three major processes: developing awareness and knowledge of the new product (cognition), developing a preference for the new product (affect), and deciding to purchase the new product (conation). In other words, in the case of compact fluorescent light bulbs, consumers are presumed to learn about energy-saving compact fluorescent bulbs, develop an affinity for them, and ultimately decide to purchase them.

A wealth of empirical research into markets for energy-efficient technologies supports the inclusion of knowledge- and affect-based variables along with demographic variables in models of consumer behavior, as recently reviewed by Howarth and Rosenow (2014). For example, early research by Reddy (1990) found ignorance, indifference, uncertainty, and cost-sensitivity as major barriers to consumer adoption of energy-efficiency improvements in the United States, and Dyner and Franco (2004) observed similar barriers in England. Kjaerulf (1997) found the most significant barriers to CFL adoption in Denmark to be high initial price, quality concerns, and doubts about actual savings accrued through CFL-use. Urge-Vorsatz and Hauff's(2001) research into Hungary's rapid adoption of CFLs in the late 1990s cited lack of information as the greatest single market barrier to energy efficient technologies, while also noting that availability of information was a necessary but not sufficient condition for market success. More recently, Mills and Schleich (2010) found that before the 2009 ban on the sale of incandescent light bulbs in Europe use of energy efficient bulbs was already widespread in Germany, but at low intensity. Households with higher incomes were found to be the main demographic that had already adopted CFLs, suggesting low income as a market barrier. Consumer habits and preferences favoring incandescent lights also appear to have significantly slowed CFL adoption in Europe (Howarth and Rosenow, 2014; Mills and Schleich, 2012; Wall and Crosbie, 2009). And in the United States Min et al. (2014) found that politically liberal respondents were most likely to adopt CFL technology, but also that labels displaying estimated annual energy costs for lighting alternatives (altering consumers' calculus of the potential benefits from a CFL purchase) greatly increased reported willingness to pay for CFL bulbs.

With specific regard to developing countries, early work by Meyers (1998) found the main general impediments to the adoption of energy-efficient products in low-income countries to be a lack of information and a lack of financing. Research in India meanwhile found that high product cost, lack of consumer interest, and doubts about the savings promised were the main barriers to CFL adoption for residential energy consumers (Reddy and Shrestha, 1998). A similar study in Thailand also reported that a lack of access to information, limited access to capital, preferences for a very rapid payback, and a lack of access to – and trust in – efficient technologies were key factors inhibiting the adoption of energy-efficient consumer products (ARRPE, 2000). Although more recent empirical studies in developing countries remain scarce (Evander et al., 2005), current information- and subsidy-based energy efficiency policies underway in Latin America and the Caribbean seek to overcome similar informational and economic barriers (Nogueira et al., 2015; Meza et al., 2014), while also building consumer confidence