DOES INFORMATION OVERLOAD CROWD OUT ENVIRONMENTAL CONSCIOUSNESS IN CONSUMPTION?

Chiradip Chatterjee, University of North Florida
Ece H. Guleryuz, Istanbul 29 Mayis University

ABSTRACT

This paper proposes a decision-making field experiment that explains how people respond to economic and/or environmental benefits of energy saving. A class experiment is conducted where respondents learn comparative benefits of using Compact Florescent Lamps (CFLs). Given a choice to receive two-pack CFL lamps or $10 cash, what information method increases the probability of choosing the two pack CFL lamps is studied. It is found that the probability of choosing two-pack CFLs increases the most when the respondents learn either of projected energy savings or reduction in the emission of greenhouse gases with CFLs. **JEL Classification:** H41, O30, Q21, R20, Z00

INTRODUCTION

The resources of the earth support a human population that is larger, healthier, and wealthier than ever before. Agricultural production has been intensifying, and urbanization has been spreading to nearly every corner of the world. As a result, civilization is exposed to more complex and expensive infrastructure, while also facing the constant threat of large-scale losses. Such losses often impose high per-capita burdens on precious natural assets and the environmental balance. While it is impossible to live in a totally risk free environment, there are countless individual decisions that determine environmental risk, ranging from land planning (White, 1974), to disaster plans and emergency responses (Hewitt, 1983), and from consumption patterns to contributions in environmental protection. Environmental risks may be in the form of a natural phenomenon such as an earthquake, flood, or a storm, but there are also manmade health hazards caused by pesticides, chemicals, radiation, air pollution, and water pollution. Both types of environmental risks cause anatomical or functional damage, irreversible physical changes, and increase the susceptibility to other biological, chemical, or environmental stresses (Smith, 1996; Costello et al., 2007; Wilby, 2008; Luber, 2008; Hill et al., 2009). Behavioral economists focus on determining how to reduce manmade health hazards such as emission of greenhouse gases (Haines et al., 2010). Behavioral efforts to reduce emissions have two parallel, but distinct approaches: environmental contributions and environmentally responsible consumption choices.

An example of environmental contributions in a linear public good context is the buying of carbon offsets (Rayne et al., 2009). Today, most airline companies are subject to mandatory or optional contributions for carbon offsets. Those contributions are utilized in reducing the emissions of greenhouse gases through projects, such as wind farms that produce energy from fossil fuels.[1] Consumers often weigh the quality of products with their environmental consequences. They spend more for what they perceive to be environmentally friendly, even when the private return from those expenses is negligible or even non-existent (Gazali and Simula, 1997; Wasik, 1996; Winterhalter, 1993; Weimann et al., 2012). Such environmental contributions are deemed environmentally responsible consumption. A prime example of environmentally responsible consumption is 'green electricity'; electricity generated from environmentally friendly and renewable energy sources such as wind and solar power.

The consumption of Impure Public Goods (IPGs) cannot be explained by any of the two descriptions discussed above. The consumption of IPGs carries an environmental contribution and reduction in costs at the same time (Clark et al., 2003; Kotchen, 2005). For example, energy-efficient CFLs save money spent on the electricity bill and decrease the emission of greenhouse gases due to reduction in total demand for electricity. Despite their private and environmental benefits, IPGs are not a popular choice for consumers. A search for adequate reasons leads us to the behavioral aspects of human decision-making. People fail to recognize the potential benefits of IPGs due to short sightedness, or often they underestimate future returns due to inconsistent and high short-term discount rates (Camerer and Loewenstein, 2004). The United States Environmental Protection Agency (EPA) and the Department of Energy have introduced the Energy Star program, which provides an international standard for energy efficient consumer products.[2] Electronic devices carrying the Energy Star service-mark use 20%–30% less energy than required by federal standards. While programs like Energy Star explain energy efficiency, programs such as Eco-labels and Green Stickers encompass environmental contributions. The Energy Star, Eco-labels, and Green Stickers are examples of information disclosure methods designed to take sustainability measures into account.

There are three methods of information disclosure (Ibanez and Grolleau, 2008): standard (Dosi and Moretto, 2001), process of validation (Arda, 1997; Morris, 1997), and signaling strategy (Darnall and Carmin, 2005). The primary purpose of these methods is to monitor the authenticity of manufacturers' claims (Reed and Chiang, 2012; Woods, 2008). However, authenticity is no longer the major concern of information disclosure methods (Fliegelman 2010). The focus of current research is to identify which information delivery methods are most effective in promoting environmentally friendly consumption. Consumers primarily focus on their private benefits of consumption, and care more about the possible energy cost savings than the environmental benefits (Dowlatabadi and Wilson, 2007). Although consumers care for the environment, they are exposed to information overload when they receive both energy saving and environmentally beneficial information of IPGs (Eppler and Mengis, 2004). Information overload is a term used to convey the negative impact of receiving too much information. This paper confirms incidence of information overload in a decision-making field experiment of how people respond to private and environmental benefit of energy savings.

Although there is substantial research in progress that targets information disclosure mechanisms and accuracy (Gray et al., 2009), none of them have discussed information overload in the area of environmental contribution through or environmental consciousness in consumption. In this regard, this paper is unique and the first of its kind. A survey is conducted in which respondents are informed of none, one, or both of the projected benefit of CFLs versus incandescent light bulbs in terms of energy savings and reduction in the emission of greenhouse gases. The respondents are asked if they would like to replace their incandescent light bulbs with CFLs. Second, given an option to receive a payment, they are asked whether they would like to receive \$10 in cash or a two-pack of CFLs of \$13.50 trade-in value. The empirical analysis demonstrates how respondents' preference changes with different levels and types of information. When compared to choices made in response to no information, the estimation results show that the probability of choosing the two-pack CFLs increases the most when the respondents learn either the projected energy saving or the reduction in the emission of greenhouse gases with CFLs, and the least when they learn them both.

The paper will continue as the following: section two discusses the experimental design, section three discusses the analytical framework, section four presents data description and regression specification, section five discusses the parametric and non-parametric estimation results, and section six presents the concluding remarks.

