Examining the Impact of Eco-labels on Cleaning Product Purchasing Decisions

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I. Abstract

Eco-labels encourage environmentally friendly behavior in consumers and make environmentally conscious manufacturing economically viable for producers. Our team of researchers examined the underlying preferences of consumers buying cleaning products with eco-labels. The purpose for this research is to compare eco-labeled products to their conventional counterparts in multiple aspects. To accomplish this goal, we designed and implemented a survey to gather information on consumers' perceptions and actions regarding cleaning products and the environment. The results of the survey indicate women and adults not enrolled in an institution of higher learning are willing to pay more than other demographic groups for eco-friendly cleaning products. We also found a correlation between a consumer's willingness to pay for a product and their perception of its effectiveness. Participants who thought that environmentally friendly products were more effective than conventional products had a positive trend in their willingness to pay for the environmentally friendly product. Contrary to our hypotheses, income and education were not significant predictors of a consumer's willingness to pay. Additionally, environmental inclination in participants showed to have no effect on the willingness to pay for a product with an eco-friendly label. The survey found that emphasizing the quality and low price of a good are two general improvements eco-label certifiers like Green Seal could utilize to see substantial improvement in consumer preference for environmentally friendly cleaning products.

II. Introduction

During the past three decades, concern for the environment has become a global discussion. In the 1992 United Nations Conference on Environment and Development, eco-labeling was included in debates on methods of monitoring environmental impact (Dauverge, 2005).

Eco-labeling identifies products or services developed with an environmental emphasis. It encourages businesses to consider the environment during manufacturing and development and allows consumers to be more environmentally conscious (Erskine, 1997). Companies can use eco-labels to show that after a life cycle review, their product was certified as environmentally conscious (Sustainable Business Associates, 2006). Although this method seems to positively influence consumers and producers towards a greener market, it also allows producers to exploit the trend for profit. Businesses can use either self-created or third party labels to designate their products or services as eco-friendly. Not all eco-labels, however, are legitimate. False or misleading labeling raises concern about the effectiveness and credibility of eco-labels. One solution is increasing government

involvement and third-party verification to guarantee appropriate and valid eco-labeling. This permits consumers and producers to work together to restore the environment and develop products for an eco-friendly market.

The literature review will evaluate past strategies used to encourage consumers to purchase eco-labeled products. An emphasis will be made on consumer understanding and awareness, consumer confidence, and willingness to pay. The study will also explore research on multiple surveying methods. Utilizing established empirical techniques, a survey was developed to analyze these factors. From acquired knowledge of eco-friendly consumption and analyzation of survey responses, results regarding consumer inclination of buying eco-labeled household cleaners were reported to Green Seal.

III. Literature Review

    A. Background

The first countries that practiced an eco-friendly market existed primarily in the European Union. The primary leader, Germany, adopted the first nationwide eco-label in 1978 (Jordan et al., 2003). Austria, Australia, France, and the Netherlands followed, though each country had a different focus. For example, Austria targeted tourism for their eco-labels while Finland focused on forestry. eco-labeling eventually spread to other industrialized countries, including the United States.

eco-labeling in the United States began with the food industry. The concern for food and product safety led Theodore Roosevelt to sign the 1906 Pure Food and Drug Act (Golden, 2010). Congress established the Consumer Product Safety Commission to expand the application of labels. This was instituted primarily to disclose acute or chronic health hazards in household products to consumers (Golden, 2010). eco-labeling was introduced partially due to industries lacking transparency and concern about their environmental impact during manufacturing and distribution. Agenda 21 is the action plan proposed during the 1992 UN conference identifying eco-labeling as an important shift towards sustainability.

eco-labeling is important because it is a UN-proposed measure motivating industries to create more eco-friendly products while increasing consumers' environmental awareness (Dauvergne, 2005). The overall purpose of eco-labels is to establish an environmentally conscious economic market. Non-governmental Sustainable Business Associates' first concern is to protect the environment. The second objective is "encouraging environmentally sound innovation and leadership" (Sustainable Business Associates, 2006). It creates an incentive for environmental sustainability and innovation,

which encourages businesses towards a positive trend of environmental consciousness. The third objective is to build "consumer awareness for environmental issues" (Sustainable Business Associates, 2006). Labels teach people about specific environmental issues and the consequences of their choices (Sustainable Business Associates, 2006).

The International Organization for Standardization identifies three schemes for eco-label application. Type I encompasses a voluntary, multiple-criteria based, third-party program that licenses the use of environmental labels based on life cycle considerations (Testa, 2015). Although it competes with national schemes, the multi-issue third party voluntary scheme is the most trustworthy method (Jordan et al., 2003). Type II is self-declared and rarely used because it may lack credibility (Testa, 2015). Type III is based on voluntary programs that are verified by other qualified third parties (Testa, 2015).

B. Eco-labels and Consumer Behavior

These inconsistencies in eco-label verification informed analysts about how consumers view eco-labels, their credibility and their clarity. Horne analyzes different eco-label schemes to find the best practices in sustainable marketing (2009). His findings state that consumers are generally attracted to simple eco-labels because they are easier to understand. However, one caveat of simplicity is that it may not truly encompass the extent of its sustainability efforts (Leonidou et al., 2011). Today, fewer people believe that labels are truthfully identifying themselves as environmentally friendly. This may be due to the fact that consumers are ill-informed. Consumers who are well informed about the environment are more likely to identify genuine eco-friendly products than people who are not (TNS Opinion and Social, 2011). More generally, profits will suffer if consumers do not buy goods because they do not trust the labels. As consumer trust in a brand and its eco-label start to waver, concern for false labeling and credibility of their claims start to increase.

Many articles related to consumer choices and the environment emphasize the need to increase consumer awareness of environmental issues. A few articles including one testing for the effect of labels when choosing non-food agricultural products express the growing concern to inform consumers about environmental issues (Michaud et al., 2012). However, a lack of prior knowledge about eco-labels in Rousseau's chocolate experiment illustrate that more can still be done to inform consumers about environmentally friendly products (Rousseau, 2015). Although many people believe in helping the environment, factors such as price may cause consumers to act in discordance with their beliefs.

Over time, consumers find products they trust and begin to develop brand loyalty. Often, the consumers' trust comes from greater exposure to a brand. Introducing the public to greater benefits of green products has been shown to gain greater consumer appeal in comparison to criticizing competing brands (McGuire, 1976). After a consumer is exposed to the product and recognizes their need or desire to purchase a type of product, the last step is choosing between the multitude of options available. The consumer rarely has all the information they need to make an informed decision about which product is more beneficial to their concerns and must work with the information at hand (McGuire, 1976). It is likely there will always be consumers who will not consider environmental impacts. Likewise, other consumers will favor environmental products while compromising factors such as cost.

The type of interests and concerns people have can stem from many different places, starting with their cultures or upbringing. Often consumers develop opinions on matters based on their surroundings without questioning where their beliefs come from or putting their own thought or research into the matter. One study found that consumers were more willing to pay for organic fruits and vegetables, in comparison to other products widely available in markets (Krystallis, 2005). This finding shows that exposure is an important factor in gaining consumer trust. Therefore, marketers should focus on brand familiarity when selling eco-labeled products.

Some countries have adopted government-sponsored eco-label programs, which can help establish some credibility to the claims of eco-labeled products. For example, Australia has a three-tier system in place for eco-labeling. However, a study in Australia showed that only about 25% of consumers in the state of Victoria were aware of the labeling criteria (D'Souza, 2007). Eco-labels can be more inconsistent and confusing in countries that do not have sponsored eco-label programs. This can be seen in Australia's genetically modified food market, where differing information can be found on products between sources provided by environmental NGOs, agricultural biotechnical industries, and the government (Huffman, 2004).

Nearly 60% of consumers believe environmentally friendly products are more expensive. However, 70% of consumers from the same study said they would be willing to pay more for a environmentally healthy product (D'Souza, 2006). It is important to note that these figures are based on consumers who claim to always read the labels, suggesting that understanding the content of the label will help sell the product. Additionally, very little research is available for the lengths at which consumers are willing to pay for said environmentally healthy products.

Studies were performed on the correlation between consumers' willingness to purchase green products and social demographics. In regard to gender, many studies have differing findings (Chen,

2010). The differences may be due to geographical and cultural influences. Another simple social construct mentioned is the age of potential consumers, showing no significant correlations. However, studies have been able to find a correlation between the consumer's perception of the role of government and the consumer's willingness to buy green products. Unsurprisingly, Chen and Chai also found that people who feel a moral obligation to help the environment purchased these products more often (Chen, 2010). Therefore, marketing toward consumers who feel a moral responsibility toward environmental issues will have little effect, as they will most likely purchase green products anyway.

Most of the research currently in this field was conducted through surveying populations and observing their behavior. Therefore, most of the studies discussed here have relied on observations of purchasing habits, reports from consumers on their rationale behind purchases, and basic demographic information. However, the honesty of survey subjects' responses must be taken into account when drawing conclusions with error margins. Research also suggests that when labels are on products, consumers consider them (D'Souza, 2006). Both, developing the consumer's trust in the label's content and increasing the consumer's exposure to the labels, seem to be essential in persuading the consumer's purchasing decisions.

