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The Role of Respondent Certainty and Attribute Non-Attendance on the Willingness to Pay for the Attributes of Recyclable Aluminum Bottled Water

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Abstract

With the recycling constraints on traditional plastic bottles and environmental concerns regarding the volume of non-recycled plastic packaging, aluminum bottles and cans offer an environmentally-friendly alternative to packaging drinking water. This research utilizes a stated preference discrete choice experiment to measure consumers' willingness to pay for recyclable aluminum water bottles and their attributes. We find that the type of bottle top is crucial, with consumers willing to pay a premium for resealable aluminum water bottles compared to a plastic bottles but more for plastic bottles over aluminum cans with a non-resealable pop top. This provides insight into the potential for using recycled aluminum packaging in bottled water production to mitigate the volume of plastics in the environment. The application also examines model calibration to address choice certainty and inferred attribute non-attendance. Our findings also indicate that accounting for choice certainty and inferred attribute non-attendance can influence attribute coefficient estimates and marginal willingness to pay.

Keywords: willingness to pay, certainty, attribute non-attendance, discrete choice experiment

1. Introduction

There has been considerable growth in recent years in for-profit businesses with environmental or socially-defined missions (Schaltegger& Wagner 2011; Terán-Yépez, et al. 2020). While the primary goal of these purpose-driven businesses is to manufacture and sell products for profit, their products also provide larger societal benefits as a core component of their business strategy. Examples of such products range from well-established certified goods like Fair Trade coffee, dolphin-safe tuna, and cruelty-free cosmetics to small-scale locally sourced meat and produce. However, the costs of producing these more "environmentally friendly" products are typically greater than a nongreen competitor. As suggested by Pettie (2001), "the reality is not that these (conventional) products are unusually expensive, but that conventional products are unrealistically cheap since they are effectively subsidized by the environment."

Bottled water provides a relevant example of a good that is typically packaged in way to minimize costs at the expense of the environment. The production costs of a typical PET plastic bottle are approximately 5% of its retail price, yet the environmental damage can be considerable. Approximately 50 billion plastic bottles of drinking water are purchased every year in the United States with only 29 percent of these bottles recycled in 2018[1]. On a global scale, over 76 billion cases of bottled water are purchased annually (Ridder 2022). Consequently, millions of tons worth of polyethylene terephthalate (PET) plastics end up in landfills, waterways, and oceans each year, disrupting ecosystems and causing serious environmental impacts. Globally, it is estimated that 90 million tons of plastic ends up in oceans every year (Howard et al. 2018). The consequences of PET plastic waste streams end up being a significant externalized cost on society that can be felt locally, regionally, or when moved by ocean currents, within large marine ecosystems. Infinitely recyclable aluminum bottles provide a market alternative to purchasing drinking water in PET bottles with the highest recycling rate of any beverage container.

[1] See <https://www.earthday.org/fact-sheet-single-use-plastics/>

Understanding consumers' willingness to pay (WTP) for a new product and its attributes can be a critical component in assessing whether a new and more expensive substitute good can potentially be successful at market. Moreover, understanding whether consumers are willing to pay more or less for specific characteristics of a product (relative to a substitute good) can aid in assessing potential price premiums that can be charged for a good based on the differences in attributes relative to competitors (as well as providing important *ex ante* information for product design). Similarly, it benefits companies to gain a better understanding of the role of product information provided to potential consumers in understanding their preferences for novel product attributes.

There has been considerable research effort into consumer preferences for sustainable food products. Most of this literature focuses on eco-labels (Vlaeminck et al. 2014), organic labels (Xie et al. 2017), fair trade labels (Grunert et al. 2014), and local food manufacture (Darby et al. 2008). In general, findings suggest that consumers are willing to pay more for products that are labeled as "sustainable". For example, Gao et al (2020) use the contingent valuation method (CVM) to elicit consumer preferences for milk labeled as "produced with sustainable production method". They find that the premium consumers are willing to pay is about 40% above regularly produced milk. With respect to recycled products, some research demonstrates that there has been a shift in consumer interest towards preferences for greener and recycled products and that this behavioral shift provides new opportunities for product differentiation strategies (Tsen et al. 2006; D'Souza et al 2007). Guagnano (2001) further indicates that consumers express social responsibility through their purchasing of green products, while other research suggests that consumers are motivated in their purchasing decisions by environmental consciousness and social responsibility (Schifferstein and Oude Ophius 1998; Carrigan and Attalla 2001). In terms of a willingness to pay premium, Guagnano (2001) finds that 86 percent of surveyed respondents are willing to pay more for a common household good if it is made from recycled material.

Fewer studies have investigated the effects of the use of environmentally friendly packaging – defined as packaging that is easily recycled and is safe for individuals and the environment – in a valuation context. Some of this work investigates consumer responses to price increases due to environmentally friendly packaging. Overall, the results are mixed with some findings suggesting a negligible effect on demand (Prakash and Pathak 2017), while others indicate that the increase in price decreases purchasing intentions (Martinho et al. 2015). One study by Popovic et al. (2020) surveys 7,028 consumers in different countries around the world and asks whether consumers would be willing to pay more to purchase liquids (like milk or orange juice) in environmentally friendly packaging. They find that positive attitudes towards the environmental friendliness of the packaging act as a strong predictor for consumers' WTP for environmentally friendly packaging. In turn, ecoliteracy (understanding environmental logos) and ecofriendly lifestyle (habits and preferences towards environmentally friendly products) influence these positive attitudes. A similar study uses the contingent valuation approach to examine consumers' WTP for reusable containers for delivery food and find that WTP point estimates range from $1.92 to $2.18 per container depending on whether the customer has to return the container or if it's collected up by the delivery company (Schuermann and Woo 2022). Some studies have shown that consumers are willing to pay a premium for sustainable plastic alternatives (Zwicker et al. 2021; Zwicker et al. 2023). For example, Zwicker et al. (2023) develop an online survey to examine participants' attitudes towards different bottle packaging. They find that participants had positive attitudes towards, and self-reported a willingness to pay premium for, a bio-based plastic bottle.

This study uses stated preference (SP) discrete choice experiments (DCE) to examine consumer preferences for attributes associated with an aluminum water bottle or can relative to a traditional PET bottle. We contribute to the literature on consumer WTP for environmentally friendly products in two principle ways. First, we provide the first estimate of consumers' WTP for bottled water packaged in recyclable aluminum. As aluminum bottle products provide a substitute for PET plastic – but at a higher cost of production – WTP findings provide important information regarding the potential for recyclable aluminum bottled water to compete with traditional PET plastic bottles. Subsequently, this provides insight into the potential for using recycled aluminum packaging in bottled water production to mitigate the volume of plastics in the environment. Second, our DCE design estimates WTP for specific attributes of the recyclable aluminum water bottles and how those attributes may increase the likelihood of success at market.