EXPERIMENTAL DESIGN

Field experiment sessions were conducted in the form of in-class surveys at Florida International University. Seven sessions were coordinated, and the average number of surveys received in one session was between twenty-two and forty-three. Instructors of the respective courses were approached for permission to do the survey in the initial 20-30 minutes of their classroom time. Respondents were enrolled undergraduate economics students at Florida International University. In order to ensure that none of the respondents took the survey twice, they were explicitly asked whether they had taken the survey before, and they were allowed to participate only when they answered 'no'. In the case that someone attended a previous session, they were asked to wait outside the classroom and return once the survey was finished. If anyone did not want to participate, they could opt out and wait outside the classroom until the survey was completed. A copy of the survey was put on display using the projector and respondents were informed that we were researchers and not employees or sponsors. At least one member of the research team was always present during each session to explain the survey and to answer any questions. Paper copies of the survey were then distributed to the respondents. On average, it took 20 minutes to complete one session.

The survey had three vital sections: I) socio-demographics, II) information treatment, and III) decision-making.[3] In the first section (socio-demographic) the respondents were asked to disclose their age, gender, ethnicity, and whether they contribute to the family expenditure on light bulbs and the monthly electricity bill. They were also asked how many bulbs they thought they would require in the next two to three months (*REQUIREMENT*). Respondents' knowledge and consumption experience of CFLs were also tested. They were asked whether they have heard (*HEARD*) or have used (*BOUGHT*) CFLs. If the respondents have used CFLs they were questioned whether they found the price unnecessarily expensive (*HIGH-PRICE*), if they thought CFLs were not as bright as their wattage claims (*BRIGHT*), and if they burnt out long before their manufacturer's claim (*BURNT*). The first section of the survey was completed by asking the respondents whether they were satisfied using CFLs (*PERFORMANCE*).

In the second section of the survey, four information treatments were integrated to the baseline design. Seventy-five respondents did not receive any information (INF_{NO}) and were through to the third section of the survey from the first section, having completed just the baseline survey. Fifty-seven respondents received information on the expected energy savings of CFLs (INF_{ENERGY}). They were informed that CFLs last up to ten times longer than regular incandescent light bulbs, and use 50-80% less energy. In an attempt to quantify the benefit, the respondents were told that an 18-watt CFL could replace a 75-watt incandescent light bulb and save \$45 over its lifetime (U.S. Department of Energy, 2013). This is defined as energy information treatment (treatment one).

Another fifty-six respondents were given comparative benefit information regarding the use of CFLs in terms of the reduction in emission of greenhouse gases ($INF_{EMISSION}$). These respondents were informed that replacing a single incandescent bulb with a CFL prevents the emission of half-a-ton of carbon dioxide into the atmosphere over its lifetime. They were told that 90 average size power plants could be retired if everyone in the United States starts using energy-efficient lighting. This is defined as emission information treatment (treatment two). The remaining fifty-seven respondents received both the energy and the emission information (INF_{DUAL}). This is defined as the dual information treatment (treatment three). These different versions of the survey are summarized in Table 1.

In the third section of the survey, the respondents were asked to make two choices: I) whether they would like to replace their incandescent light-bulbs with CFLs; and II) if they were to be compensated for their time, would they like to receive \$10 in cash or a box of two CFLs equal to a \$13.50 trade-in value.

Four surveys were created with different information treatments in the second section. In the baseline survey (survey one) section one and section three were included. In the second survey section two with the energy information treatment (treatment one) were added to the baseline survey. The second section of the third survey had the emission information treatment (or treatment two). The fourth survey had the dual information treatment (treatment three). Only one survey per classroom session were used.

ANALYTICAL FRAMEWORK

A flexible random utility theoretic framework is used to gain insight into the respondents' willingness to accept a two-pack of CFLs rather than \$10 in cash. Given that the preference is made in a multidimensional context, the indirect utility function of a respondent can be written as the following:

$$U = U\{Y_0, Y_1(INF), ENV(INF), B(INF), X\} \quad (1)$$

That is, the utility measure of a respondent depends on their present (Y_0) and expected future (Y_1) disposable income, expected environmental attributes of consumption (ENV), the information pressure (B), and personal characteristics (X). The indirect utility is increasing in disposable income, i.e., $\frac{\delta U}{\delta Y_0}$ and $\frac{\delta U}{\delta Y_1} > 0$. It is assumed that respondents are pro-environmental, or $\frac{\delta U}{\delta ENV} > 0$. As explained before, information (INF) can be one of four types: INF_{NO}, INF_{ENERGY}, $INF_{EMISSION}$, and INF_{DUAL} (i.e., both INF_{ENERGY} and $INF_{EMISSION}$).

Let us suppose that levels of Y_1 and ENV when the respondent chooses the '$10 in cash' are Y_{10} and ENV_0. In contrast, when a respondent chooses 'two-pack CFLs', the levels of Y_1 and ENV are Y_{11} and ENV_1. Therefore, a respondent chooses the two-pack of CFLs if

$$U\{Y_0, Y_{11}, ENV_1, B(INF), X\} \geq U\{Y_0 + \$10, Y_{10}, ENV_0, B(INF), X\} \quad (2)$$

Therefore, the probability of choosing the two-pack CFLs (B) can be written as the following.

$$P = P[U\{Y_0, Y_{11}, ENV_1, B(INF), X\} \geq U\{Y_0 + \$10, Y_{10}, ENV_0, B(INF), X\}] \quad (3)$$

The expected future disposable income is at its maximum when the respondent receives energy saving information of CFLs and chooses 'two-pack CFLs'. That is,

$$Y_{11}(INF_{DUAL}) \cong Y_{11}(INF_{ENERGY}) >> Y_{11}(INF_{EMISSION}) \cong Y_{11}(INF_{NO}) \quad (4)$$

The expected environmental attribute of consumption is at its maximum when a respondent receives the emission information ($INF_{EMISSION}$). Therefore,

$$ENV(INF_{DUAL}) \cong ENV(INF_{EMISSION}) >> ENV(INF_{ENERGY}) \cong ENV(INF_{NO}) \quad (5)$$

The information pressure is proportional to added pieces of information. That is,

$$B(INF_{NO}) \ll B(INF_{ENERGY}) \cong B(INF_{EMISSION}) \ll B(INF_{DUAL}) \quad (6)$$

It is believed the maximum information pressure, $B(INF_{DUAL})$, is information overload. With evidence from the empirical analysis, the findings can be outlined as the following.