C. Case Study: Cleaning Products

A prominent eco-labeled market today can be seen with cleaning products which are heavily associated with concerns of toxicity and consumer health. In general, most people associate less negative health implications with eco-friendly cleaning products, compared to conventional cleaning products. Cleaning products are a major source of exposure to toxicants, comprising of a large fraction of industries worldwide and are commonly found in households. Toxicity develops when a toxicant comes into contact with the skin, eyes, or mucosa of the digestive or respiratory tract. High doses of toxicant exposure over a long time period induce a larger health effect on an individual (Agency for Toxic Substances and Disease Registry, 2013). Household cleaning products are potential sources of indoor air pollution and can result in health problems such as asthma and allergies. Toxicants in cleaning agents can react with air contaminants and produce harmful secondary products, posing a greater health threat (Nickmilder et al, 2007).

The most common category of toxicants found in household cleaning products is solvents. A solvent is defined as "a liquid that has the ability to dissolve, suspend, or extract other materials, without chemical change to the material or solvent" (Chen, 2001). Their ability to dissolve and extract

substances make them effective for cleaning, which is why they are commonly found in household cleaners such as disinfectants (U.S. National Library of Medicine, 2015). Common solvents are toluene, xylene, and the chlorinated solvents trichloroethylene and perchloroethylene. Acute health effects of solvents are eye, nose, and throat irritation (Chen, 2001). More chronic health effects can be neurobehavioral, affecting the central nervous system. Primary symptoms include impaired memory, fatigue and poor concentration. Some experience mood changes, altered personalities, and impairment in intellectual function. Solvents are volatile agents responsible for releasing volatile organic compounds (VOCs) into the air. Household dust traps high levels of VOCs emitted, contributing to indoor pollution (Rudel, 2003).

Household cleaning products contain numerous endocrine disruptors which cause problems in reproductive development (Wolkoff, 1998). Humans are not heavily studied subjects. Thus, most knowledge about potential health effects are from animal studies. Therefore, there is a gap of knowledge in literature about the chronic exposure of toxicants in cleaning products to humans. Further studies on health effects strictly on toxicants found in household cleaning products are needed to expand our knowledge.

Household cleaning products can affect our air by the volatilization that occurs after contact with the surface to be cleaned, pushing VOCs into the atmosphere that can eventually form ozone. A study carried out by Hyeong-Moo Shin et al. in May of 2015 sought to quantify the potential of indoor products to contribute to ozone formation (Shin et al., 2015). The article highlights that a major reason cleaning products have the ability to produce ozone is that many include low vapor pressure-volatile organic compounds (LVP-VOCs). Many products contain LVP-VOCs with a maximum incremental reactivity (MIR) above that of ethane, which is considered by the U.S. EPA to be the threshold compound for negligible reactivity (Carter, 2010; Dimitriades, 1996; Shin et al., 2015). This means LVP-VOC cleaning products have the ability to create ozone, but are not always regulated. To form ozone (O_3), the VOC must combine with sunlight and nitrogen oxides (NO_X), which are prevalent in the air (Shin et al., 2015).

The results of the study found that 90% of the compounds degraded in the air, meaning most LVP-VOCs can react with sunlight and NO_X to form ozone (Shin et al., 2015). The sewage treatment plant (STP) model found that compounds that went down the drain and through the wastewater treatment plant (WWTP) were almost entirely biodegraded or removed via sorption (Shin et al., 2015). While 23% were discharged to surface waters after going through the treatment plant, an insignificant portion of that was then volatilized to the atmosphere and instead biodegraded into the water or soil (Shin et al., 2015). This means that the LVP-VOCs that are rinsed down the drain after

consumer use pose almost no threat to ozone formation and can be ignored. However, of the LVP-VOCs that are volatilized into the air, 90% have the potential to react in the atmosphere to form ozone (Shin et al., 2015).

In a second study carried out by Trieu-Vuong Dinh et al. in 2014 the compositions of VOCs from several consumer and commercial products were analyzed (Dinh et al., 2015). The results of the study found that 96.4% (by weight) of the spray products emitted VOCs and 21.6 - 96.4% of the spray's VOCs are components of liquefied petroleum gas (Dinh et al., 2015). Non-spray products like dishwashing detergents had low VOC concentrations at just 1.6% by weight (Dinh et al., 2015). Diverse VOCs ranging from C_2 to C_{11} were found in the dishwashing detergents and air fresheners (Dinh et al., 2015). The study also concluded that spray consumer and commercial products had a much higher chance of forming ozone than the gel or liquid products (Dinh et al., 2015).

The most impactful way cleaning products affect the environment is its contribution to ozone. The studies done by Shin et al. and Dinh et al. both showed that the majority of volatilized cleaning products can react with sunlight and NO_X to form ozone, with the biggest culprits being spray cleaners (Dinh et al., 2015; Shin et al., 2015). This matters as ozone affects the health of plants and animals, posing threats to both the environment and the agricultural economy. Although the effect cleaning products have on the air is well researched, more research must be done to fully comprehend the ways cleaning products affect water bodies, as well as the effect the plastic packaging has on the environment. More research will provide consumers with a way to better protect the environment by ensuring sustainable practices are applied at home.

 D. Significance of Studying Eco-labels

Eco-labels can be of interest to companies because past research has shown that "a properly designed labeling program can be a significant stimulus for market transformation toward environmentally preferable products" (Banerjee and Soloman, 2003).

In 2004, the Journal of International Consumer Marketing conducted a study evaluating the use of visual and verbal communication on spending on environmentally conscious products. The highest recorded consumer spending on green products was observed when both visual and verbal communication were used in conjunction (Tang et al. 2004). Eco-labels and the visual messages they communicate can make a real impact, not just environmentally, but also financially. From this data, it can be inferred that sustainable projects can be financially lucrative to producers if certain market interventions are in place.

Eco-labels can have a multitude of effects on consumer opinion, economics, and resource consumption. eco-labeling policies can be improved if they are developed off the mistakes of past labels. One idea is to focus on single separate impact areas such as greenhouse gas emissions. This can negate the complexity and interconnectedness of environmental issues. However, these practices may unknowingly create unexpected shifts in the behavior of the resource users towards more harmful methods; this could possibly render the policy either ineffectual or damaging (Golden et al., 2010). In other words, these failures and unintentional consequences have significant value in shaping and perfecting the next generation of eco-labels. This distinction has proved to be a successful way to satisfy user opinion given the right conditions.

One widespread improvement moving forward could be the overall clarity of the information conveyed. As seen with almost all eco-labels, when asked for consumer opinions, there were many questions regarding the specific nature of the eco-label after identification (Banerjee and Soloman, 2003). Improvements can be made by reviewing the information on the eco-label and making sure that is readable, understandable and digestible (Banerjee and Soloman, 2003). This can also be an opportunity to rethink the purpose of the eco-label and what it stands for, leading to the evaluation of whether or not it is communicating its message effectively.

The eco-labels with the greatest amount of credibility and public appreciation are those associated with the government. Examples *Energy Star* and *Energy Guide* both carry a lot of influencing power in consumer decision making (Banerjee and Soloman, 2003). This disparity between governmental institutions and non-governmental groups is substantial. Support from a governing body will produce a positive effect in an eco-label's credibility. The general public trusts that the government is a trustworthy source.

Eco-labels are a great way to provide the consumer with information as they may not be aware of the harmful affects their buying decisions can potentially have. This is an attempt to solve a disconnect of information. This disconnect, which implies that "people simply lack the knowledge required to act out effective behaviors," is called a deficit in information (Rajagopal, 2015). Eco-labels appeal to the environmentally sympathetic part of the population that, unprompted with this information, do not know how to incorporate sustainable choices into their daily lives. As sustainable choices gain popularity there is an increasing interest in eco-labels and their bearing on consumption in different areas. One important area of research will be developing a strategy to optimize the effectiveness of eco-labels. Exploring communication types in addition to consumer opinion will help to narrow down effective strategies non-profits, non-governmental organizations, and government organizations can utilize to make full use of eco-labels.

Most of the research conducted on eco-labeling and consumer interest is done by utilizing an empirical study structure. The survey can either be experimental or observational, and is conducted on a specific sample size. When analyzing the effectiveness of empirical studies on eco-labels, they are often limited by practical considerations of time and money, especially when researchers study a large number of products and consumers (Andersson et al., 2012; Shingrup, 2013). These limitations can force researchers to employ methodology that is not statistically robust, such as convenience sampling (Dekhili et al., 2014). Different quantitative studies can measure different variables such as average scores on a performance test or proportions of consumers who choose a certain label. However, the most commonly measured factor across all studies is the test subjects' willingness to pay for a product in the relevant currency (Ceci-Renaud et al., 2012; Dekhili et al., 2014).

E. Empirical Studies of Eco-labels

Empirical studies on eco-labels can be influenced by response bias, which most researchers further classify into strategic, social judgment, and hypothetical situation bias (Ceci-Renaud et al., 2012; Shingrup, 2013). Strategic bias occurs when an individual makes choices with the intention of achieving a specific outcome. For example, an environmentalist may intentionally overstate his or her willingness to pay in hopes of contributing to increased development of environmentally friendly products (Ceci-Renaud et al., 2012). Social judgment bias implies that a subject responds a certain way in order to conform to social pressures (Ceci-Renaud et al., 2012). Hypothetical situation bias describes the discrepancy in consumer behavior during a hypothetical situation as opposed to a real situation (Ceci-Renaud et al., 2012).