This study utilizes data from a DCE. We conducted the DCE surveys on a sample of 586 US residents who currently consume bottled water. The design utilizes choice sets for the purchase of a single bottled water based in which consumers choose between 1) a resealable aluminum bottle, 2) a resealable plastic bottle, and 3) aluminum can with pop top. The design also includes attributes such as water type, the presence of an environmentally-motivated company mission via the removal of ocean-going plastic waste, and price. Attributes based on celebrity ownership of the product are also included to test the influence of a popular actor on support for an environmentally-motivated product.[2]

To address the potential for hypothetical bias in SP responses, we use an *ex ante* cheap talk script in combination with 1) *ex post* calibration of certainty statements; 2) *ex post* calibration using inferred attribute non-attendance (ANA); and 3) a combination of certainty calibration and inferred ANA. In SP experiments, without any actual economic commitment, hypothetical bias may occur as an individual is not incentivized to behave in the way they would in a real market (Harrison 2007, Hensher 2010). Research has investigated both *ex ante* and *ex post* methods to make experiments incentive compatible, or whereby respondents are better off to truthfully reveal their private information within the experiment.

The use of certainty statements is an *ex post* technique that asks respondents how certain they are that they would actually make the choice that they stated. Research has indicated that using only responses from respondents who are certain of their response has the potential to mitigate hypothetical bias, and when respondents are uncertain about their choice, their decision is less likely to be in line with choices made in real-world situations (Penn and Hu 2023). This is the motivation to use certainty scales in an attempt to reduce hypothetical bias. While certainty statements are used extensively in contingent valuation, far less attention has been put on their use in experiments. Promisingly, some studies have shown that analyzing certain responses brings results from hypothetical scenarios in line with real market behavior (Norwood 2005;

[2] Many environmentally friendly products are endorsed or owned by celebrities. Examples of celebrity endorsement or ownership include organic beauty products (Gwyneth Paltrow, Drew Barrymore, Miranda Kerr, Millie Bobby Brown), organic or sustainably sourced products (Woody Harrelson, Nikki Reed, Stella McCartney), and products using recycled materials (Pharrell and Jason Momoa).

Ready et al. 2010; Beck et al. 2013). With respect to WTP, Penn and Hu's (2023) meta-analysis of the literature on the use of certainty corrections finds that these approaches have the potential to completely address hypothetical bias. Also, Hindsley et al. (2020), using a seven-point Likert scale, find that *ex post* certainty calibration can lead to less variability in mean WTP estimates.

In DCE settings, there is also a phenomenon known as attribute non-attendance (ANA) – a type of choice behavior where respondents can ignore one or more attributes in DCE choice sets (see for example, Hensher, Rose, and Greene 2005; Scarpa et al. 2009; Hess and Hensher 2010; and Scarpa et al. 2013). Accounting for ANA has shown to have a direct impact on measures of WTP. While some studies have found that ANA methods decrease measures of WTP (Hensher, Rose, and Greene 2005; Campbell, Hutchinson, and Scarpa 2008; Campbell and Lorimer 2009; Puckett and Hensher 2008, 2009; Scarpa et al. 2013), there are also examples of ANA methods increasing WTP (Scarpa et al. 2010; Caputo et al. 2018). Numerous studies have noted that one reason ANA addresses hypothetical bias is that it calibrates estimates for the marginal utility of income by correcting the parameters on tax and fee (Koetse 2017; Hindsley et al 2020, Lew and Whitehead 2020). In other words, estimates of individuals' responses to changes in prices become more in line with real behavior.

Researchers have addressed ANA using both stated and inferred ANA methods. Stated ANA involves follow-up questions to respondents following each choice task (choice task stated ANA) or after all choice tasks (serial stated ANA). Inferred ANA models enable the empirical model to provide clues about ANA (Harrison, Naumenko, and Whitehead 2021). There are different potential approaches to modeling inferred ANA. One method requires choice model estimation and using distributions of coefficients to impose ANA on re-estimated models (Harrison, Naumenko, and Whitehead 2021). Another method of inferred ANA is to estimate a latent class model and impose attribute coefficient constraints to identify the probability that a survey respondent will ignore attributes (Scarpa et al. 2009). We follow Campbell, Hensher, and Scarpa (2011) and control for inferred ANA using an equality constrained latent class model (ECLC).

In total, four models are estimated, comparing a baseline model without an *ex post* correction to three combination of approaches to address choice certainty and inferred ANA. The four models are a (1) a baseline model; (2) an inferred ANA model; (3) a certainty model; and (4) a certainty with inferred ANA model. Our approach to make coefficients conditional on both choice certainty and ANA builds upon work by Hindsley, Landry, and Morgan (2020). We deviate from their approach by incorporating inferred ANA rather than stated ANA. Our survey employs certainty measures for each choice set and inferred ANA to assess the impacts of choice uncertainty and attribute non-attendance on parameter estimates and welfare measures.

Results from mixed logit models show varied results regarding the influence of product attributes on individual preferences and WTP values. The most striking result is with respect to the bottle/can and top attributes. The results show that – relative to plastic – consumers prefer aluminum bottles with a resealable top. Conversely, they prefer plastic packaging over aluminum if the aluminum bottle has a pop top. Clearly, the type of top (resealable versus pop top) is important to the consumer. Findings show, compared to a 16 fluid ounce (oz) plastic bottle, consumers are willing to pay approximately 55 cents more for an aluminum bottle with a resealable top. Conversely, consumers are willing to pay approximately 30 cents more for a 16 oz plastic bottle compared to an aluminum bottle if it comes with a pop top. For the eco-friendly "Buy One, Remove One" campaign for a brand, consumers are willing to pay an additional \$0.34 to \$0.55 per 16-oz container. Findings on the "celebrity effect" are mixed. In some model specifications, having a celebrity endorse the sustainable product has no influence on preferences. In others, the celebrity effect negatively influences consumer preferences and consumers exhibit marginal willingness to pay (MWTP) for the product with a celebrity association.

In terms of *ex post* certainty calibration, when accounting for choice certainty, most coefficient estimates are larger in absolute value for certain respondents relative to uncertain ones. As a result, MWTP estimates were generally higher for the certain group. We also observe that accounting for certainty in joint certainty/choice models has mixed effects on coefficient estimates. Marginal utilities for the resealable aluminum bottle and Buy One, Remove One social mission increase for both certain and uncertain respondents, while the disutility associated with the pop-top can decreases (increases) for certain (uncertain) respondents. Both certain and uncertain respondents also exhibit a marginal disutility toward a celebrity endorsement and a positive MWTP for a product that is not associated with a celebrity in any way.

2. Survey Design

The main focus of the survey is the discrete choice experiment (DCE) used to elicit bottled water consumers' WTP for different attributes of bottled waters, including relatively new entrants to this space in the form of pop-top aluminum cans and twist top aluminum bottles. To explore heterogeneity in decision making, the survey instrument also collects information related to bottled water consumers' purchasing behavior, attitudes and preferences toward attributes of aluminum bottles, and sociodemographic information. All survey respondents communicated that they purchase bottled water. We excluded any respondent who responded that they did not purchase bottled water from the survey sample.

The online survey was administered through the Prolific platform for online survey participants. Prolific selected a sample of 586 participants residing in the United States who were chosen to have approximately the same distribution of age, sex, and ethnicity as the general population of the United States (based on data from the last census). Survey participants were paid for their time in completing the survey.

Once respondents answer consent questions for the survey, they are asked to select their appropriate age bracket. A similar age-related question is also repeated at the end of the survey. Any respondent with solicited ages that did not match across both questions was removed from the survey.