A. Probability of accepting two-pack CFLs increases as respondents receive information of expected energy savings of CFLs (INF_{ENERGY}). That is,

$$\frac{\delta P}{\delta INF_{ENERGY}} > 0 \quad (7)$$

B. Probability of accepting two-pack CFLs increases as respondents receive comparative benefit information of using CFLs in terms of reduction in emission of greenhouse gases ($INF_{EMISSION}$). That is,

$$\frac{\delta P}{\delta INF_{EMISSION}} > 0 \qquad (8)$$

C. Probability of accepting two-pack CFLs decreases with information overload. That is,

$$\frac{\delta P}{\delta INF_{DUAL}} \ll \frac{\delta P}{\delta INF_{ENERGY}} \text{ and } \frac{\delta P}{\delta INF_{DUAL}} \ll \frac{\delta P}{\delta INF_{EMISSION}} \qquad (9)$$

Different characteristics of respondents (*X*) might influence the probability of accepting CFLs. Respondents' characteristics such as, gender, ethnicity, knowledge of and/or experience using CFLs, and economic responsibility are included in the regression analysis.

DATA DESCRIPTION AND ESTIMATION

Among the two hundred and forty five respondents who completed the survey, one hundred and fifty seven were male (*MALE*) and eighty-eight were female (*FEMALE*). The average age (*AGE*) of the respondents was twenty-four years old. Among all respondents, forty were Caucasian (*CAUCASIAN*), eleven of them were African-American (*BLACK*), one-hundred seventy-one were Hispanic (*HISPANIC*), twelve were Asian (*ASIAN*), and ten were of other races (*OTHERS*). Thirty-one of the respondents said they buy light-bulbs (PAY_{BULB}), thirty-three of them said they pay all or a portion of the electricity bill ($PAY_{ELECTRIC}$), and eighty-eight respondents said they purchase bulbs and pay/share in the electricity bill (PAY_{BOTH}). Ninety-three respondents said they neither purchase light bulbs nor pay/share electricity bill (PAY_{NONE}). Eighty-two respondents said they would not need any light bulb in next 2-3 months; one hundred and twenty one respondents said they would need 1-5 light bulbs; twenty-six respondents said they would need 6-10 light bulbs, and sixteen respondents said they would need more than 10 light bulbs. One hundred and twenty eight respondents said they had heard of CFLs (*HEARD*), while one hundred and twelve of them said they have used CFLs before (*BOUGHT*). Twenty-one respondents said CFLs are expensive (*HIGH-PRICE*), twenty-nine respondents said CFLs are not bright (*BRIGHT*), and sixteen respondents said their CFLs burned out long before their manufacturer's claim (*BURNT*). Eighty-two respondents said they were overall satisfied with their CFLs (*PERFORMANCE*). Altogether two hundred and three respondents said they would replace their incandescent light bulbs with CFLs (*PREFERENCE*) and eighty-eight respondents said they would choose a box of two CFLs of $13.50 trade-in value as their survey payment (*PAYMENT*). The responses and corresponding variables are summarized in Table 2.

Although the respondents' utility are not seen, their decisions are observed to either choose a 2-pack of CFLs (trade in value $13.50) or $10 in cash. The probability of choosing CFLs as the survey payment is estimated using a probit model, which is often used as the estimation method of dichotomous choices. The benchmark probabilistic regression equation can be seen below as,

$$\begin{aligned} PAYMENT = {} & \beta_0 + \beta_1\, AGE + \beta_2\, MALE + \beta_3\, BLACK + \beta_4\, HISPANIC + \beta_5\, ASIAN \\ & + \beta_6\, OTHERS + \beta_7\, PAY_{BULB} + \beta_8\, PAY_{ELECTRIC} + \beta_9\, PAY_{BOTH} \\ & + \beta_{10}\, REQUIREMENT + \beta_{11}\, HEARD + \beta_{12}\, BOUGHT \\ & + \beta_{13}\, H\,\beta\, IGH\text{-}PRICE + \beta_{14}\, BRIGHT + \beta_{15}\, BURNT \\ & + \beta_{16} PERFORMANCE + \beta_{17}\, INF_{EMISSION} + \beta_{18}\, INF_{DUAL} \\ & + \beta_{19}\, PREFERENCE + \varepsilon \end{aligned} \tag{10}$$

The variables *FEMALE*, *CAUCASIAN*, PAY_{NONE}, and INF_{NO} (or, INF_{ENERGY}) are dropped to avoid multicollinearity. Six different variations (Model 1 to Model 6) of the benchmark regression equation are estimated and reported in Table 3.

PARAMETRIC AND NON-PARAMETRIC ESTIMATION RESULT

The parametric result shows that the respondents who are interested in replacing their incandescent bulbs with CFL are more willing to receive a two-pack of CFLs. In Table 3, the estimated coefficient of *PREFERENCE* is consistently positive and statistically significant at the1% level in all six models. It is found that the effect of information on a respondent's willingness to receive a two-pack of CFLs is also statistically significant and consistent in all six models. In order to prevent the problem of multicollinearity, the dummy variable INF_{NO} is dropped in first three estimation models (Model 1 to Model 3). The dummy variable INF_{NO} represents no information treatment or the responses when respondents received neither energy saving (INF_{ENERGY}) nor emission information ($INF_{EMISSION}$). The coefficients of INF_{ENERGY}, $INF_{EMISSION}$, and INF_{DUAL} in Model 1 to Model 3 show the effect of the corresponding information on the probability of accepting a two-pack of CFLs. All coefficients of INF_{ENERGY}, $INF_{EMISSION}$, and INF_{DUAL} are positive and significant at 1% or 5% level in Model 1 to Model 3. Hence, the probability of choosing a two-pack of CFLs significantly increases in response to energy-saving and/or emission information.