The large variety of empirical studies on eco-labels complicates the ability to make credible comparisons between the results of different studies (Shingrup, 2013). Some researchers have attempted to clarify this confusion by proposing four general categories of studies: direct declaration, hypothetical choice experiments, laboratory experiments with real payments, and in-store experiments (Ceci-Renaud et al., 2012).

In the direct declaration method, researchers give a survey to a random sample of subjects and directly ask about their willingness to pay. This method tends to be quicker and more practical, but it is vulnerable to the bias mentioned earlier (Ceci-Renaud et al., 2012; Dekhili et al., 2014). Hypothetical choice experiments also involve surveys, but they provide subjects with hypothetical situations. This method can reduce the influence of strategic and social judgment bias, but it is still vulnerable to hypothetical situation bias (Ceci-Renaud et al., 2012). Laboratory experiments involve

test subjects buying products with real money in a provided situation. Researchers can manipulate information associated with different products to isolate influences behind willingness to pay in order to reduce hypothetical situation bias (Ceci-Renaud et al., 2012). However, since test subjects know that they are in an experiment, this type of study can be heavily influenced by strategic bias (Ceci-Renaud et al., 2012). Finally, in-store experiments allow researchers to manipulate and observe real products with real points of sale. This study most closely mirrors a consumer's typical behavior patterns, but is often restricted by practical considerations (Ceci-Renaud et al., 2012). For most studies in this category, it entails the number of observable products and the possibility that results are only applicable to the specific location studied (Ceci-Renaud et al., 2012).

Some researchers have brought up the idea of an "eco-label effect," which is defined as a placebo effect for consumers' perception on the quality of environmentally friendly products (Sorqvist et al., 2015). One such study found this by administering an objective color discrimination test to subjects working in a room lit by either environmentally friendly lights or conventional lights (Sorqvist et al., 2013). Another finding is that consumers may factor the product's country of origin into their purchasing decision possibly because of environmental favorability (Dekhili et al., 2014). However, it is important to examine decision-making based on country of origin is subject to other influences such as political views. Finally, researchers suggested that auctions could be a possible new method of finding an unbiased value for willingness to pay since consumers offer up as much money as they want for a products (Uchida et al., 2013). However, this finding may not be very useful because most markets do not operate under the auction system.

To evaluate the effects or perceptions of eco-labels, it is important to first examine the factors affecting consumer behavior. Designing and implementing an effective survey to discover these trends is necessary in gathering data for researchers to analyze. Selecting a statistical methodology to interpret the results is also necessary to determine the factors influencing consumer choice (Kasunic, 2005).

IV. Research Questions

The following are our focused research questions:

- Are consumers aware of and knowledgeable about eco-labels?
- To what degree do consumers compare the efficacy and quality of eco-labeled cleaning products to unlabeled cleaning products?

- What is the price premium consumers are willing to pay for eco-labeled cleaning products over unlabeled cleaning products?
- What relationships can we find between consumer demographics and their purchase of eco-labeled goods?

We hypothesize that consumers prioritize price when purchasing household cleaning products. Previous studies have shown factors such as price may cause consumers to act in discordance with their beliefs. In a study by Clare D'Souza, age and interest in labeled goods are positively correlated (D'Souza, 2007). Thus, we hypothesize that consumers with higher income and education levels will also favor eco-labeled products over cheaper alternatives. We also hypothesize that there is a low level of trust for eco-labels from third-party certifiers because according to a similar consumer study by Banerjee and Soloman, eco-labels with the greatest amount of credibility and public appreciation are those associated with governmental institutions (Banerjee and Soloman, 2003).

V. Deliverables

Expected outputs comprise of the survey questionnaire aimed to reach 1,000 participants, data collected from the survey, and results of data analysis. Results will reflect which eco-label attributes consumers value and different circumstances (eg. income, education, age) that may be correlated to the attributes that they value.

VI. Methodology

In order to provide Green Seal with research on eco-labels and its influence on consumer preference, we first developed a survey using the online platform Qualtrics, then analyzed the data once we received the desired number of responses. This required us to formulate hypotheses and develop questions based on insights from our literature review.

In our literature review, we learned about survey design techniques and how data can be extrapolated from particular types of surveys. This ultimately helped us create our research objectives and methodology. We focused on obtaining comprehensive information about consumer preferences and their explanatory factors. We also designed our own labelled products to control scenarios that test our hypotheses.

Survey questions were designed to be clear yet brief to ensure the greatest quality of resulting data. A discrete choice analysis, also known as a choice-based conjoint or CBC, was utilized to provide survey participants with realistic scenarios in selecting products at their own freedom. Our aim was to create questions free of scientific jargon and environmental bias. Additionally, we edited questions for brevity to follow the effective survey tips researched in our literature review.

A sample survey can be found in Appendix B. The questions in the survey were organized into three categories: demographics, beliefs, and consumer behavior. The demographic questions aimed to account for the possibility of consumer backgrounds having an affect on their decisions. The questions about beliefs helped assess consumer awareness, confidence, and understanding of current labelling organizations as that may affect perception of eco-labeled products. Consumer behavior questions were designed to test whether or not consumers' beliefs align with their real life decision-making.

One of the ways we decided to test consumer behavior was by creating visual representations of hypothetical cleaning products for our survey. Modeled after a previously distributed consumer wine survey from UCLA, we decided to show four different cleaning product bottles for each question, as well as an option for survey participants to not choose any. The decision to include the option to not choose any product served to emulate a realistic shopping scenario for our participants. Because cleaning products can contain many different labels, we did not know which specific labels most accurately represented options that consumers would normally be faced with or interested in.

To narrow down which labels we would ultimately portray on our survey bottles, we devised a list of options using real cleaning products as a reference. We then designed and distributed a preliminary survey on Qualtrics via social media allowing participants to rate the importance of certain attributes on a 1 to 5 scale. Using the results from the 148 participants, we concluded consumers have the highest regard for effectiveness as represented by "powerful formula," environmental concern as represented by "biodegradable," and health as represented by "non-toxic" when buying cleaning products. To ensure that each combination of cleaning product attributes were equally available, we underwent a label randomization process. The objective of the randomization process was to ensure no bottle options in a given question were represented with the same combination of labels. Additionally, we wanted to be sure that each label appeared the same amount of times throughout the survey, to avoid any bias in that manner.

Before implementing the survey, each member of our team needed to obtain approval from the Institutional Review Board (IRB). All team members completed the mandatory Collaborative Institutional Training Initiative, allowing us to conduct our research. We regularly consulted UCLA

Professor Magali Delmas during this process because of her extensive experience with the IRB. After preliminary review by Delmas, each edit made on the survey required an additional review by the IRB, most of which took less than a week.

Once the first draft of the survey was approved by the IRB, a pilot survey was distributed for feedback. Most feedback pertained to aesthetics and question clarity. In the amendments to our submission to the IRB, we made some images and fonts bigger for greater readability, as well as adjusted certain wording for comprehension. We also used these results to test if the initial data would be useful in helping us answer our hypotheses. After the survey's second draft, we launched it via various social media platforms including Facebook, Reddit, and Twitter. We also reached out to others via email. These were all generated by personal outreach by members of the team. To get a better representation of American consumers, the market Green Seal aims to appeal to, we used the paid service Mechanical Turk to generate more varied responses from around the country. Mechanical Turk is a online platform that allows users to be compensated for taking surveys based on survey length and surveyor's discretion. The initial survey advertised a $50 gift card giveaway; however, the Mechanical Turk survey paid approximately $1 for each participant after a $0.20 user fee, thus Mechanical Turk participants were not offered the gift card. We ultimately obtained 705 responses from people who took our survey using Mechanical Turk.

To increase variation, we also surveyed participants in-person at grocery stores. Since the paper version of our survey varied slightly from the one online, we had to reformat the survey to decrease wasted space. However, due to time constraints and an increase in our project budget, we chose to allocate our funding towards acquiring more survey responses via the online site Mechanical Turk.

As responses were collected, we analyzed the data on a weekly basis at our scheduled meetings to look for trends. Within the first week of launching the survey on Qualtrics, it was made clear that we needed to acquire more responses from age groups outside of the 18-29 year old range. With more responses from Mechanical Turk, we were able to gather answers from people with varying backgrounds, especially in age and geographic location. We made one final effort to distribute our online surveys through Qualtrics to reach our goal of having data from 1,000 surveys. After locking the surveys to prevent more responses and eliminating the surveys with blanks, we had a pool of 1,037 surveys to analyze our data from. Our survey ensured the anonymity of all participants who completed the survey, whether it was in-person or online.

After obtaining the data, we decided to test the following eco-label attributes: brand, biodegradability, compostability, environmental impact, health hazard, natural derivation, price, and

quality. These variables were compared across different demographics such as age and education level. Data analysis was done using R and Excel. We began analyzing the factors stated in our hypotheses such as the effect people's income had on their purchasing decisions for cleaning products. The main statistical methods besides summary statistics were linear regression and two sample t-tests of the mean. All t-tests used alternative hypothesis $\mu_1 \neq \mu_2$ and compared against significance level p=0.05.