The first section of the survey examines respondents' revealed preferences for bottled water in terms of quantities and brand types. To establish a revealed preference baseline level of quantity and price, respondents are provided with a bottled water brand list and asked to indicate the quantities of each brand that they purchased over the last two-week period. Table 1 presents the average response, by brand. Over 34 percent of respondents indicate that they purchase a store brand with Aquafina and Dasani as the most consumed brands with 11.9 percent and 9.7 percent, respectively. In terms of price and to be in line with the follow-up SP DCE questions, respondents are asked a series of questions to establish the price they would pay for a 16 oz plastic water bottle. Respondents are taken through a step process asking if they'd pay more or less than a specified amount. Once a potential range for a price is established, they are asked to state the price they'd pay for a 16 oz plastic bottle within that range. Respondents are also asked how they typically purchase bottled water. Table 2 provides details on responses for these questions. Forty-five percent of respondents buy their bottled water in bulk at a grocery store, while 22 percent purchase individual bottles for convenience. A further 32 percent of respondents purchase bottled water in both bulk and individually.[3] Across all consumers, the average price is $1.08 for a 16 oz bottle. The average price per bottle is $0.89 for those who only buy in bulk, $1.18 per bottle for those who buy individual bottles and bulk, and $1.34 for those who only buy single bottles. Figure 1 depicts a density plot capturing price that respondents pay for – or are willing to pay for – any 16 oz plastic bottle of water. Figure 2 provides density plots for those respondents who only buy in bulk, those who buy single bottled waters and bottled water in bulk, and only single bottled waters.

Next we provide respondents with a series of statements regarding beliefs on the use of plastics in product manufacturing with five-point Likert scale responses (ranging from "Strongly disagree" to "Strongly agree"). Figure 3 summarizes responses. Ninety-two percent of respondents either agree of strongly agree that plastic has a negative effect on the coastal and marine environment. Eighty-eight percent and 82 percent agree or strongly agree that businesses should reduce the amount of plastic used in products, and that we should act to physically remove plastic from the natural environment, respectively. Only 23 percent and 11 percent think that the use of plastics in consumer products and that the environmental impacts of plastics is acceptable, respectively.

2.1 Description of the Discrete Choice Experiments

[3] Respondents that indicate that they do not purchase bottled water and are taken to the end of the survey.

The second element of the survey is the DCE. The DCE script begins by informing respondents that they are going to be asked a series of questions regarding their willingness to purchase a single, 16 oz water from the refrigerated section of a retail store. In each choice set, respondents are asked to choose between three generic bottled water brands (Brand A, B, or C). By design, all three options in each choice set will be for either a 16 oz plastic bottle with a resealable top, a 16 oz aluminum can with a pop top, or a 16 oz aluminum bottle with a resealable top, in no particular order (see Figure 4). The DCE design also includes water type, removal of ocean-going plastic associated with each bottle purchased ("Buy One, Remove One"), a celebrity company ownership attribute, and product price. The survey provides a series of informational screens that describe the attributes and levels of the bottle/can types. The script uses a combination of pictures and written descriptions of attributes.

The first attribute references the type of bottle or can (plastic or aluminum) and top (resealable top or pop-top). Each bottle type includes a picture of the bottle/can. For the plastic bottle with resealable top, we inform respondents that this is the most common option for retail bottled water and comes in the form of polyethylene terephthalate (PET) plastic. For the aluminum can with a pop top, we inform respondents that the cans are made from aluminum and allow for a convenient way to drink water but that they cannot be resealed for drinking in multiple time periods. Finally, for the aluminum bottles with resealable twist tops, we communicate that the resealable bottles are made from aluminum and the resealable twist top allows for a convenient way to drink water that can be resealed for drinking in multiple time periods.

The next attribute is the type of water in the form of 1) purified water or 2) spring water. Purified water is described as "water that has been produced by distillation, deionization, reverse osmosis, or other suitable processes while meeting the definition of "purified water" in the U.S. Pharmacopeia. Some types of purified water use multiple methods of purification". Spring water is "water that is derived from an underground formation from which water flows naturally to the surface of the earth. The water is treated following collection from this source".

Our next attribute refers to the potential for removal of plastic from the environment if a certain brand is purchase (termed "Drink One, Remove One"). This attribute has two levels – the presence and absence of the mission driven program. Under “Drink One, Remove One”, we inform respondents that “When you buy a water bottle or can, the company producing the water bottle/can will remove the equivalent of 1 plastic bottle from ocean-going waste or landfills for each bottle purchased. Removal of plastic occurs in numerous locations internationally including developing countries on the coast”. The alternative option has no plastic removal from the environment and “the purchase of the water bottle or can will not be associated with removal of plastic from the environment”.

The next attribute refers to celebrity ownership. We use Jason Momoa – a well-known actor with strong environmental interests – as the celebrity owner. The attribute on celebrity ownership has two levels. In the survey, respondents are shown a picture of Jason Momoa together with text explaining his role in the brand. Specifically, respondents are told that:

> “Owner Jason Momoa. Jason is not only an actor but also an actor-vist. The things that Jason likes are making movies and drinking clean water. Among the things Jason doesn’t like is single-use plastics because he believes they’re really bad for the natural environment and the ocean. Jason is the founder of a company with a mission to eliminate single-use plastics by providing drinking water in recyclable aluminum cans. He supports aluminum cans/bottles because 1) consumers recycle them at a higher rate than PET plastic bottles, 2) producers use more recycled aluminum in the production of new aluminum cans/bottles than they use recycled plastic in the production of new plastic water bottles, and 3) cans/bottles made from aluminum have less impact on the natural environment when compared to products made from plastics.”

We inform respondents that there are two levels for the celebrity ownership attribute. Either a brand is associated with celebrity ownership or that the brand is not owned or promoted by a celebrity actor-vist. The celebrity ownership attribute is conditional on the water bottle/can type. Celebrity ownership is only available for the aluminum pop-top can and the resealable aluminum bottle alternatives.

The final attribute is price. We tell respondents that this represents the price of a single 16 oz plastic or aluminum bottle or can of water in US dollars. Then, via an abbreviated cheap talk script, we communicate that “research studies have shown that when people are asked about whether they are willing to pay for something like this they often say yes to a specific choice at the time they are surveyed, but later think that they should have made a different choice. This can be for a good reason, as people later realize that this would take money away from other things that are important to them. So, when considering your willingness to purchase bottled water in a retail environment such as a retail or convenience store, please think carefully about whether the choice you make reflects what you would do in a real situation”. Our approach follows the findings of Penn and Hu (2019) who show that cheap talk scripts more effectively reduce hypothetical bias in the context of public goods (where the presence of hypothetical bias tends to be more prevalent), when used with a budget reminder and in conjunction with other strategies to mitigate hypothetical bias. As we discuss below, we also utilize certainty scales and inferred ANA to mitigate hypothetical bias. While bottled water is a private good, there are public goods components to recyclable aluminum packaging and a “Buy One, Remove One” campaign.