In Models 4, 5, and 6 the dummy variable INF_{ENERGY} is dropped instead of INF_{NO} in order to avoid the problem of multicollinearity. Therefore, the coefficient of INF_{NO}, $INF_{EMISSION}$, and INF_{DUAL} in model 4, 5, and 6 symbolize the effect of the no information, emission information, and both of energy and emission information on the probability of accepting a two-pack of CFLs in comparison to receiving the energy information. The coefficients of INF_{NO} and INF_{DUAL} are both negative at 1% and at 5% level of significance in all three models (Model 4 to 6). The coefficient of $INF_{EMISSION}$ is negative but not significant in any of model 4, 5 and 6. It represents that the probability of choosing a two-pack of CFLs is significantly lower in response to no information (INF_{NO}) and dual information (INF_{DUAL}), than in response to energy information (INF_{ENERGY}).

The non-parametric estimation results in Table 5 partially supports the parametric estimation result. It suggests that the probability of choosing a two-pack of CFLs increases under the savings information, emission information, and dual information treatments at 1% or 5% level of significance. However, any significant evidence that the probability of accepting a two-pack of CFLs decreases under the no information or dual information treatments is not found when compared to the energy-savings information treatment.

The information about the respondents' responsibility of purchasing light bulbs and their contribution to their monthly electricity bill are also taken into account. Our estimation result suggests that compared to respondents who do not pay for light bulbs and electricity, the probability of choosing CFLs is higher when the respondents pay for their electricity bill ($PAY_{ELECTRIC}$) or for their electricity and light bulbs (PAY_{BOTH}). The coefficient of $PAY_{ELECTRIC}$ is positive and significant at 1% or 5% level in all six estimation models. The coefficient of PAY_{BOTH} is positive and consistently significant in all six estimation models at 1% level. The coefficient of PAY_{BULB} is positive, but never statistically significant in any of the six models.

Table 4 reports the marginal effects of independent variables on the probability of accepting CFLs as the survey payment. Considering the statistically significant components in Tables 3, INF_{DUAL} decreases the probability of accepting CFLs by 14.8%-15.7% based on Model 5 and Model 6 at 10% level of significance. Among other major drivers, *PREFERENCE* (by 24%-24.1%) and $PAY_{ELECTRIC}$ (by 24.8%-25.2%) significantly increase the probability of accepting CFLs only in models 5 and 6. INF_{NO} (by 34.2%-35.7%) reduces the probability of accepting CFLs in models 5 and 6.

CONCLUSION

Consumer demand for CFLs has not yet reached a level to promote them as a convenient alternative to traditional incandescent bulbs (Herberich, List, and Price, 2011). This occurs despite the fact that if every household in the United States would replace one incandescent light bulb with a CFL, energy expenditures would decrease by nearly $800 million. In order to break the trend the federal government of USA enacted the Energy Independence and Security Act in December 2007. The act effectively banned the manufacturing or importing of most incandescent bulbs of that time. In keeping with the law passed, on January 2014, 40- and 60-watt incandescent light bulbs can no longer be manufactured in the U.S. This is the last part of the gradual phase-out that began in 2012 with 100-watt bulbs, and now the 75-watt variety is discontinued too. Governments around the world have also passed measures to phase out incandescent light bulbs. While Brazil and Venezuela started the phase-out in 2005, the European Union, Switzerland, and Australia started in 2009. Many other nations are also implementing new energy standards or have scheduled phase-outs. The gradual demise of the incandescent light bulb has generated a backlash among some who see it as taking away consumers' free choice. The conservative Heritage Foundation in the United States has stated that government's light bulb ban is just plain destructive.[4] However, a public-opinion survey commissioned by lighting manufacturer Osram Sylvania indicates that only three in ten consumers intend to hoard supplies of the old bulbs and stick with them.[5] Most people said they would switch to one of the newer lighting technologies.

It might be argued that to break out of path dependence in consumption, phase out is important and effective. However, with frequent change in modern technologies and public backlash, phase out is not always recommended. Phase out might take quite some time to retire specific technologies. For example, the incandescent bulbs still will be available on store shelves, alongside the electricity-saving alternatives, until the supplies run out. Once over, the same debate can start all over again comparing CFL and LED lights, or CFL and updated higher-efficiency versions of the incandescent bulb that use halogen gas to slow down deterioration of the tungsten filament. Therefore, it is important to study consumer preference in detail and understand how information can help adoption of energy saving technologies.

Although hundreds of studies have been undertaken, no definitive explanation has yet been found that explain the gap between the possession of environmental knowledge and environmental awareness, and displaying pro-environmental behavior (Kollmuss and Agyeman, 2002). There is large discrepancy between measured attitudes and actions (Newhouse, 1990). For example, after the Chernobyl disaster (nuclear accident that occurred on 26 April 1986 at the Chernobyl Nuclear Power Plant in Pripyat, Ukraine) an overwhelming majority of Swiss people opposed to nuclear energy. However, a narrow margin of population in Switzerland approved the memorandum that put a 10-year halt to building any new nuclear reactors only two years later. It is difficult to design valid studies that measure and compare attitude and behavior. Ajzen and Fishbein addressed these issues of measurement discrepancies in their theory of reasoned action and planned behavior (Fishbein & Ajzen, 1977). A contingent valuation study in the form of a hypothetical choice experiment of stated preference is done through class surveys. Our respondents are students and many of them do not contribute in household expenditures. Furthermore, due to the large number of students in class, they could not completely be stopped them from interacting with each other. Therefore, it is suggested that similar studies are conducted through household surveys concentrating on environmentally friendly products usage and consumption in the future. Responses to household surveys would be more realistic since the respondents would be people who make contributions in household expenditures. Efforts should also be made to substitute the stated preference approach with a revealed preference survey. The findings would be more factual if respondents reveal their choices and receive a two-pack of CFLs or $10 in cash, instead of stating what they would have chosen. For example, DNV GL (2014) uses in-store intercepts surveys to capture purchase decisions about an upstream lighting program in California.

The data forming the sample might not be viewed as rich. However, all of these respondents are selected and divided into subgroups on a completely random basis. Seventy percent of them identify themselves as Hispanic, which may be identified as the only statistical tendency in the sample. However, that is purely due to the population characteristics of Miami, Florida. Hence, it can comfortably be said there has not been any purposeful or discriminative method followed in determining the sub – respondent groups going through different treatments.