Questions that measured a range of belief or trust were answered on 1-7 scale to represent a spectrum from strong disagreement to strong agreement. Qualitative variables in the survey were coded with specific numbers. Highest education level was coded on a 1-6 scale to represent some high school, high school diploma, some college, associate's degree, bachelor's degree, and postgraduate degree. Income was coded on a 1-7 scale to represent <$12,500, $12,500-$29,999, $30,000-$59,999, $60,000-$99,999, $100,000-$149,999, $150,000-$199,999, and >$200,000 per year. Gender was coded on a 0-2 scale to represent females, males, and other. "Other" was dropped during analysis because its sample size was too small. Questions pertaining to opinions on the environment were divided into two groups: environmentally favorable and unfavorable. For the sake of data analysis, participants were categorized as environmentally inclined if they achieved an average score of 5 or higher on environmentally favorable questions and an average score of 3 or lower on environmentally unfavorable questions. Otherwise they were categorized as environmentally disinclined.

VII. Results and Discussion

Table 1: Definitions and clarifications for variable names used in survey and data analysis

Variable Name	Definition	Measurement Method
Choose Friendly	A participant's choice to purchase environmentally friendly cleaning products over conventional goods	1-5 scale; 1 being most unlikely and 5 being most likely
Choose Labeled	A participant's choice to purchase eco-labeled cleaning products over unlabeled goods	1-5 scale; 1 being most unlikely and 5 being most likely
Effectiveness	The relative effectiveness of an environmentally friendly product compared to conventional goods	1-5 scale; 1 being far less effective and 5 being far more effective
Environmental Opinion	A participant's opinion such that they are either environmentally inclined or disinclined.	Refer to pages 13-14 for methodology on dividing participants.
Label Attribute	Any emphasized component or information on an eco-label. Refer to page 13 for attributes measured in survey	1-7 scale; 1 being least important and 7 being most important
Price (when used in Linear Regression)	The price in USD of a product when participants chose one of four hypothetical cleaning products	Dollar amount between $3 and $6
Willingness to Pay	The price premium a consumer will pay for an environmentally friendly cleaning product over a conventional one measured in USD	Dollar and cent amount between $0.00 and $3.00

Table 2: Summary Demographics of Survey Respondents compared to the United States' Population for: (a) Gender (b) Age (c) Education (d) Income (e) Environmental Opinion

Population Characteristics	Survey Respondents	United States Population (2014)
a) Gender		
Female	53.25%	49%
Male	46.75%	51%
b) Age		
18-29 years	52.76%	17.6%
30-39 years	26.04%	13%
40-49 years	11.14%	14.2%
50-64 years	8.48%	19%
65 years and above	1.58%	13.1%
c) Education		
No High School Diploma or Equivalent	0.02%	9.42%
High School Diploma or Equivalent	10.65%	22.8%
Some College	33.73%	14.97%
Associate's degree	9.27%	7.16%
Bachelor's degree	34.52%	14.42%
Post Graduate Degree	11.64%	7.94%
d) Income		
Less than $12,500	13.41%	7.09%
$12,500 to $29,999	20.41%	15.18%
$30,000 to $59,999	29.59%	24.06%
$60,000 to $99,999	20.02%	26.31%
$100,000 and over	16.27%	28.04%
N/A	0.30%	
Mean Income Range	$30,000 to $59,999	

e) Environmental Opinion‡		
Environmentally Inclined	47.06%	
Environmentally Disinclined	52.94%	
‡ Refer to Table 1 for definition		

Although a small proportion of our survey participants were from outside the United States, the ratio of females to males was similar to that of the US population. 53% of participants were female and 47% were male. Approximately half of the participants were 18 to 29 years old. A majority of participants were either college students or graduates, due to the use of social media platforms to provide people with access to the survey. The mean income range was between $30,000 and $59,999, and most participants' incomes were below $100,000. 47% of participants were considered environmentally inclined while 53% were considered environmentally disinclined.

Table 3: Summary statistics for willingness to pay.

	Mean	**SD**
Willingness to Pay‡	1.42	0.91
‡ Refer to Table 1 for definition		

Table 4: Summary statistics for willingness to pay and income level based on gender.

	Willingness to Pay‡ (mean)	**Willingness to Pay‡ (std dev)**	**Income**	**Number of Participants**
Female	1.5	0.9	$30,000-$59,999	531
Male	1.31	0.89	$30,000-$59,999	494
‡ Refer to Table 1 for definition				

On average, survey participants are willing pay $1.42 more for an eco-labeled cleaning product. According to Table 3, females have both a higher average income and greater willingness to pay for environmentally friendly products compared to males. However, Table 10 shows that income

and willingness to pay do not have a statistically significant relationship. Therefore, the income discrepancy between genders does not explain the difference in their willingness to pay.
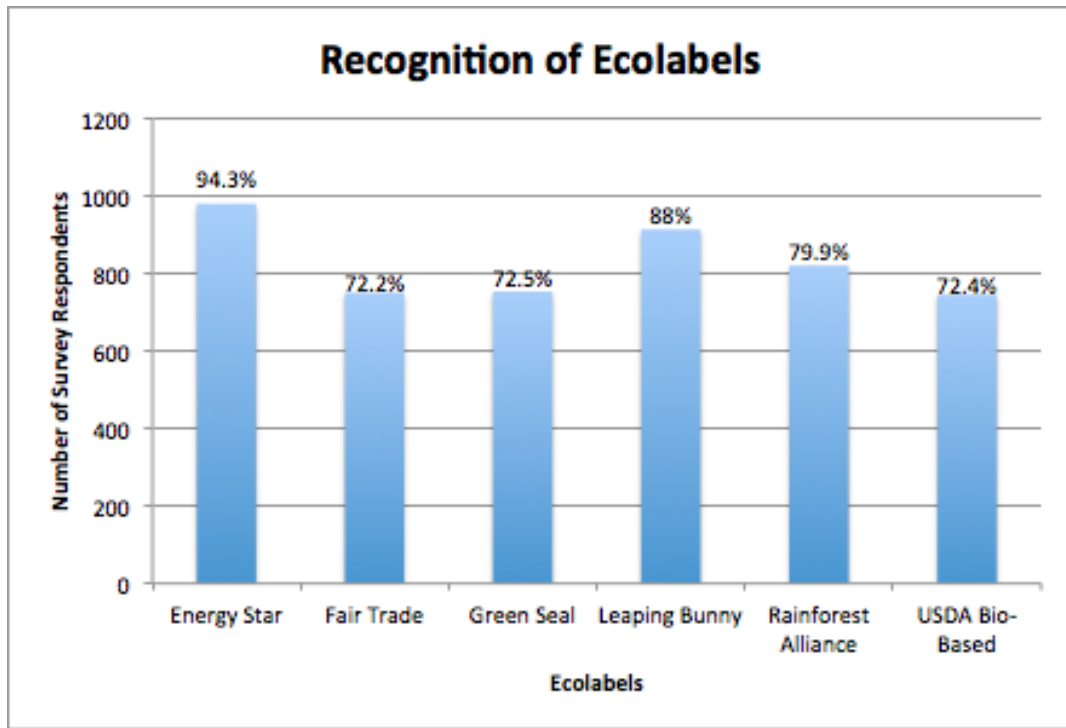
Figure 1: Recognition of Eco-labels

When presented with images of six eco-labels, participants recognized each label at least 70% of the time. Energy Star received the greatest recognition while Fair Trade, Green Seal, and USDA Bio-Based received the least.
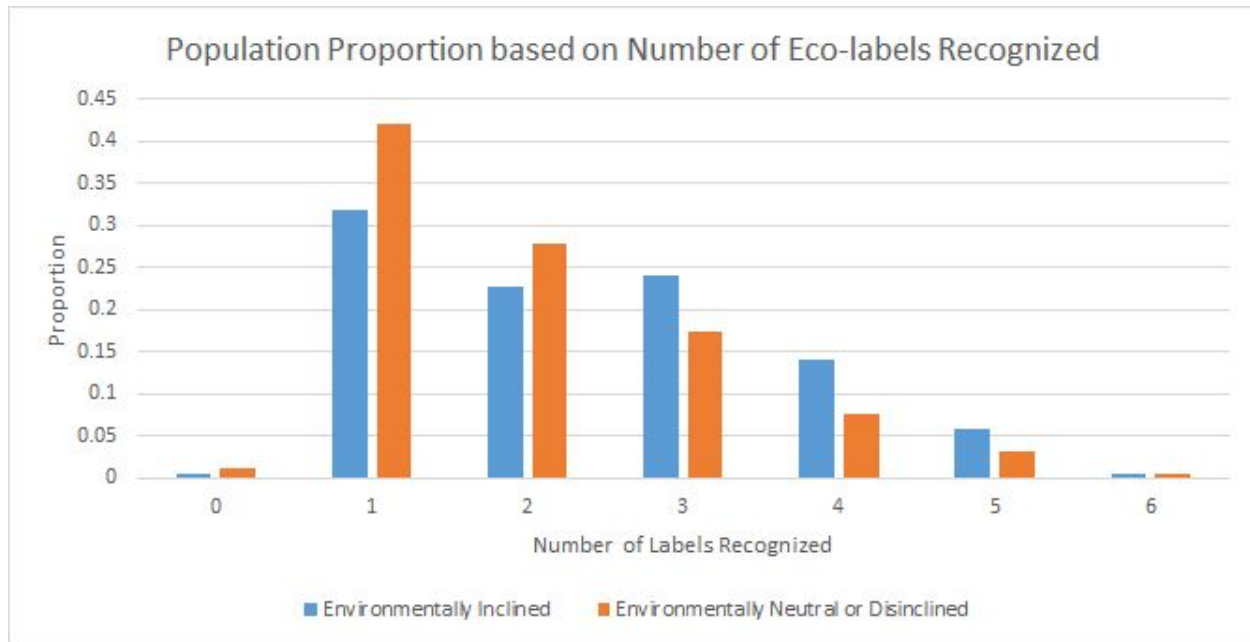
Figure 2: Graph of population proportion based on number of eco-labels recognized when presented with six publically known eco-labels. The blue bars represent environmentally disinclined participants and the orange bar represents environmentally inclined participants.