Before the DCE, respondents are asked to state the level of importance, on a five-point Likert scale ranging from “Unimportant” to “Very Important”, the level of importance each attribute type just described. Table 3 shows the percent of respondents that ranked the importance of each attribute as “Important” or “Very Important”. As expected, price is ranked as the most important attribute. The type of bottle top is ranked as the next most important with almost three-quarters of respondents stating that the top is either important or very important. The bottle/can type (aluminum versus plastic) and the “Buy One, Remove One” attributes also rank highly with respondents. Very few respondents identify celebrity ownership as important.

Respondents are then told that they will be presented with a series of choices regarding bottled water products and their attributes. Given the number of attributes and the different possible levels (see Table 4), it is impractical to implement a full factorial design. Therefore, we use a fractional factorial design optimized based on D-error. The optimal design is determined with the Ngene software package (Choicemetrics 2018). As part of an iterative design process, we conducted a pilot study of 100 respondents. The pilot study data is used to calculate parameter estimates for use as fixed priors in an efficient discrete-choice experimental design. The efficient design attempts to lead to parameter estimates that minimize standard errors.[4]

In each choice set, there are three brands for respondents to choose from (Brand A, B, and C) – either a 16 oz plastic water bottle with a resealable top, a 16 oz aluminum bottle with a resealable top, or a 16 oz aluminum can with a pop-top. In each choice set, all three brand alternatives are always provided as a possible choice to the respondent. Using this approach, we constructed five blocks of six choice sets – yielding 30 unique choice-set scenarios. In practice, each individual respondent is randomly assigned to 1 of the 5 blocks and then faces six choices between brand options. Figure 5 depicts an example of one choice-set scenario randomly presented to a respondent. Each of the six choice sets like the one shown in Figure 5 varies the attributes presented to the respondents. The different possible levels of attributes are shown in Table 4.

After each of the six choices, respondents are asked a follow-up certainty question. The question asks "given the product option that you chose, on the following scale, how certain are you that you would make that choice?" Potential answers are on a five-point Likert scale, ranging from "very unlikely" to "very likely". There has been much discussion in the stated preference literature on the use of certainty scales (Champ et al. 1997; Norwood 2005; Lundhede et al. 2009; Brouwer et al. 2010; Ready, Champ, and Lawton 2010; Beck, Rose, and Hensher 2013; Fifer, Rose, and Greaves 2014; Rose, Beck, and Hensher 2015; Beck, Fifer, and Rose 2016; Dekker et al. 2016) to address hypothetical bias in stated preference models. In a meta-analysis of the literature, Penn and Hu (2023) find strong evidence that certainty follow-up can completely address hypothetical bias and in some cases may overcorrect for it.

A pilot survey was completed on March 9, 2022. Based on data collected from the pilot surveys, amendments were made to the survey design. The full survey was completed on March 21 and 22.

[4] The Ngene software develops an efficient design by determining the optimal asymptotic variance-covariance matrix using the experimental components and prior information about parameter estimates, as determined from the pilot study. We used the D-error measure for the multinomial-logit model to determine our efficient design. Our model's D-error efficiency measure was 0.2233.

3. **Methodology**

We analyze SP data representing individuals' discrete choices between bottled water alternatives. We utilize these SP choices to analyze individuals' preferences for the attributes of bottled water with a random utility model (RUM) (McFadden 1974). The utility (U_{njt}) for a given bottled water alternative *j* to person *n* on the *t* choice occasion is the sum of a deterministic portion of utility (V_{njt}), which captures observable attributes, and a stochastic (ε_{njt}) that constitutes the unobserved component of utility, such that

$$U_{njt} = V_{njt} + \varepsilon_{njt}. \quad (1)$$

If we represent utility to be linear in observed attributes for each alternative *j* and the corresponding parameters, β, this becomes

$$U_{njt} = \sum_{k=1}^{K} \beta_{nk} x_{jtk} + \phi p_{jt} + \varepsilon_{njt}, \quad (2)$$

where the utility associated with a bottled water is a function of the linear combination of the unknown parameters for the water bottles, β_{nk}, model attributes, x_{njtk}, the unknown price parameter, ϕ, and the price of the bottled water, p_{jt}. In (2), the unobserved component of utility, ε_{njt}, is the idiosyncratic error that exhibits an i.i.d. Gumbel distribution. Given the unobserved elements of utility, we consider an individual n choosing alternative j is

$$P_{njt} = P\left(\sum_{k=1}^{K} \beta_{nk} x_{jtk} + \phi p_{jt} + \varepsilon_{njt} > \sum_{k=1}^{K} \beta_{nk} x_{itk} + \phi p_{it} + \varepsilon_{nit};\ \forall i \in J\right). \quad (3)$$

In this paper, we use the mixed logit model (MXL), which allows for preference heterogeneity (Train 2009). Under the MXL model, the marginal utility for attribute k is

$$\beta_{nk} = \underline{\beta}_k + \theta_k z_n. \quad (4)$$

In (4), $\underline{\beta}_k$ is the mean for the distribution of parameters, θ_k represents the spread of preferences around that mean, and z_n represents random draws from a specified distribution for each individual, *n*. We utilize 1000 halton draws from a normal distribution for each individual.

The probability that respondent *n* in choice task t is observed to choose alternative j is

$$P_{njt} = \int_{\beta} P_{njt}(\beta) f(\beta|\theta) d\beta \tag{5}$$

where $f(\beta|\theta)$ is the probability density function of β, given the distributional parameters θ.

The integral in (5) has no closed form solution, so we use simulation to approximate the model. We compute the simulated log-likelihood function using the expected probability computed from (5) using 1000 halton draws. The simulated maximum likelihood model is

$$SLL = \sum_{n=1}^{N} log\, log\, E\left(\prod_{t \in T} \prod_{j \in J} \left(P_{njt}\right)^{y_{njt}}\right). \tag{6}$$

We take a systematic approach to mitigating hypothetical bias by estimating multiple models shown to reduce this bias. First, our analysis mitigates hypothetical bias through the joint estimation of both choice and choice certainty (Beck, Fifer, and Rose 2016; Hindsley, Morgan, and Landry 2020). In SP studies, a range of issues related to survey design, strategic response, and uncertainty can lead to biased estimates of economic value. One meta-analysis of the empirical literature estimated the average upward hypothetical bias in SP studies at factor of 1.96 (Penn and Hu 2018). Economists have developed a variety of *ex ante* and *ex post* methods to mitigate this bias. In SP studies, Beck, Fifer, and Rose (2016) show certainty statements, or scales, can mitigate bias in DCEs when compared to real payments. A meta-analysis by Penn and Hu (2023) makes similar conclusions for the larger stated preference literature and Penn and Hu (2023) find corrections using certainty scales to be efficacious. Our approach uses certainty scale questions at the bottled water choice-task level and applies inferred ANA for individual attributes.

In application, respondents' hypothetical choices are more likely to diverge from their real choices when they are uncertain. This uncertainty may manifest itself due to preferences or choice context (Dekker et al. 2016; Landry 2017). We account for choice certainty by modeling choice and uncertainty simultaneously (Rose, Beck, and Hensher 215; Beck, Fifer, and Rose 2016; Hindsley, Landry, Morgan 2020). We demarcate certain and uncertain choices using an ex post 5-point Likert scale question (from “1 = very uncertain” to “5 = very certain”) with uncertain responses represented by 3 or lower and certain responses captured by 4 and 5.