This paper examines consumers' stated preference to receive CFLs by the type and extent of information provided to them through a field experiment. It was found that the probability of choosing a two-pack of CFLs is crowded out in response to information overload; in this case, when respondents were informed of both the energy savings and reduction in greenhouse gases. Information is a useful tool that increases environmental concern. However in the presence of excess information, people may have difficulty acknowledging the purpose and making the right choices. Information overload is the term used to describe this specific difficulty (Eppler and Mengis, 2004).

According to Ojea and Loureiro (2007), environmental contribution is determined by altruistic, egoistic and biospheric values. By definition, if the pro-environmental attitude emerges to avoid consequences over nature, it is classified as a biospheric orientation. When an individual takes pro-environmental action because of the consequences incurred on oneself, it is classified as having an egoistic perspective. The altruistic orientation is used when pro-environmental actions emerge due to concerns about the consequences to other people. However, in all three cases it is the intrinsic motivations of people to contribute for environmental benefit (Frey, 1994; Kotchen, 2005; Kotchen and Moore, 2007). Energy saving combined with reduction in emission information of CFLs causes 'over-justification effect' (Bénabou and Tirole, 2005), crowding out respondents' intrinsic motivation for environmental contribution (Brekke et al. 2003). Therefore, INF_{DUAL} decreases moral obligation to the environment, which in return decreases the probability of choosing a two-pack of CFL.

It is clear that consumers do not always behave with altruistic motivations (altruistic vs. egoistic motivations) when they make their purchase decisions and consumption preferences (Kollmuss and Agyeman, 2002; Stern, 2000). They would not naturally perceive choosing environmentally friendly goods over other products as a moral duty they should take on to expand the welfare of the society they live in (Bortoleto, 2014). Instead of intrinsic motivations often times they should be given extrinsic motivations with well – designed green programs prepared by policy makers and scientists. In this way, consumers will be willing to take up the role of 'the responsible citizen' and participate in the green programs to enhance welfare of fellow citizens.

According to Blake (1999), there are three barriers to environmental actions: individuality, responsibility, and practicality. Individual barriers are with attitude and temperament of a person, which is especially influential in people that do not have a strong environmental concern. Responsibility, on the other hand, is very close to the psychologist's notion of 'locus of control'. Most people who don't act pro-environmentally feel that they cannot influence the situation or should not have to take the responsibility. A lack of trust in local and national government also stops people from acting pro-environmentally—since they are less willing to follow the prescribed actions. The third barrier, practicality, Blake lists constraints such as lack of time, lack of money, and lack of information.

It is necessary to distinguish between different levels of knowledge. Clearly, basic knowledge about environmental issues reasons conscious pro-environmental behavior. Kempton et al. (1996) indicated that most people do not know enough about environmental issues to act in an environmentally responsible way. Information often creates motivation that works as strong internal stimulus around which behavior is organized (Wilkie, 1990, as quoted in Moisander, 1998). Primary motives are often covered up by more immediate and selective motives, which evolve around one's own needs such as being comfortable, or saving money and time. However, significant researches have shown that very detailed technical knowledge does not seem to foster or increase pro-environmental behavior (Diekmann and Preisendoerfer, 1998; Fliegenschnee and Schelakovsky, 1998). The producers and governments should cooperate for the optimal marketing of the environmentally friendly products. The estimation results indicate that consumers should be provided with some information about the product but they should not receive too much information. When exposed to the products' display, consumers may usually make their purchase decisions in a short time period and they can act with egoistic motivations rather than caring for the future generations.

It is tried to make information be similar to the ones displayed on commercial lamp boxes/packages as much as possible. There is no literature available that discusses commercial effect of providing environmental benefit on product packaging or information overload. Interestingly, lamp boxes/packages only displays the future energy saving and do not exhibit the environmental impact. Increased interest in climate change over the past couple of years has led to rising calls for labeling to allow consumers to differentiate between more or less sustainable choices. This is assumed that if consumers receive the appropriate information their purchases will change and more sustainable purchasing will result. However, the labeling schemes have been only limited to expected energy saving, and not their environmental impact (Horne, 2006). Although information overload for consumers has never been supported with choice experiments, in one survey by Lloyd (2006), 97% of those surveyed indicated that there 'was more stuff to read than I could ever dream of reading' and 92% indicated that they felt 'surrounded' by information. It is therefore important that not only the validation measures of disclosed information are discussed (e.g. eco label), but also the details to maximize environmental contribution.

ENDNOTES

[1]Visit http://southafrica.to/transport/Airlines/Carbon-neutral-flight/Carbon-neutral-flight.php5 for details.

[2]For details, please visit http://www.energystar.gov/index.cfm?c=about.ab_history.

[3]The detailed survey is available on request made to the correspondent author.

[4]For details, please visit http://www.heritage.org/research/reports/2010/09/governments-light-bulb-ban-is-just-plain-destructive

[5]Please see the report available at https://assets.sylvania.com/assets/Documents/Socket%20Survey%206%200%202013%20web.ace8e42b-1aa1-4d10-897c-78e40ff72ccb.pdf

REFERENCES

Arda, M. (1997). Environmentally preferable commodities. *In Eco-Labelling and International Trade* (pp. 348-356). Palgrave Macmillan UK.

Bénabou, R., & Tirole, J. (2006). Incentives and prosocial behavior. *The American Economic Review*, 96(5), 1652-1678.

Blake, J. (1999). Overcoming the 'value-action gap' in environmental policy: Tensions between national policy and local experience. *Local Environment*, 4(3), 257-278.

Bortoleto, A. P. (2014). Waste prevention policy and behaviour: New approaches to reducing waste generation and its environmental impacts. Routledge.

Brekke, K. A., Kverndokk, S., & Nyborg, K. (2003). An economic model of moral motivation. *Journal of Public Economics*, 87(9), 1967-1983.

Clark, C. F., Kotchen, M. J., & Moore, M. R. (2003). Internal and external influences on pro-environmental behavior: Participation in a green electricity program. *Journal of Environmental Psychology*, 23(3), 237-246.

Colin, C., & George, L. (2004). Behavioral economics: Past, present, future. *Advances in Behavioral Economics*. Princeton, 3-51.