According to Figure 2, environmentally disinclined participants generally recognized fewer eco-labels compared to environmentally inclined participants. Participants who recognized two or less of these labels were more often environmentally disinclined. Those who recognized three or more eco-labels were more often to be environmentally inclined.

Table 5 : Summary Statistics for Label Attributes.

	Mean	SD
Brand	3.44	1.76
Biodegradable	3.86	1.85
Compostable	3.23	1.85
Env. Impact	4.24	1.81
Health	4.95	1.75
Nat. Deriv.	3.51	1.88
Price	5.62	1.44
Quality	5.96	1.23

Participants valued price and quality as the most important attributes out of the eight eco-label attribute options. Environmental impact and health also achieved a score greater than 4, with 4 representing a neutral opinion. Brand and compostability were the lowest ranked attributes. It is important to note the high variance in certain attributes: the standard deviation for compostability and naturally derived were over half the value for their means. Overall, this data suggests that consumers prefer cleaning products with eco-labels emphasizing product quality, cost effectiveness, and health safety.

Table 6: Percentage of instances when an attribute was ranked as most important

Label Attribute‡	Percentage
Price	25.55%
Quality	24.78%
Health	9.84%
Brand	1.06%
‡ Refer to Table 1 for definition	

When examining what consumers ranked as the most important attribute in a cleaning product, 25.55% of participants chose price, 24.78% chose quality, 9.84% chose health, and 1.06% chose brand as their top attribute preference. This data may indicate that price is the main motivation behind consumer's desire to purchase cleaning products. Brand was most likely chosen least often because of the natural association between brand and quality. Consumers may believe brand and quality are correlated when this is not always the case.

Table 7: Comparison of label attribute choices between age groups 18-29 and 30+. Highlighted cells indicate statistically significant results.

	Mean (Age 30+)	Mean (Age 18-29)	SD (Age 30+)	SD (Age 18-29)	t-statistic
Brand	3.29	3.58	1.81	1.7	-2.60*
Biodegradable	4	3.73	1.92	1.78	2.30*
Compostable	3.37	3.11	1.91	1.78	2.26*
Env. Impact	4.37	4.12	1.87	1.74	2.21*
Health	5.1	4.82	1.76	1.73	2.57*
Nat. Deriv.	3.69	3.35	1.91	1.85	2.80*
Price	5.53	5.71	1.46	1.41	-2.05*
Quality	5.97	5.95	1.2	1.26	0.24
* p<0.05 Total observations: 1037 ‡ Refer to Table 1 for definition					

Participants were divided between age groups to account for any generational differences in perception of eco-label attributes. All attributes except quality showed statistically significant differences in ranking. Older participants prioritized biodegradability, compostability, non-toxic, naturally derived, and environmental impact. Conversely, younger participants favored brand and price. Quality was scored similarly and as the most important attribute in both groups.

Table 8: Comparison of label attribute choices based on environmental opinion‡. Highlighted cells indicate statistically significant results.

	Mean (Inclined)	Mean (Disinclined)	SD (Inclined)	SD (Disinclined)	t-statistic
Brand	3.25	3.6	1.77	1.73	-3.16*
Biodegradable	4.14	3.6	1.89	1.76	4.65*
Compostable	3.4	3.09	1.91	1.75	2.65*
Env. Impact	4.65	3.87	1.74	1.78	6.99*
Health	5.09	4.84	1.77	1.73	2.27*
Nat. Deriv.	3.79	3.27	1.88	1.85	4.40*
Price	5.58	5.66	1.44	1.42	-0.89
Quality	5.97	5.94	1.26	1.23	0.38
* p<0.05 Total observations: 1037 ‡ Refer to Table 1 for definition					

Participants were then divided by environmental opinion to see if environmental inclinations affected the relative significance of certain attributes. Incidentally, environmentally inclined participants favored environment-related attributes such as environmental impact and biodegradability more than disinclined participants did. Brand was the only attribute more valued by environmentally disinclined participants. This is not an indicator that they are more likely to disregard labels surrounding health since the mean scores for other attributes are still higher than that of brand. Therefore, third party eco-label certifiers should consider the promotion of preferred product attributes like lower price and better quality for environmentally disinclined consumers.

Table 9: Comparison of environmentally inclined and disinclined‡ participants' beliefs for effectiveness of green products, their preference for green products, as well as their preference for a labeled or unlabeled product. Highlighted cells indicate statistically significant results.

	Mean (Inclined)	Mean (Disinclined)	Std Dev (Inclined)	Std Dev (Disinclined)	t-statistic
Effectiveness‡	2.76	2.73	0.69	0.77	0.656
Choose Friendly‡	3.16	2.89	0.69	0.66	6.32*
Choose Labeled‡	3.09	2.83	0.7	0.71	5.84*
* p<0.05 Total observations: 1037 ‡ Refer to Table 1 for definition					

Differences in environmental opinion were further applied to direct comparisons between environmentally friendly and conventional goods. Environmentally inclined participants were more likely to purchase environmentally friendly and labeled products over conventional goods. A participant's perceived effectiveness of environmentally goods compared to conventional products was independent of their environmental opinion.
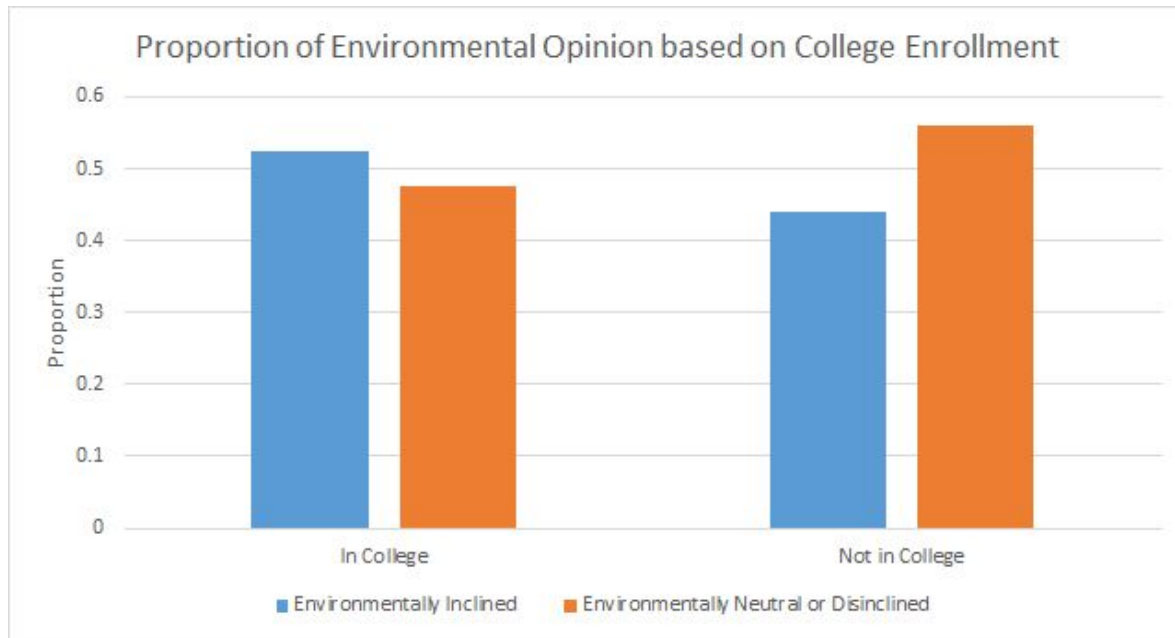
Figure 3: Clustered bar chart of proportion of environmentally inclined and disinclined individuals based on education level

Table 10: Comparison of willingness to pay between participants enrolled in college and participants not enrolled in college. Highlighted cells indicate statistically significant results. Thus, non-college participants were willing to pay more for environmentally friendly products.

	Mean (College)	Mean (Not college)	Std Dev. (College)	Std Dev. (Not college)	t-statistic
Willingness to Pay‡	1.34	1.46	0.88	0.92	-2.03*
* p<0.05 Total observations: 1037 ‡ Refer to Table 1 for definition					

Participants were then divided by college enrollment to see if college education and lifestyle affected not only environmental opinion but also willingness to pay. Participants who are currently in college consisted of more environmentally inclined people than any other education level. Environmental inclination declined after college. Participants not enrolled in college had a higher willingness to pay than college students. These results suggest that while participants enrolled in

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college have more favorable views of the environment, their hypothetical behavior may not necessarily support that opinion.

Table 11: Multiple linear regression of willingness to pay on environmental opinion, gender, income, and opinion on effectiveness of environmentally friendly goods. Dummy variables used were environmentally disinclined, just as effective, and male.