Following Campbell, Hensher, and Scarpa (2011), we control for inferred attribute non-attendance (ANA) using a latent class model with fixed coefficients across classes – often called the equality constrained latent class model (ECLC). Campbell, Hensher, and Scarpa (2011) estimate separate classes of respondents with different combinations of ignored attributes. Class probabilities provide estimates for respondents who ignore different combinations of attributes. The estimated class probabilities can then be used to assign observations to attending and non-attending classes. Multiple studies use ANA to mitigate bias in cost coefficients and attribute it to hypothetical bias (Koetse 2017; Hindsley, Landry, and Morgan 2022). Downward bias in cost coefficients leads to upward bias in willingness to pay.

Our approach also builds upon work by Hindsley, Landry, and Morgan (2020) by making coefficients conditional on both choice certainty and attribute non-attendance. We deviate from their approach by incorporating inferred ANA rather than stated ANA. The general structure of this approach estimates the following choice model

$$U_{njt} = \sum_{k=1}^{K} \sum_{c=0}^{C} \sum_{a=0}^{A} \beta_{nk|ac} x_{njtk} + \sum_{c=0}^{C} \sum_{a=0}^{A} \phi_{1|ac} p_{jt} + \varepsilon_{njt}, \quad (7)$$

where utility is a linear combination of unknown parameters and attributes seen in equation 2. This generalization allows for the base model (c = 0 & a = 0) as well as conditioning based on certainty (c = 1; c = 2) and/or inferred attribute non-attendance (a = 1). For application of the certainty scale, the estimated parameters can be conditional on respondents’ choice certainty (c = 1) or on a lack of choice certainty (c = 2). With inferred ANA, our model accounts for attended attributes (a = 1).

We use the SP model to estimate willingness-to-pay values for bottled water attributes. We estimate the willingness-to-pay for attribute k as

$$WTP_k = \frac{\beta_k}{\beta_c} \quad (8)$$

such that, β_k represents the coefficient for attribute k and β_c represents the bottled water cost coefficient.

4. Results

A total of 586 respondents took the survey. After eliminating incomplete responses, there are 462 usable observations for analysis. Respondent descriptive statistics are provided in Table 5. Fifty percent of respondents are male, with 68 percent Caucasian. The average income across the sample is approximately $73,000, with 34 and 3 percent earning a college degree or Ph.D., respectively. The average respondent is 44 years of age with 2.6 persons living in their household.

We estimate four mixed logit models. The four models are a (1) a baseline model; (2) an inferred ANA model; (3) a certainty model; and (4) a certainty with inferred ANA model. Results across all models are presented in Tables 6 and 7. Using McFadden's R-square and AIC, the preferred model fit can be evaluated. Comparing model fit using McFadden's R2 suggests that both inferred ANA models are preferred. The overall fit using the AIC criterion indicates that the inferred ANA model is best.

In all models, we find the influence of the price of a water bottle/can to be negative and statistically significant ($p<0.01$). Simply put, this means water bottle/can consumers prefer products with a lower price – a result that is consistent with economic theory.

The first model – the baseline model – has no controls for uncertainty or attribute non-attendance. The important finding regarding consumers' preferences for attributes of a recyclable bottle/can are reflected in their marginal utility or disutility associated with the presented attribute types. With resealable plastic bottles as the omitted dummy for bottle type, the positive coefficient on aluminum resealable bottles indicates that consumers have a strong preference for this resealable bottle type relative to resealable single-use plastic. This result is robust across all models. However, consumers prefer resealable single-use plastic bottles to aluminum cans with a pop top. Combined, this implies that the top is a very important attribute in consumers' decision making, with a clear preference for a resealable top over a pop top. So much so, that all else equal, on average they prefer plastic bottles with resealable tops over aluminum if the aluminum cans are not resealable. This finding aligns with the pre-DCE attitudinal questions in which the type of bottle top is ranked as the most important attribute after price, with almost three-quarters of respondents stating that the top is either important or very important. The importance of the resealable top to consumers is likely driven by the ability to consume water across multiple time periods but also to reuse the bottle at a future point in time. With respect to the resealable and non-resealable aluminum attributes, we also find large, statistically significant standard deviations for these parameters, indicating preference heterogeneity for these products among individuals.

Respondents also indicate a strong preference for purchasing a product if it's associated with our proposed social mission – here in the form of removing a used plastic bottle from the system upon purchase of the chosen product. The positive impact on consumer preferences provides important feedback to companies that promote a social mission with their product. With respect to the type of water, "water type" is coded as equal to one for spring water, zero otherwise. We do not find that spring water influences respondents' choices in the baseline model, however this result is not consistent across all models, although we do find heterogeneity in preferences around the mean. In the baseline model, celebrity ownership has no influence on bottled water preferences – a result that doesn't hold across all models.

Mean willingness to pay (MWTP) estimates are presented in Tables 8 and 9. All MWTP estimates are for 16 oz bottled or canned water. Confidence intervals for the mean MWTP estimates are calculated using the Delta Method and presented along with the means. We also use the complete combinatorial approach to perform statistical tests on the differences in the empirical distributions of MWTP estimated using the Krinsky-Robb procedure (Poe, Girard, and Loomis 2005). The complete combinatorial procedure assesses differences by comparing every MWTP estimate generated from the Krinsky-Robb parametric bootstrapping procedure.

From the full baseline model, consumers will pay, on average, $0.52 [95% CI: $0.43, $0.61] more for a 16 oz resealable aluminum bottle compared to a 16 oz resealable plastic one. However, with respect to aluminum pop-top cans, consumers' MWTP is negative. That is, consumers will pay $0.33 [95% CI: $0.24, $0.43] more for a resealable plastic bottle than an aluminum can if it has a pop-top. If consumers are educated with respect to the "Buy One, Remove One" campaign for a brand, they are willing to pay an additional $0.34 [95% CI: $0.28, $0.38] for the product relative to one without such a campaign. Overall, MWTP estimates results provide important feedback for the design of a new environmentally friendly product to be successful at market but also the need for marketing to educate consumers about the product and its social value. For example, when purchasing a bottled water, consumers would need to be familiar with the Buy One, Remove One campaign.

The second model accounts for inferred ANA. Based on the AIC criterion, this is the preferred model. In comparison to the baseline results, the inferred ANA model produces a larger marginal utility of income and mixed differences to attribute coefficients. This further produces differences in MWTP estimates when compared to the baseline model. The marginal utility associated with the resealable aluminum bottle is greater in the inferred ANA model but weakens for the plastic bottle when compared to the pop top aluminum can. Accounting for inferred ANA, consumers also exhibit a marginal disutility towards the brand associated with celebrity ownership. In terms of MWTP, there are no statistically significant changes with regard to bottle/can attributes. However, the MWTP for the Buy One, Remove One campaign increases from $0.34 [$0.28, $0.39] to $0.54 [$0.49, $0.59]. This increase is statistically significant at the 0.05 level. We also observe a significantly negative MWTP for celebrity ownership, so after accounting for ANA, consumers are willing to pay more for the bottle/can without any celebrity attachment.