Costello, C., Springborn, M., McAusland, C., & Solow, A. (2007). Unintended biological invasions: Does risk vary by trading partner?. *Journal of Environmental Economics and Management*, 54(3), 262-276.

Darnall, N., & Carmin, J. (2005). Greener and cleaner? The signaling accuracy of US voluntary environmental programs. *Policy Sciences*, 38(2), 71-90.

Diekmann, A., & Preisendörfer, P. (1998). Umweltbewusstsein und Umweltverhalten in Low-und High-Cost-Situationen. *Zeitschrift für Soziologie*, 27(6), 438-453.

DNV.GL (2014). California Upstream and Residential Lighting Impact Evaluation Work Order 28 (WO28) Final Report. California Public Utility Commission, Energy Division.

Dosi, C., & Moretto, M. (2001). Is ecolabelling a reliable environmental policy measure?. *Environmental and Resource Economics*, 18(1), 113-127.

Dowlatabadi, H. and Wilson, C. (2007). Models of decision making and residential energy use. *Annual Review of Environment and Resources* 32, 169–203.

Eppler, M. J., & Mengis, J. (2004). The concept of information overload: A review of literature from organization science, accounting, marketing, MIS, and related disciplines. *The Information Society*, 20(5), 325-344.

Fishbein, M., & Ajzen, I. (1977). Belief, attitude, intention, and behavior: An introduction to theory and research.

Fliegelman, J. E. (2010). The next generation of greenwash: diminishing consumer confusion through a national eco-labeling program. Fordham Urb. LJ, 37, 1001.

Fliegenschnee, M., & Schelakovsky, A. (1998). Umweltpsychologie und Umweltbildung: eine Einführung aus humanökologischer Sicht. facultas. wuv/ maudrich.

Frey, B. S. (1994). How intrinsic motivation is crowded out and in. *Rationality and Society*, 6(3), 334-352.

Ghazali, B. H., & Simula, M. (1994). Certification schemes for all timber and timber products. International Tropical Timber Organization. Yokohama, Japan:

April.
Gray, R., Owen, D., & Adams, C. (2009). Some theories for social accounting?: A review essay and a tentative pedagogic categorisation of theorisations around social accounting. Sustainability, environmental performance and disclosures (pp. 1-54). Emerald Group Publishing Limited.
Haines, A., McMichael, A. J., Smith, K. R., Roberts, I., Woodcock, J., Markandya, A., ... & Bruce, N. (2010). Public health benefits of strategies to reduce greenhouse-gas emissions: overview and implications for policy makers. *The Lancet*, 374(9707), 2104-2114.
Herberich, D., List, J., & Price, M. (2011). How many economists does it take to change a light bulb? A natural field experiment on technology adoption.
Hewitt, K. (1983). Interpretations of calamity from the viewpoint of human ecology.
Hill, J., Polasky, S., Nelson, E., Tilman, D., Huo, H., Ludwig, L., ... & Bonta, D. (2009). Climate change and health costs of air emissions from biofuels and gasoline. *Proceedings of the National Academy of Science*s, 106(6), 2077-2082.
Horne, R. E. (2009). Limits to labels: The role of eco-labels in the assessment of product sustainability and routes to sustainable consumption. International *Journal of Consumer Studies*, 33(2), 175-182.
Ibanez, L., & Grolleau, G. (2008). Can ecolabeling schemes preserve the environment?. *Environmental and Resource Economics*, 40(2), 233-249.
Kempton, W., Boster, J. S., & Hartley, J. A. (1996). Environmental values in American culture. MIT Press.
Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?. *Environmental Education Research*, 8(3), 239-260.
Kotchen, M. J. (2005). Impure public goods and the comparative statics of environmentally friendly consumption. *Journal of Environmental Economics and Management*, 49(2), 281-300.
Kotchen, M. J., & Moore, M. R. (2007). Private provision of environmental public goods: Household participation in green-electricity programs. *Journal of Environmental Economics and Management*, 53(1), 1-16.
Lloyd, S. (2006). Future shock. *Business Review Weekly,* 4 May, 38.
Luber, G., & McGeehin, M. (2008). Climate change and extreme heat events. *American Journal of Preventive Medicine*, 35(5), 429-435.
Moisander, J. (1998). Motivation for ecologically oriented consumer behaviour. In 2nd European Science Foundation Workshop, Lancaster, ESF-Term programme: Consumption, Everyday Life and Sustainability.
Morris, J. (1997). Green goods?: consumers, product labels and the environment. IEA Environment Unit.
Newhouse, N. (1990). Implications of attitude and behavior research for environmental conservation. *The Journal of Environmental Education*, 22(1), 26-32.
Ojea, E., & Loureiro, M. L. (2007). Altruistic, egoistic and biospheric values in willingness to pay (WTP) for wildlife. *Ecological Economics*, 63(4), 807-814.
Rayne, S., Forest, K., & Friesen, K. J. (2009). Analytical framework for a risk-based estimation of climate change effects on mine site runoff water quality. *Mine Water and the Environment*, 28(2), 124-135.

Reed, M. E., & Chiang, D. T. (2012). Eco-advantage strategies and supply chain effects. *Journal of Supply Chain and Operations Management*, 10(1), 212.

Smith, K. (2013). Environmental hazards: assessing risk and reducing disaster. Routledge.

Stern, P. C. (2000). Towards a Coherent Theory of Environmentally Significant Behavior, *Journal of Social Issues*, 56.

The United States Environmental Protection Agency (EPA) (2015). The Clean Power Plan, Factsheet.

U.S. Department of Energy (2013). Lighting choices to save you money.

Wasik, J. F. (1996). Green marketing and management: A global perspective. Wiley.

Weimann, J., Brosig, J., Hennig-Schmidt, H., Keser, C., & Stahr, C. (2012). Public-good experiments with large groups. Univ., Fak. für Wirtschaftswiss.

White, G. F. (1974). Natural hazards, local, national, global. Oxford University Press.

Wilby, R. L. (2008). Constructing climate change scenarios of urban heat island intensity and air quality. Environment and Planning B: Planning and Design, 35(5), 902-919.