	Willingness to Pay	Willingness to Pay
	OLS	Tobit
Environmental Opinion‡	0.20***	0.25***
	(0.09 - 0.31)	(0.12 - 0.38)
Effectiveness: far less effective	-0.55***	-0.78***
	(-0.94 - -0.17)	(-1.31 - -0.26)
Effectiveness: somewhat less effective	-0.28***	-0.32***
	(-0.40 - -0.16)	(-0.46 - -0.18)
Effectiveness: somewhat more effective	0.44***	0.53***
	(0.26 - 0.63)	(0.30 - 0.75)
Effectiveness: far more effective	0.57***	0.70***
	(0.28 - 0.86)	(0.29 - 1.11)
Gender: Female	0.18***	0.22***
	(0.07 - 0.29)	(0.09 - 0.35)
Income	-0.00	-0.00
	(-0.00 - 0.00)	(-0.00 - 0.00)
*** p<0.01, ** p<0.05, * p<0.1 **Total observations: 1037** **Values in parentheses are 95% confidence intervals for slope of the predictor** **‡ Refer to Table 1 for definition**		

Multiple linear regression helped determine the relative impact certain variables had on willingness to pay because of their relationship to perception of environmentally friendly products. Other variables were included to verify results found in earlier analyses, such as Table 4. Ordinary least squares and tobit regression were used to account for limitations that could have been caused by confining the range of answers between 0 and 3 dollars. Aside from income, all regressed variables had a statistically significant impact on willingness to pay when compared against dummy variables. The tobit correction verifies these results and increases their magnitude. Most notably, participants who thought that environmentally friendly products were more effective than conventional products had a positive trend in their willingness to pay. On the other hand, people who thought that environmentally friendly products were less effective than their conventional counterparts displayed negative trends in their willingness to pay.

Table 12: Multiple linear regression of chosen bottle price on environmental opinion, gender, and other label attributes..
Dummy variables used were environmentally disinclined, male, and lack of a specific label.

	Price‡
Environmental Opinion	0.07**
	(0.01 - 0.14)
Biodegradable	0.28***
	(0.24 - 0.33)
Non-toxic	0.34***
	(0.29 - 0.39)
Powerful Formula	0.74***
	(0.71 - 0.78)
Gender: Female	0.09***
	(0.03 - 0.16)
Environmental Opinion x Biodegradable	0.04
	(-0.05 - 0.12)
*** p<0.01, ** p<0.05, * p<0.1 **Total observations: 1037** **Values in parentheses are 95%** **confidence intervals for slope of the** **predictor** **‡ Refer to Table 1 for definition**	

Multiple linear regression also helped determine the impact of each eco-label on chosen price of hypothetical cleaning products. All regressed variables except for Environmental Opinion x Biodegradable were statistically significant predictors of participant behavior in choosing bottles of a higher price. Powerful formula, an indicator of quality, was the most influential factor. The results agree with Table 4, because quality was shown to be the highest ranked attribute, while health and

biodegradability were ranked above the neutral score. This shows that for the above variables, participants' behavior generally matched their opinions when given hypothetical questions.

Those that were environmentally inclined were willing to pay on average seven cents more for a labeled cleaning product; however, it was not statistically significant that they were willing to pay more for a product with the label biodegradable.

Table 13: Analysis of specific bottle choice questions. Price attributes may have had no labels present or any combination of labels on the bottle. The percentages listed for biodegradable, non-toxic, and powerful formula include any time those labels appeared on an option, with or without another label present. Clear trends are observed with regards to price and number of labels on a bottle.

Option Attributes	Percentage Option was Chosen
Price	
$3	42.20%
$4	25.64%
$5	19.05%
$6	10.52%
Product Attributes	
Biodegradable Label	35.40%
Non-Toxic Label	35.38%
Powerful Formula Label	26.50%
Number of Labels	
Any One Label	13.19%
Any Two Labels	32.23%
All Labels	54.18%

A compilation of summary statistics was done to analyze responses from the first seven questions of our survey. These questions presented four different mock cleaning products, each with unique labels and prices. These mock products were randomized so each survey taker would see one of four different sets of seven questions. Each individual question had a bottle that was $3, $4, $5, and $6, and had labels that were randomly assigned to them. The randomization process ensured that no two bottles with the same qualities would appear in the same questions.

Despite the findings represented in Tables 5 and 12, when actually presented with options to choose from (compared to beliefs), we noticed that price and label quantity were the most commonly considered factor. Of all options, the option that was $3 was chosen 42.20% of the time, regardless of what labels, or lack thereof, were represented. As the prices of the options increased to $4, $5, and $6, the frequency they were chosen decreased to 25.64%, 19.05%, and 10.52%, respectively. Additionally, a similar trend was observed with the quantity of labels on products. An option with all three labels was chosen 54.18% of the time, while the options with two labels and one label were chosen 32.23% and 13.19% of the time, respectively.

The survey found that participants valued effectiveness in their cleaning products most out of any other attribute. However, when choosing a cleaning product in the survey, participants chose the bottle options with the indicator of quality, "powerful formula" least often. The attributes biodegradable and non-toxic were chosen more often. In spite of that, Table 12 shows that "powerful formula" had the largest impact on willingness to pay. This is another indicator that beliefs and behavior surrounding eco-labeled cleaning products differs in populations.

Based on these results, it is safe to assume people are considering the options they have, at least on a surface level. People favored lower prices, but they were willing to pay more for the added benefit of at least one label. When examining which labels people preferred, we found that the option chosen contained the biodegradable label or the non-toxic label almost exactly the same amount of times (35.40% and 35.38% respectively). Powerful formula was chosen 26.50%, which contradicts our earlier finding that people consider the quality of the product more than any other attribute when purchasing a product. Even so, the more participants trusted the effectiveness of an eco-friendly product, the more they were willing to pay for it. This indicates trust in product quality is a large factor for consumers when making purchasing decisions.

VIII. Recommendations and Limitations

Over the course of this project, we encountered several limitations to our research. First, during our randomization process, we did not consider the prices each label was associated with, and therefore the average prices for bottles with each label became disproportionate. On average, bottles containing powerful formula cost $4.91 as compared to bottles with non-toxic, which cost an average of $4.51, and biodegradable, which cost an average of $4.37. This may have affected our results for the additional amount of money people were willing to pay for products with the powerful formula label. An improvement for future studies utilizing hypothetical scenarios similar to our cleaning product selection would be to evenly distribute the labels across the price ranges displayed, instead of having the options completely randomized.

In addition, our team could have implemented different forms of statistical analysis other than linear regression. A number of different logit models were mentioned in our literature review, and it would have been helpful to have analyzed our data using those methods of analysis. By utilizing a greater range of analysis techniques, our team may have been able to uncover additional results from the survey data. A more in-depth knowledge of statistics would be recommended for future studies involving survey data.

While our team decided to test consumers' perceptions of eco-labels on clean products using a hypothetical scenario in our survey, it would be interesting to design a similar study using real-world products in a store. One of the advantages to utilizing real-world products at a store that involves survey participants spending real money is that the data collected to test their behavior is a better representation of reality. In tandem with this study, a more accurate assessment of consumer preferences would be established.

Another improvement would be to sample from a larger, more diverse pool of people. We had to rely on convenience sampling to fulfill the response quota due to budget limitations. For example, our reliance on using social media to distribute the survey likely introduced bias in our response. More objective and widespread methods of distributing the survey could be considered in future iterations of the study. Furthermore, our surveyed population was found to be more educated compared to the general US population (Table 1). Discrepancies in demographic factors suggest that our results on consumers' willingness to pay for environmentally friendly cleaning products may be optimistic. A greater number of survey participants would be necessary for the education and environmental inclination levels to regress to the general mean. In order to do so, additional resources would be needed to distribute more surveys on online platforms like Mechanical Turk.

Finally, the questions in the survey could be refined to give more conclusive results. For example, data such as income was simplified to number ranges instead of discrete numbers to simplify the survey and avoid infringing upon participants' personal information. Our ability to analyze the bottle questions of our survey was also limited because of the complex nature of the randomization. If there was a way to reduce ambiguity in these types of questions, there would be more definitive data to analyze.

IX. Conclusion

Our results have shown us multiple factors that influence consumer behavior. For example, an individual's environmental opinion can be correlated to their trust of different types of label certification. There are also statistically significant differences within demographics that affect an individual's willingness to pay a price premium for environmentally friendly cleaning products. Most notably, our results show that people are willing to pay for environmentally friendly products. Our findings indicate this price lies somewhere between $0.28 and $1.42 depending on the label presented. Furthermore, we see that a consumer's willingness to pay is affected by the product's perceived effectiveness. There is a positive correlation between the amount consumers are willing to pay and how much they trust the effectiveness of an environmentally friendly cleaning product. In addition, the consumers value the quality and effectiveness of cleaning products. This was indicated not only by their rankings of label attributes but also their valuation of effectiveness when choosing hypothetical cleaning products.

Based on these results, we recommend that producers and eco-label certifiers emphasize product quality and effectiveness on eco-labels to attract more consumer attention. There should also be a secondary emphasis on a product's price as consumers also valued that highly. However, an environmentally friendly market cannot thrive only on supply-side action; consumers can also test claims made on cleaning products with eco-labels by purchasing some themselves. Mobilizing consumers across all age groups to try these products, as seen in our survey, is one way to build consumer trust in the product's quality.