The third model examines the impact respondent certainty on preferences. This is a certainty-choice model for those that state they are certain or uncertain of their choices and provides separate coefficients for certain and uncertain choices. As such, model parameters are conditioned on being a certain or uncertain respondent. In estimation, we use the *ex post* five-point Likert certainty sale to characterize "certain respondents" as those that are "certain" or "very certain" of their choice and "uncertain respondents" as all other respondents. The first finding of note is that certain respondents have a higher marginal utility of income than uncertain respondents. Across the bottle/can attributes, in general, we find that certain respondents exhibit larger marginal utilities than uncertain respondents. The main takeaway findings from these models (Table 6) are that certain respondents have stronger preferences for the resealable aluminum bottle (over the plastic bottle) than uncertain respondents. This translates into greater MWTP for resealable aluminum cans, relative to plastic bottles, with certain respondents willing to pay $0.23 more for a resealable aluminum bottle compared to uncertain respondents ($0.55 [95% CI: $0.45, $0.65] compared to $0.32 [95% CI: $0.13, $0.52]). This difference is not statistically significant at the 0.05 level. Conversely, there is essentially no difference in MWTP for plastic bottles compared to non-resealable aluminum cans between certain and uncertain respondents. Certain and uncertain respondents are willing to pay $0.34 [95% CI: $0.23, $0.44] and $0.35 [95% CI: $0.12, $0.59] more for a plastic bottle than an aluminum can with a pop top, respectively. Certain respondents indicate stronger preferences – and are willing to pay more – for the "Buy One, Remove One" company mission than uncertain respondents ($0.36 versus $0.23), however, this difference is not statistically different at the 0.05 level. Finally, for both certain and uncertain respondents, water type and celebrity ownership are not influential.

The final model provides parameter estimates conditional on choice certainty/uncertainty for non-attended attributes. This model extends work by Hindsley, Morgan, and Landry (2020) – who address choice certainty and stated attribute non-attendance – through joint estimation of choice certainty and inferred attribute non-attendance. Comparing results from the certainty/ANA model to the certainty model, we observe that marginal utilities for resealable cans and the Buy One, Remove One attributes increase for both certain and uncertain respondents. However, the marginal disutility for aluminum cans with pop tops decreases when accounting for certainty and ANA for certain respondents but increases for uncertain respondents. Finally, after accounting for inferred ANA, both certain and uncertain respondents have a marginal disutility associated with the celebrity ownership attribute. In terms of changes in MWTP, accounting for inferred ANA has the largest effect on the "Buy One, Get One" attribute. Accounting for inferred ANA increases MWTP a premium for removing the equivalent of a plastic bottle from the system from $0.36 to $0.55 for certain respondents and from $0.23 to $0.44 for uncertain respondents. Similar to the comparison of the inferred ANA to baseline model, this increase in MWTP for certain respondents is significant at the 0.05 level for certain respondents. Finally, after accounting for ANA, both certain and uncertain respondents are willing to pay a premium for the product if it's not attached to any celebrity ownership.

We do not find statistically significant differences between MWTP estimates for resealable aluminum bottles across models. When we use the use the complete combinatorial approach to assess differences for empirical distribution of MWTP estimates for non-resealable aluminum cans across models, we find statistically significant differences for models with inferred ANA (ANA Inferred Model, Certainty Inferred ANA Model) as compared to those without (Baseline Model, Certainty Model), at the .1 level. Addressing for inferred ANA increases the mean MWTP for non-resealable aluminum cans. When we test for differences in MWTP for water type across models, we find no statistically significant differences. When we test for differences in MWTP for the Buy One, Remove One characteristic, we find statistically significant differences for models with inferred ANA (ANA Inferred Model, Certainty Inferred ANA Model) as compared to those without (Baseline Model, Certainty Model), all at the .001 level. The inclusion of inferred ANA increases the mean MWTP for the Buy One, Remove One attribute. Last, we test for differences in MWTP for the celebrity ownership attribute. We find statistically significant differences for models with inferred ANA (ANA Inferred Model, Certainty Inferred ANA Model) as compared to those without (Baseline Model, Certainty Model), all at the .001 level. We find negative values for models with inferred ANA.

5. Conclusion

This research constructed a stated preference (SP) discrete choice experiment (DCE) to examine consumer preferences for attributes associated with an aluminum water bottle or can relative to a traditional PET bottle. With the recycling constraints on PET plastic bottles and environmental concerns regarding the volume of non-recycled plastic packaging, aluminum bottles and cans offer an environmentally-friendly alternative to packaging drinking water and the potential for substitute products to be successful in the bottled water market. However, while companies will have full information regarding their production costs and competitor prices, consumer willingness to pay for such a new product is not known. Further, the value that customers place on different potential attributes of the new product are also not understood. By DCE design, estimating consumer willingness to pay for attributes of different drinking water packaging can help in company decision making and marketing efforts.

When choosing between alternative bottle types, results indicate that consumers exhibit strong preferences for the type of bottle/can top. With respect to bottle type, the packaging material and bottle/can type are clearly important. When comparing two resealable bottles but produced from different materials – one aluminum and one plastic – consumers will pay between $0.32 and $0.57 (depending on model specification) more for a 16 oz resealable aluminum bottle than an equivalent sized plastic bottle. However, the preference for aluminum over plastic is eclipsed by the bottle/can top. We found that consumers will pay between $0.23 and $0.43 more for a 16 oz resealable plastic bottle than an aluminum can with a pop top. Consumers clearly place a significant value on resealable tops and the benefits of being able to consume water across different time periods. From a design and production perspective, this provides important feedback regarding the influence of specific product attributes in driving consumer preferences.

Our results also add to the slight but growing literature on the use of *ex post* certainty statements and attribute non-attendance. A series of regression models were constructed to explore the influence of respondent certainty/uncertainty and attribute non-attendance on stated preference choice parameter estimates and WTP for attribute types. We found the best model fits for the inferred ANA and certainty inferred ANA models. Accounting for inferred ANA and compared to the baseline results, we observed a significant increase in MWTP for the product's social mission attribute of removing the equivalent of an ocean-going plastic bottle from the system upon purchase. Controlling for choice certainty, most coefficient estimates were larger in absolute value for certain respondents (relative to uncertain respondents), and so, MWTP estimates were generally higher (although not statistically significant at the 0.05 level).

Our final model extended work by Hindsley, Landry and Morgan (2020) by making coefficients conditional on both choice certainty and attribute non-attendance. We deviated from their approach by incorporating inferred ANA rather than stated ANA. Accounting for attribute non-attendance had mixed effects on attribute coefficient estimates for certain and uncertain respondents. Marginal utilities for the resealable aluminum bottle and social mission increased for both certain and uncertain respondents, while the marginal disutility associated with aluminum pop-top cans decreased for certain respondents but increased for uncertain respondents. Further, this model impacted individuals' marginal utility associated with the celebrity endorsement of the bottle/can. In the certainty model, certain respondents exhibited a slight marginal utility for celebrity endorsement. Conditioning coefficients on both certainty and inferred ANA, certain respondents then had a marginal disutility for this attribute. The same is also true for uncertain respondents in this model. In terms of MWTP, certain and uncertain respondents would pay \$0.12 and \$0.20 more for a bottle/can, respectively, if it was not associated with any celebrity endorsement.