Wilkie, W.L. (1990). Consumer Behavior. 2nd edn, New York, John Wiley & Sons.

Winterhalter, D. (1993). United states hardwood forests: consumer perceptions and willingness to pay. Purdue University, Department of Forestry and Natural Resources.

Woods, J. (2008). Of Selling the Environment-Buyer Beware-An Evaluation of the Proposed FTC Green Guides Revisions. Loy. *Consumer L. Rev*., 21, 75.

TABLE 1: SUMMARY DESIGN OF SURVEY ONE, SURVEY TWO, SURVEY THREE, AND SURVEY FOUR

Survey	Sections	Treatment Details	Treatment Information
Survey One (Baseline)	Socio-demographics + Decision making		
Survey Two	Baseline + Treatment One	Energy information of CFLs (Treatment one)	CFLs last up to 10 times longer than regular incandescent bulbs. CFLs use 50% - 80% less energy than incandescent. A single 18-watt CFL used in place of a 75 watt incandescent saves $45.
Survey Three	Baseline + Treatment Two	Emission Information of CFLs (Treatment two)	Replacing a single incandescent bulb with a CFL keeps a half-ton of CO_2 out of the atmosphere over the life of the bulb. If everyone in the U.S. uses energy-efficient lighting, 90 average size power plants can be retired.
Survey Four	Baseline + Treatment One + Treatment Two	Energy Information + Emission Information (Treatment three)	CFLs last up to 10 times longer than regular incandescent bulbs. CFLs use 50% - 80% less energy than incandescent. A single 18-watt CFL used in place of a 75 watt incandescent saves $45. Replacing a single incandescent bulb with a CFL keeps a half-ton of CO_2 out of the atmosphere over the life of the bulb. If everyone in the U.S. uses energy-efficient lighting, 90 average size power plants can be retired.

TABLE 2: DESCRIPTIONS OF THE DEPENDENT AND INDEPENDENT VARIABLES

Variable	**Description**	***N***	**Mean**	**S. E.**
	Socio-demographics			
AGE	Age of respondent	243	24.24	5.71
MALE	1 if Male; 0 Otherwise	245	0.64	0.48
FEMALE	1 if Female; 0 Otherwise	245	0.36	0.48
WHITE	1 if White; 0 Otherwise	245	0.16	0.37
BLACK	1 if African-American; 0 Otherwise	245	0.04	0.21
HISPANIC	1 if Hispanic; 0 Otherwise	245	0.70	0.46
ASIAN	1 if Asian; 0 Otherwise	245	0.05	0.22
OTHERS	1 for other ethnicities; 0 Otherwise	245	0.04	0.20
PAY_{BULB}	1 if pay for light-bulb; 0 otherwise	243	0.13	0.33
$PAY_{ELECTRIC}$	1 if pay/share electricity bill; 0 otherwise	243	0.13	0.34
PAY_{BOTH}	1 if pay for light-bulb and pay/share electricity bill; 0 otherwise	243	0.40	0.48
PAY_{NONE}	1 if pay neither for light-bulb nor for electricity bill; 0 otherwise	243	0.38	0.49
REQUIREMENT	How many bulbs do you expect you will need in the next 2-3 months? 0 = None 1 = Between 1 and 5 2 = Between 6 and 10 3 = More than 10	245	0.98	0.83
HEARD	1 if the respondent has heard of CFL; 0 otherwise	245	0.52	0.50
BOUGHT	1 if the respondent has used CFL; 0 otherwise	245	0.12	0.32
HIGH-PRICE	I have bought CFL-bulb and their prices are unnecessarily high. 1 = Agree 0 = Otherwise	245	0.09	0.28
BRIGHT	I have used CFL-bulb but it was not as bright as the wattage said. 1 = Agree 0 = Otherwise	245	0.12	0.32

BURNT	The CFL, I bought, burnt out much before than the manufacturer claims. 1 = Agree 0 = Otherwise	245	0.07	0.25
PERFORMANCE	I have bought CFL-bulb before, and I am overall satisfied with its performance. 1 = Agree 0 = Otherwise	245	0.33	0.47
Information Treatment				
INF_{NO}	1 = Survey one; 0 = Otherwise	245	0.31	0.46
INF_{ENERGY}	1 = Survey two; 0 = Otherwise	245	0.23	0.42
$INF_{EMISSION}$	1 = Survey three; 0 = Otherwise	245	0.23	0.42
INF_{DUAL}	1 = Survey four; 0 = Otherwise	245	0.23	0.42
Decision Making				
PREFERENCE	Would you like to replace your incandescent bulbs with CFL-bulbs? 0 = No 1 = Can't decide now 2 = Yes	244	1.78	0.52
PAYMENT	If you were to be paid to participate to this survey, what would you like to receive? 0 = $10 in cash 1 = A box of two CFL-bulbs that cost $13.98 trade in value	245	0.36	0.48

Note: *N* represents the number of total observations.

TABLE 3: PROBIT MODEL ESTIMATION RESULTS (DEPENDENT VARIABLE: *PAYMENT*)