The data gathered in this study could prove to be important to engage consumers in purchasing eco-friendly goods. If we know which demographics buy or avoid eco-labeled products and the reasons behind their decisions, Green Seal can develop a strategy to target those audiences and potentially change consumers' purchasing behavior, thereby lowering our environmental impact .

X. Acknowledgements

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XII. Appendix

A. Tables and Figures

Figure 1: Sample eco-label images

Table 1: Population proportion based on number of labels recognized.

	0	1	2	3	4	5	6	Mean Score
Environmentally Neutral or Disinclined	0.004098	0.319672	0.227459	0.241803	0.141393	0.059426	0.006148	2.01
Environmentally Inclined	0.010929	0.420765	0.278689	0.174863	0.076503	0.032787	0.005464	2.40

Table 2: Comparison of trust for eco-label sources between environmentally friendly and unfriendly participants. * Indicates statistically significant results.

	Third Party	First Party	Governmental
Mean (Friendly)	4.75	2.77	5.31
Mean (Unfriendly)	4.49	3.04	4.86
Std Dev (Friendly)	1.42	1.56	1.39
Std Dev (Unfriendly)	1.45	1.67	1.55
t-value	2.87*	-2.65*	4.85*

Table 3: Comparison of label attribute choices across highest level of education achieved. * indicates largest value in each category. "Some High School" was omitted

	Brand	Biodegradable	Compostable	Env. Impact	Health	Nat. Deriv.	Price	Quality
Post-Grad	*3.76	*4.25	*3.57	*4.59	5.03	*3.76	5.47	5.91
Bachelor's	3.45	3.95	3.28	4.4	5.01	3.63	5.55	5.97
Associate's	3.52	4.02	3.38	4.32	*5.12	3.66	5.8	*6.04
Some College	3.22	3.63	3.04	4.01	4.87	3.28	5.69	5.96
High School Diploma	3.66	3.68	3.18	3.98	4.79	3.45	*5.71	5.93
Some High School	3	3.5	2.5	3.5	5.5	3	5	4

Table 4: Comparison of trust for environmentally friendly products between age groups 18-29 and 30+. * indicates statistically significant results

	Effectiveness	Choose Environmentally Friendly Good	Choose Labelled Good
Mean (Age 30+)	2.68	3.01	2.94
Mean (Age 18-29)	2.8	3.02	2.96
SD (Age 30+)	0.76	0.71	0.74
SD (Age 18-29)	0.71	0.68	0.69
t-value	-2.57*	-0.23	-0.44

Table 5: Summary statistics of willingness to pay across all age groups.

Age Group	18-29	30-39	40-49	50-64	65+
Mean	1.41	1.42	1.44	1.45	1.42
SD	0.85	0.97	1.03	0.93	0.96
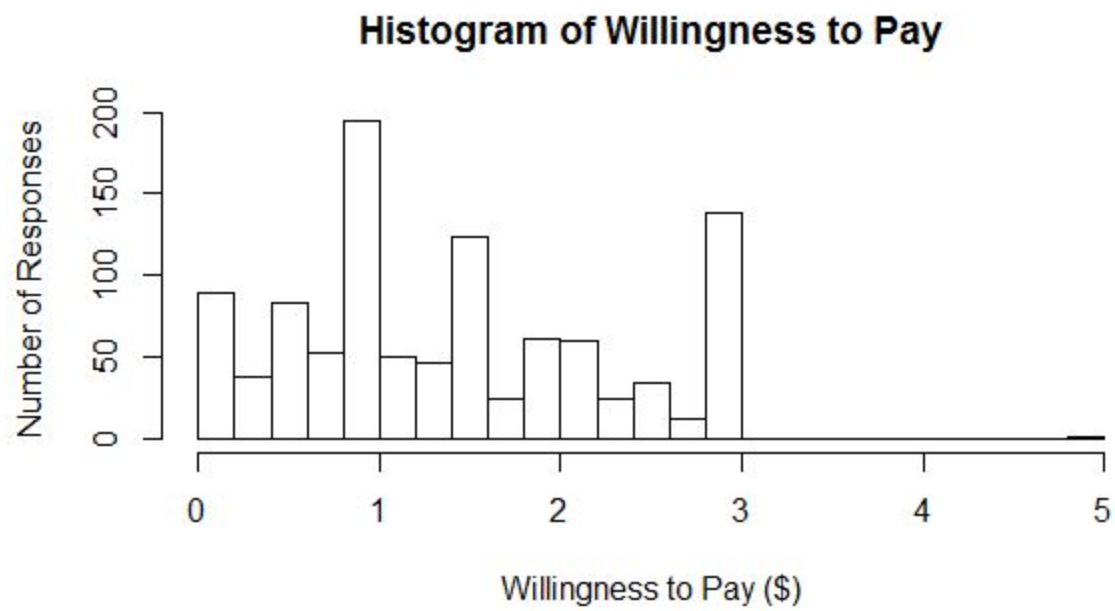
Figure 3: Histogram of willingness to pay (In USD)

Percentages of people who picked that bottle when it appeared						
	$3	**$4**	**$5**	**$6**		
Unlabeled	15.10%	1.53%	0.56%	N/A		
B	30.04%	8.20%	2.00%	1.69%		One-label option
NT	35.15%	12.26%	7.96%	1.95%		13.19%
PF	24.56%	8.06%	3.70%	1.86%		
B / NT	75.48%	53.70%	29.63%	19.50%		Two-label option
NT / PF	64.92%	54.10%	15.02%	10.50%		32.23%
B / PF	62.57%	25.35%	22.52%	5.90%		
All	88.53%	72.34%	54.24%	27.85%		All-label option
						54.18%
	Any $3 option	Any $4 option	Any $5 option	Any $6 option		
	42.20%	25.64%	19.05%	10.52%		

Black = 7 appearances	total of 224 bottles across all questions		
Dark Red = 6			
Red = 5			
Orange = 4		Label by label	
Purple = 3	B = Biodegradable	35.40%	
Green = 2	NT = Non-Toxic	35.38%	
Blue = 1	PF = Powerful Formula	26.50%	

Formula used: $(((a_1+a_2+...+a_N)/(177*N))+((b_1+b_2+...+b_N)/(83*N)))/2$

Where:

$a_{1,N}$ = **Number of people who chose that bottle when it appeared (Mturk)**

$b_{1,N}$ = **Number of people who chose that bottle when it appeared (Qualtrics)**

N = Number of appearanes that bottle had on the survey

177 = average amount of responses each question got (Mturk)

83 = average amount of responses each question got (Qualtrics)

Table 6: Shows the percentages of times people picked a bottle out of the total number of times it appeared. The same method was applied to specific labels, amount of labels, and price options available.

B. Survey

Random 1

You are at the grocery store and need to purchase household cleaner but your usual cleaner is out of stock. You will be shown 7 sets of 4 cleaning products. From each set, select the one you would most likely purchase.

Which product would you purchase? (1 of 7)

Which product would you purchase? (2 of 7)

Which product would you purchase? (3 of 7)

Non-Toxic CLEANER POWERFUL FORMULA Biodegradable	CLEANER	Biodegradable CLEANER	Non-Toxic CLEANER POWERFUL FORMULA	Would not purchase any
$5	$3	$4	$6	
○	○	○	○	○

Which product would you purchase? (4 of 7)

Biodegradable CLEANER	POWERFUL FORMULA CLEANER	Non-Toxic CLEANER POWERFUL FORMULA Biodegradable	Non-Toxic CLEANER	Would not purchase any
$3	$6	$5	$4	
○	○	○	○	○

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Which product would you purchase? (5 of 7)

Non-Toxic CLEANER POWERFUL FORMULA	Non-Toxic CLEANER	Biodegradable CLEANER POWERFUL FORMULA	Biodegradable CLEANER	Would not purchase any
$6	$4	$5	$3	
○	○	○	○	○

Which product would you purchase? (6 of 7)

Biodegradable CLEANER POWERFUL FORMULA	Non-Toxic CLEANER POWERFUL FORMULA Biodegradable	Non-Toxic CLEANER	CLEANER	Would not purchase any
$6	$4	$3	$5	
○	○	○	○	○

Which product would you purchase? (7 of 7)

POWERFUL FORMULA CLEANER	Biodegradable CLEANER Non-Toxic	Non-Toxic CLEANER	Biodegradable CLEANER POWERFUL FORMULA	Would not purchase any
$4	$6	$3	$5	
○	○	○	○	○

Random 2

You are at the grocery store and need to purchase household cleaner but your usual cleaner is out of stock. You will be shown 7 sets of 4 cleaning products. From each set, select the one you would most likely purchase.