Overall, with the growth in corporate sustainability practices and green products, our finding that a company's social mission can influence preferences and consumer willingness to pay is timely. With many environmentally products associated with celebrity owners or endorsements, results show that, celebrity ownership may not play a persuasive role in guiding consumer preferences in favor of a product.

Our findings illustrate the importance of marketing attributes to the potential consumer base. All our results are based on information provision with the DCE framework. The potential for these effects to hold in a real market setting is conditional on adequate information provision to consumers. For a new environmentally friendly product alternative gain traction in an established market with entrenched consumer behaviors, appropriate marketing strategies need to be established to provide full information to potential consumers.

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Figure 1. Density plot depicting price respondents will pay for a 16 oz bottled water (plastic bottle).

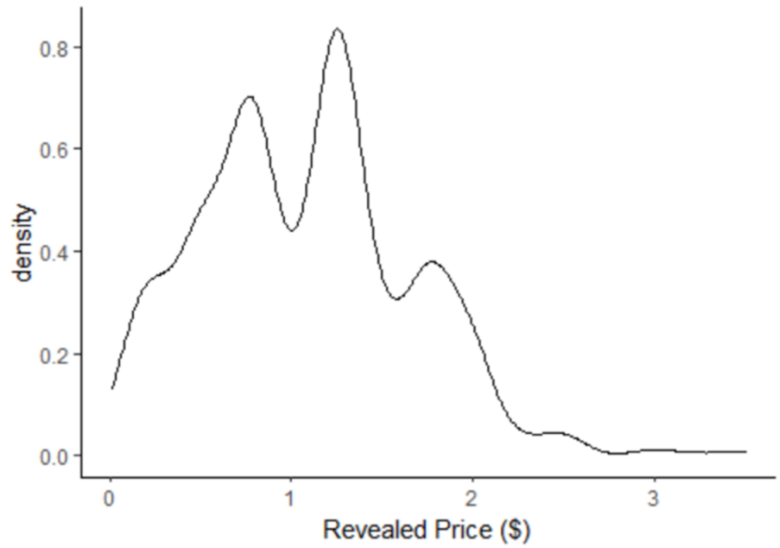

Figure 2. Density plot depicting price respondents will pay for a 16 oz bottled water (plastic bottle) by purchase type (Bulk Only, Bulk and Single, Single Only).

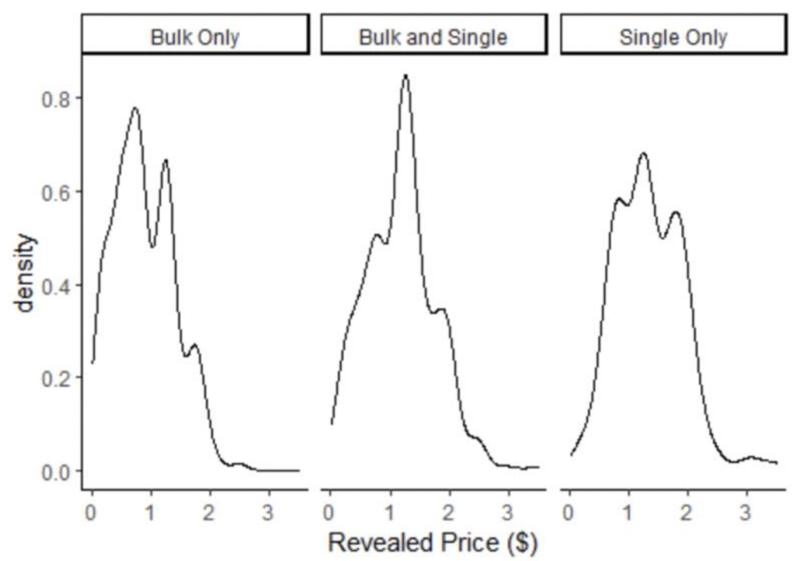

Figure 3. Respondent Attitudes Toward Plastics

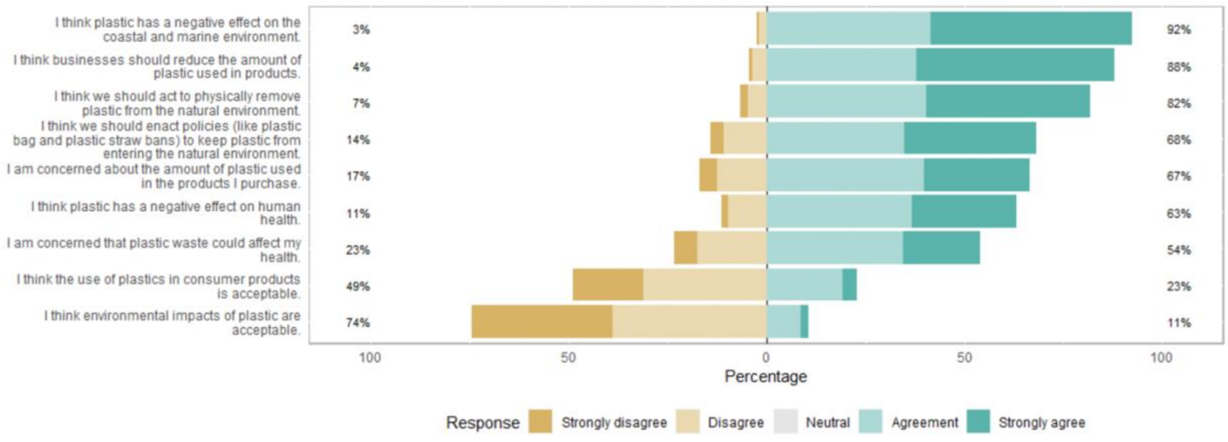

Figure 4. Plastic Bottle and Aluminum Can/Bottle Types

Plastic Bottle with Resealable Top	Aluminum Can with Pop Top	Aluminum Bottle with Resealable Twist Top
		

Figure 5. Example Choice Set

Please consider the three following options for your next purchase of drinking water.

Attributes	Brand A	Brand B	Brand C
			
Plastic or Aluminum	Aluminum	Aluminum	Plastic
Resealable Top or Pop Top	Pop Top	Resealable	Resealable
Plastic Removal	Buy One, Remove One	No Plastic Removal	Buy One, Remove One
Spring or Purified Water	Purified	Spring	Spring
Celebrity, Actor-vist	Jason Momoa	No Celebrity Ownership	No Celebrity Ownership
Price per 16oz bottle/can	$1.79	$2.39	$1.79

Please indicate which brand you would choose for your next purchase.