	(Model 1) *PAYMENT*	(Model 2) *PAYMENT*	(Model 3) *PAYMENT*	(Model 4) *PAYMENT*	(Model 5) *PAYMENT*	(Model 6) *PAYMENT*
PREFERENCE	0.718*** (0.211)	0.669*** (0.202)	0.679*** (0.198)	0.679*** (0.198)	0.706*** (0.201)	0.709*** (0.192)
INF_{NO}				-1.004*** (0.270)	-1.081*** (0.260)	-1.021*** (0.254)
INF_{ENERGY}	1.009*** (0.279)	0.946*** (0.277)	0.922*** (0.270)			
$INF_{EMISSION}$	0.770*** (0.272)	0.744*** (0.271)	0.725*** (0.269)	-0.197 (0.259)	-0.190 (0.259)	-0.159 (0.250)
INF_{DUAL}	0.532** (0.265)	0.512** (0.263)	0.491** (0.259)	-0.437* (0.267)	-0.401* (0.257)	-0.375* (0.252)
PAY_{BULB}	0.336 (0.300)	0.289 (0.298)	0.286 (0.295)	0.286 (0.295)	0.195 (0.281)	0.171 (0.279)
$PAY_{ELECTRIC}$	0.587*** (0.307)	0.571*** (0.303)	0.565*** (0.300)	0.565*** (0.300)	0.465** (0.280)	0.456** (0.276)
PAY_{BOTH}	0.809*** (0.256)	0.784*** (0.251)	0.702*** (0.244)	0.702*** (0.244)	0.719*** (0.221)	0.606*** (0.210)
HEARD		0.045 (0.202)	-0.082 (0.187)	-0.082 (0.187)		-0.024 (0.178)
BOUGHT	-0.305 (0.309)				-0.234 (0.294)	
REQUIREMENT	0.182 (0.116)	0.181 (0.116)	0.164 (0.115)	0.164 (0.115)	0.225 (0.107)	0.210 (0.106)
HIGHPRICE	-0.085 (0.375)	-0.178 (0.368)			-0.108 (0.360)	
BRIGHT	-0.132 (0.337)	-0.255 (0.319)			-0.160 (0.322)	
BURNT	-0.078 (0.424)	-0.135 (0.421)			-0.094 (0.407)	
PERFORMANCE	-0.028 (0.297)				0.069 (0.280)	
AGE	-0.144 (0.0196)	-0.146 (0.0193)	-0.175 (0.0190)	-0.175 (0.0190)		
MALE	-0.051 (0.201)	-0.039 (0.199)	-0.075 (0.197)	-0.075 (0.197)		
WHITE	3.649 (212.8)	3.592 (274.8)	3.549 (249.0)	3.549 (249.0)		
HISPANIC	5.033 (212.8)	4.935 (274.8)	4.901 (249.0)	4.901 (249.0)		
ASIAN	1.825 (212.8)	1.825 (274.8)	1.821 (249.0)	1.821 (249.0)		
OTHERS	2.104 (212.8)	2.048 (274.8)	2.031 (249.0)	2.031 (249.0)		
Observations	242	242	242	242	244	244
LR χ^2	56.88	54.76	52.13	52.13	39.40	35.78

Note: The constant terms are suppressed; ***, **, * imply significance at 1%, 5%, and 10% levels, respectively.

TABLE 4: MARGINAL EFFECTS OF PROBIT ESTIMATION (DEPENDENT VARIABLE: *PAYMENT*)

	(Model 1) *PAYMENT*	(Model 2) *PAYMENT*	(Model 3) *PAYMENT*	(Model 4) *PAYMENT*	(Model 5) *PAYMENT*	(Model 6) *PAYMENT*
PREFERENCE	0.220 (1.180)	0.206 (1.414)	0.211 (1.281)	0.211 (1.281)	0.240*** (0.073)	0.241*** (0.070)
NO-INF				-0.300 (0.250)	-0.357*** (0.068)	-0.342*** (0.068)
INF_{ENERGY}	0.418 (0.987)	0.392 (1.275)	0.384 (1.113)			
$INF_{EMISSION}$	0.318 (0.981)	0.308 (1.241)	0.301 (1.081)	-0.073 (0.490)	-0.077 (0.090)	-0.065 (0.088)
INF_{DUAL}	0.215 (0.828)	0.207 (1.035)	0.199 (0.890)	-0.152 (1.106)	-0.157* (0.082)	-0.148* (0.082)
PAY_{BULB}	0.175 (0.655)	0.149 (0.758)	0.149 (0.668)	0.149 (0.668)	0.107 (0.109)	0.093 (0.108)
$PAY_{ELECTRIC}$	0.310 (0.783)	0.301 (0.997)	0.299 (0.869)	0.299 (0.869)	0.252** (0.108)	0.248** (0.107)
PAY_{BOTH}	0.282 (1.153)	0.273 (1.448)	0.246 (1.188)	0.246 (1.188)	0.269*** (0.081)	0.227** (0.078)
HEARD		0.015 (0.120)	-0.026 (0.172)	-0.026 (0.172)		-0.008 (0.065)
BOUGHT	-0.097 (0.532)				-0.082 (0.106)	
REQUIREMENT	0.035 (0.192)	0.035 (0.244)	0.032 (0.198)	0.032 (0.198)	0.047 (0.039)	0.044 (0.039)
HIGHPRICE	-0.047 (0.296)	-0.093 (0.769)			-0.066 (0.122)	
BRIGHT	-0.062 (0.382)	-0.114 (0.957)			-0.083 (0.108)	
BURNT	-0.048 (0.313)	-0.080 (0.662)			-0.065 (0.138)	
PERFORMANCE	-0.009 (0.110)				0.026 (0.104)	
AGE	-0.004 (0.023)	-0.004 (0.030)	-0.005 (0.032)	-0.005 (0.032)		
MALE	-0.017 (0.112)	-0.013 (0.111)	-0.025 (0.165)	-0.025 (0.165)		
WHITE	0.915 (6.870)	0.913 (9.119)	0.909 (8.551)	0.909 (8.551)		
HISPANIC	0.826 (13.579)	0.819 (17.972)	0.820 (16.234)	0.820 (16.234)		
ASIAN	0.790 (5.979)	0.789 (7.736)	0.785 (7.076)	0.785 (7.076)		
OTHERS	0.790 (4.814)	0.788 (.)	0.783 (.)	0.783 (.)		
Observations	242	242	242	242	244	244

Note: The constant terms are suppressed; ***, **, * imply significance at 1%, 5%, and 10% levels, respectively.

TABLE 5: NON-PARAMETRIC TEST RESULTS

B / ***A***	***ENERGY -INF***		***EMISSION-INF***		***DUAL-INF***	
	t-Test	RANK	t-Test	RANK	t-Test	RANK
NO-INF	-0.260*** (0.007)	-3.149*** (0.002)	-0.215*** (0.004)	-2.636*** (0.008)	-0.155** (0.025)	-1.958** (0.050)
ENERGY -INF			0.045 (0.317)	0.480 (0.631)	0.105 (0.130)	1.133 (0.257)
EMISSION-INF					0.060 (0.260)	0.650 (0.516)

Note: ***, **, * imply significance at 1%, 5%, and 10% levels respectively; Numbers in the parenthesis are p-values.
The RANK (rank-sum) and the t-test statistics represent mean (A) – mean (B).