Which product would you purchase? (1 of 7)

Biodegradable CLEANER Non-Toxic	CLEANER	Non-Toxic CLEANER POWERFUL FORMULA Biodegradable	POWERFUL FORMULA CLEANER	Would not purchase any
$4	$3	$5	$6	
○	○	○	○	○

Which product would you purchase? (2 of 7)

Non-Toxic CLEANER	Biodegradable CLEANER POWERFUL FORMULA	CLEANER	Non-Toxic CLEANER POWERFUL FORMULA Biodegradable	Would not purchase any
$4	$5	$3	$6	
○	○	○	○	○

Which product would you purchase? (3 of 7)

Biodegradable CLEANER	Non-Toxic CLEANER POWERFUL FORMULA	Biodegradable CLEANER Non-Toxic	POWERFUL FORMULA CLEANER	Would not purchase any
$4	$6	$3	$5	
○	○	○	○	○

Which product would you purchase? (4 of 7)

POWERFUL FORMULA CLEANER	Biodegradable CLEANER	Non-Toxic CLEANER	Non-Toxic CLEANER POWERFUL FORMULA Biodegradable	Would not purchase any
$6	$5	$4	$3	
○	○	○	○	○

Which product would you purchase? (5 of 7)

POWERFUL FORMULA CLEANER	Biodegradable CLEANER Non-Toxic	Non-Toxic CLEANER	Biodegradable CLEANER POWERFUL FORMULA	Would not purchase any
$5	$6	$3	$4	
○	○	○	○	○

Which product would you purchase? (6 of 7)

Biodegradable CLEANER Non-Toxic	Non-Toxic CLEANER POWERFUL FORMULA	Biodegradable CLEANER	POWERFUL FORMULA CLEANER	Would not purchase any
$3	$5	$4	$6	
○	○	○	○	○

Which product would you purchase? (7 of 7)

POWERFUL FORMULA CLEANER	Biodegradable CLEANER Non-Toxic	CLEANER	Non-Toxic CLEANER POWERFUL FORMULA Biodegradable	Would not purchase any
$3	$6	$4	$5	
○	○	○	○	○

Random 3

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You are at the grocery store and need to purchase household cleaner but your usual cleaner is out of stock. You will be shown 7 sets of 4 cleaning products. From each set, select the one you would most likely purchase.

Which product would you purchase? (1 of 7)

$4	$6	$5	$3	Would not purchase any
O	O	O	O	O

Which product would you purchase? (2 of 7)

$3	$4	$6	$5	Would not purchase any
O	O	O	O	O

Which product would you purchase? (3 of 7)

Biodegradable CLEANER Non-Toxic	Biodegradable CLEANER POWERFUL FORMULA	Non-Toxic CLEANER POWERFUL FORMULA	CLEANER	Would not purchase any
$5	$6	$4	$3	
○	○	○	○	○

Which product would you purchase? (4 of 7)

Non-Toxic CLEANER	POWERFUL FORMULA CLEANER	Biodegradable CLEANER Non-Toxic	Biodegradable CLEANER POWERFUL FORMULA	Would not purchase any
$6	$5	$3	$4	
○	○	○	○	○

Which product would you purchase? (5 of 7)

POWERFUL FORMULA
CLEANER
$3
○

Non-Toxic
CLEANER
$5
○

Biodegradable
CLEANER
$6
○

Non-Toxic
CLEANER
POWERFUL FORMULA
Biodegradable
$4
○

Would not purchase any
○

Which product would you purchase? (6 of 7)

Biodegradable
CLEANER
POWERFUL FORMULA
$4
○

Non-Toxic
CLEANER
$6
○

Non-Toxic
CLEANER
POWERFUL FORMULA
Biodegradable
$3
○

CLEANER
$5
○

Would not purchase any
○

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Which product would you purchase? (7 of 7)

Non-Toxic CLEANER POWERFUL FORMULA	Biodegradable CLEANER Non-Toxic	Biodegradable CLEANER POWERFUL FORMULA	CLEANER	Would not purchase any
$4	$6	$5	$3	
○	○	○	○	○

Random 4

You are at the grocery store and need to purchase household cleaner but your usual cleaner is out of stock. You will be shown 7 sets of 4 cleaning products. From each set, select the one you would most likely purchase.

Which product would you purchase? (1 of 7)

Non-Toxic CLEANER	Non-Toxic CLEANER POWERFUL FORMULA Biodegradable	CLEANER	Biodegradable CLEANER POWERFUL FORMULA	Would not purchase any
$3	$6	$4	$5	
○	○	○	○	○

Which product would you purchase? (2 of 7)

Non-Toxic CLEANER	Biodegradable CLEANER POWERFUL FORMULA	Biodegradable CLEANER	Non-Toxic CLEANER POWERFUL FORMULA	Would not purchase any
$5	$3	$4	$6	
○	○	○	○	○

Which product would you purchase? (3 of 7)

Biodegradable CLEANER Non-Toxic	POWERFUL FORMULA CLEANER	Non-Toxic CLEANER	Biodegradable CLEANER POWERFUL FORMULA	Would not purchase any
$3	$5	$4	$6	
○	○	○	○	○

Which product would you purchase? (4 of 7)

Biodegradable CLEANER Non-Toxic $5	Non-Toxic CLEANER $3	Biodegradable CLEANER POWERFUL FORMULA $4	POWERFUL FORMULA CLEANER $6	Would not purchase any
○	○	○	○	○

Which product would you purchase? (5 of 7)

CLEANER $4	Non-Toxic CLEANER POWERFUL FORMULA Biodegradable $5	Biodegradable CLEANER $3	Non-Toxic CLEANER POWERFUL FORMULA $6	Would not purchase any
○	○	○	○	○

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Which product would you purchase? (6 of 7)

Would not purchase any

Which product would you purchase? (7 of 7)

Would not purchase any

Cleaning products and labels

Which of the following labels do you recognize?

Energy Star	Fair Trade	Green Seal	Leaping Bunny	Rainforest Alliance
☐	☐	☐	☐	☐

When purchasing a household cleaning product (e.g., detergents or toilet cleaners), how do these rank in importance to you on a scale from 1-7?

	Not important at all						Extremely important
	1	2	3	4	5	6	7
Price							
Brand							
Naturally Derived							
Biodegradable							
Environmental Impact							
Health							
Quality / Effectiveness							
Compostable							

When purchasing a household cleaning product (e.g., detergents or toilet cleaners), how do these rank in importance to you?

Please type a 1, 2, and 3 into your top 3 choices.

[ ] Quality / Effectiveness

[ ] Environmental Impact

[ ] Health

[ ] Biodegradable

[ ] Compostable

[ ] Price

[ ] Brand

[ ] Naturally Derived

Compared to a conventional cleaning product, how effective do you believe environmentally friendly cleaning products are?

Far less effective	Somewhat less effective	Equally effective	Somewhat more effective	Far more effective
○	○	○	○	○

How often would you buy a product that is considered "green" or "environmentally friendly" over one that is not?

Never	Not often	Sometimes	Almost always
○	○	○	○

Approximately how often do you buy household cleaning products?

Once a year	Once every few months	Once a month	Multiple times a month
○	○	○	○

How often would you choose a household cleaning product labeled as "green" or "environmentally friendly"?

Never	Not often	Sometimes	Almost always
○	○	○	○

Products that are certified as green or environmentally friendly can obtain their certification from different types of organizations. In your opinion, how trustworthy is certification from the following organizations?

	Not trustworthy at all				Extremely trustworthy		
	1	2	3	4	5	6	7
Certification from a governmental program							
Certification from the company producing the product							
Certification from a third-party program or organization							

How much more money would you pay for a household cleaning product that is environmentally friendly?

	0	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3
Amount in dollars ($)													

Demographic questions

How old are you?

- ○ 18 - 29 years
- ○ 30 - 39 years
- ○ 40 - 49 years
- ○ 50 - 64 years
- ○ 65 years and above

What is your gender?

○ Female

○ Male

○ Other

Are you of Hispanic, Latino, or Spanish origin?

○ Yes

○ No

What is your race?

(Select all that apply)

☐ White

☐ Black or African American

☐ American Indian or Alaska Native

☐ Asian

☐ Native Hawaiian or Pacific Islander

☐ Other

What is the highest level of education you have completed?

○ No High School Diploma

○ High School Diploma or Equivalent

○ Some College

○ Associate's Degree

○ Bachelor's Degree

○ Post Graduate Degree

Are you currently enrolled in a College or University, or in some other type of educational program?

○ Yes

○ No

Which category represents the total combined income of all members of this HOUSEHOLD during the past 12 months?

○ Less than $12,500

○ $12,500 to $29,999

○ $30,000 to $59,999

○ $60,000 to $99,999

○ $100,000 to $149,999

○ $150,000 to $199,999

○ $200,000 and above

In what type of residence are you currently living?

○ College Dormitory   ○ Apartment or Condominium

○ Mobile Home   ○ Single-Family Home

What is the number of individuals in your household (including yourself)?

○ 1

○ 2

○ 3

○ 4

○ 5

○ 6 or more

What is the ZIP Code of your current residence?

(If you live outside of the United States, please enter your country.)

Rate the following statements on the extent to which you agree with them.

	Strongly Disagree				Strongly Agree		
	1	2	3	4	5	6	7
We are approaching the limit of the number of people the Earth can support.							
Humans have the right to modify the natural environment to suit their needs.							
Plants and animals have as much right as humans to exist.							
The balance of nature is strong enough to cope with the impacts of modern industrial nations.							
The so-called "ecological crisis" facing humankind has been greatly exaggerated.							
The balance of nature is very delicate and easily upset.							
If things continue on their present course, we will soon experience a major ecological catastrophe.							

Are you a member of any environmental organizations?

○ Yes

○ No

Comments

Please let us know if you have any comments on this survey or this topic and anything else you want to add.