- ○ Brand A
- ○ Brand B
- ○ Brand C

Table 1. Brand Types – Percent Responses

Brand	Percent
Dasani	9.7
Fiji	4.4
Smart Water	4.3
Evian	1.4
Aquafina	11.9
Nestle	9.0
Voss	0.6
Poland Springs	8.1
Store Brand	34.2
Mananalu	0.1
Liquid Death	0.6
Other	15.7

Table 2. Price for a 16 oz bottle and Willingness to Pay More for Aluminum

Variable	Median	Mean	Std. Dev.	Min	Max
Price - All (16oz)	$1.10	$1.08	$0.57	$0.01	$3.50
Price - Bulk Only (16oz)	$0.79	$0.89	$0.50	$0.02	$2.50
Price – Bulk & Single (16oz)	$1.25	$1.18	$0.58	$0.10	$3.50
Price –Single Only (16oz)	$1.25	$1.34	$0.57	$0.15	$3.50
Buy in Bulk Only		0.45	0.50	0.00	1.00
Buy in Bulk & Single		0.32	0.47	0.00	1.00
Buy in Single Only		0.22	0.42	0.00	1.00
Pay More for Aluminum		0.35	0.48	0.00	1.00
Pay Same for Aluminum		0.55	0.50	0.00	1.00

Table 3. Importance of Attributes

Attribute	Mean	Standard Deviation	Min	Max
Bottle/can type	0.68	0.46	0.00	1.00
Bottle top	0.74	0.44	0.00	1.00
Type of water	0.50	0.50	0.00	1.00
Removing ocean-going plastic	0.64	0.48	0.00	1.00
Celebrity ownership	0.03	0.16	0.00	1.00
Price	0.80	0.40	0.00	1.00

Table 4. Attribute Levels

Attribute	Levels
Bottle/can type	Plastic resealable, aluminum resealable, aluminum pop top
Type of water	Purified or spring
Removing ocean-going plastic	Buy one, remove one or no removal
Celebrity ownership	Jason Momoa or no celebrity ownership
Price	$1.59, $1.79, $1.99, $2.19, $2.39

Table 5. Respondent Descriptive Statistics (n=462)

Variables	Mean	Standard Dev.	Min	Max
Male	0.50	0.50	0.00	1.00
Caucasian	0.68	0.47	0.00	1.00
High school	0.13	0.33	0.00	1.00
College	0.34	0.47	0.00	1.00
Ph.D.	0.03	0.18	0.00	1.00
House	2.60	1.34	1.00	7.00
Age	44.01	15.89	18.00	92.00
Income	72890.63	49120.30	10000.00	200000.00

Table 6. Model Results (Baseline and Inferred ANA Models)

Variable	Baseline		Inferred ANA Model	
	Coefft	Std Error	Coefft	Std Error
Alum Reseal	1.959***	0.176	2.516***	0.134
Alum Non-reseal	-1.263***	0.190	-1.101***	0.169
Water Type	-0.004	0.110	0.016	0.086
Remove One	1.286***	0.116	2.377***	0.117
Momoa	0.123	0.101	-.548***	0.113
Price	-3.795***	0.208	-4.428***	0.170
Standard Deviations				
Alum Reseal (Normal)	2.487***	0.196	0.891***	0.164
Alum Non-reseal (Normal)	2.827***	0.232	2.167***	0.192
Water (Normal)	1.582***	0.147	0.648***	0.147
Remove (Normal)	1.309***	0.146	0.006	0.177
Momoa (Normal)	0.480***	0.289	0.011	0.177
Model Fit				
Log likelihood function	-2017.2		-1645.2	
McFadden Pseudo R-squared	0.337		0.459	
Chi Square	2049.8		2793.6	
AIC/n	1.465		1.196	
n (number of observations)	2769		2769	
k (number of parameters)	11		11	

Note - ***, **, * indicate 0.01, 0.05, ands 0.1 levels of significance, respectively.

Table 7. Model Results (Certainty and Certainty/Inferred ANA Models)

Variable	Certainty Model				Certainty/Inferred ANA Model			
	Certain		Uncertain		Certain		Uncertain	
	Coefft	Std Error	Coefft	Std Error	Coefft	Std Error	Coefft	Std Error
Alum Reseal	2.178***	.210	.947***	.284	2.614***	0.147	1.762***	0.298
Alum Non-reseal	-1.342***	.217	-1.038***	.365	-1.072***	0.177	-1.540***	0.493
Water Type	-.043	.122	.111	.214	-0.007	0.092	0.250	0.224
Remove One	1.438***	.139	.661***	.209	2.505***	0.131	1.602***	0.279
Momoa	.190*	.113	-.009	.237	-0.537***	0.122	-0.724**	0.324
Price	-3.969***	.243	-2.934***	.209	-4.562***	0.190	-3.623***	0.375
Std Devs								
C_Alum Reseal (Normal)	2.737***	.240	2.737***	.240	0.972***	0.177	0.024	0.617
C_Alum Non-reseal (Normal)	3.086***	.283	3.086***	.283	2.156***	0.206	2.145***	0.598
C_Water (Normal)	1.685***	.176	.993**	.407	0.665***	0.162	0.155	1.012
C_Remove (Normal)	1.480***	.171	.457	.516	0.016	0.207	0.025	0.666
C_Momoa (Normal)	.481	.321	.076	.739	0.011	0.188	0.019	0.448
Model Fit								
Log likelihood function	-2031.5				-1645.2			
McFadden Pseudo R-squared	.332				.459			
Chi Square	2021.2				2793.6			
AIC/n	1.483				1.204			
n (number of observations)	2769				2769			
k (number of parameters)	22				22			

Note - ***, **, * indicate 0.01, 0.05, ands 0.1 levels of significance, respectively.

Table 8. Mean Willingness to Pay Estimates - Full and ANA Inferred Models (95% Confidence Intervals in Parentheses)

Variable	Baseline Model	ANA Inferred Model
Alum Reseal	**$0.52 ($0.43, $0.61)**	**$0.57 ($0.51, $0.62)**
Alum Non-reseal	**-$0.33 (-$0.43, -$0.24)**	**-$0.25 (-$0.32, -$0.17)**
Water Type	$0.00 (-$0.05, $0.06)	$0.00 (-$0.03, $0.04)
Remove One	**$0.34 ($0.28, $0.39)**	**$0.54 ($0.49, $0.59)**
Momoa	$0.03 (-$0.02, $0.08)	**-$0.12 (-$0.17, -$0.07)**

Table 9. Mean Willingness to Pay Estimates - Certainty and Certainty/Inferred ANA Models (95% Confidence Intervals in Parentheses)

Variable	Certainty Model		Certainty Inferred ANA Model	
	Certain	Uncertain	Certain	Uncertain
Alum Reseal	**$0.55 ($0.45, $0.65)**	**$0.32 ($0.13, $0.52)**	**$0.57 ($0.51, $0.63)**	**$0.49 ($0.32, $0.65)**
Alum Non-reseal	**-$0.34 (-$0.44, -$0.23)**	**-$0.35 (-$0.59, -$0.12)**	**-$0.23 (-$0.31, -$0.16)**	**-$0.43 (-$0.69, -$0.16)**
Water Type	-$0.01 (-$0.07, $0.05)	$0.04 (-$0.11, $0.18)	$0.00 (-$0.04, $0.04)	$0.07 (-$0.05, $0.19)
Remove One	**$0.36 ($0.30, $0.40)**	**$0.23 ($0.10, $0.35)**	**$0.55 ($0.50, $0.60)**	**$0.44 ($0.29, $0.59)**
Momoa	$0.05 (-$0.01, $0.10)	$0.00 (-$0.16, $0.16)	**-$0.12 (-$0.17, -$0.07)**	**-$0.20 (-$0.38, -$0.02)**