Consumer Preferences and Demand for Packaging Material and Recyclability

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Abstract

An increase in the amount of packaging consumed in the U.S. has put pressure on companies to take responsibility for the entire life-cycle of their product. This study uses discrete choice experiments to assess consumer willingness to pay (WTP) for packaging materials and recyclability of a beverage product. A between subject design was used to analyze the effectiveness of indirect questioning in addressing issues of social desirability bias as well as the effects of information on consumer behavior. Consumer WTP for packaging material was highest for plastic packaging, followed by glass, carton and aluminum. Our empirical analysis reveals that indirect questioning results in WTP values for packaging recyclability that are 60% lower than those from direct questioning. We find that information from a video treatment had a significant and positive effect on consumer preferences and demand for packaging recyclability. Our results suggest that more scrutiny should be placed on studies that do not address social desirability bias when evaluating recycling behavior.

Keywords: Packaging, recycling, choice experiment, preference heterogeneity

1. Introduction

Total household trash generated in the United States is at an all time high (EPA, 2015), which poses environmental problems and wastes resources. Recycling has been proposed as part of the solution to mitigate this problem. As the amount of packaging consumed has increased, companies are pressured to take responsibility for the entire life cycle of their product and interest in environmentally friendly packaging has started to increase (Martinho et al., 2015).

Companies have responded by promoting increasing recycling of their packaging materials. For example, Coca-Cola has released a green leaf recycling logo for their products in an effort to promote recycling behavior. Even though there has been an increase in the overall amount of packaging recycled, the percent of packaging that is recycled has remained stagnant in recent years. Previous research has mainly focused on cumulative household recycling habits (e.g. Saphores et al., 2014), with relatively little work available on product-specific recycling.

In this study we utilize discrete choice experiments to assess consumer willingness to pay (WTP) for packaging materials and recyclability of a beverage product. A between subject design was used to analyze the effectiveness of indirect questioning in addressing issues of social desirability bias as well as the effects of information on consumer behavior. Our results provide strong evidence for the effects of information, via a video treatment, on consumer preferences and demand for product recyclability. We also find potential evidence of social desirability bias in self-reported recycling data and discuss the need for additional research that focuses addressing this type of bias when evaluating recycling behavior.

To examine these issues the study is outlined as follows. In the next section we present a more in-depth discussion on the background and motivation for our study. Section 3 provides the economic theory and method behind our approach. Section 4 discusses our choice experiment design, survey and data. Section 5 presents our results. Section 6 examines the implications of our findings and concludes the paper.

2. Background

Research on product specific recycling and consumer preferences for recyclability is scarce. Rokka and Uusitalo (2008) is one of a few studies that have researched consumer

preference for packaging attributes. They used a choice experiment to find the relative importance of different packaging attributes in consumers' choices, including re-sealability, brand, and recyclability. They found that consumers receive 34% of their overall product utility from packaging and that a portion of respondents (31%) placed environmentally-friendly packaging as the most important factor driving their purchasing decision. When determining factors that contributed to valuing packaging sustainability, they found no strong relationship with a particular demographic variable; rather valuing packaging sustainability correlated more closely to common interests and preferences (Rokka and Uusitalo, 2008).

Despite the lack of research on product-specific recycling, various studies have examined household behavior regarding curbside recycling. While some of these studies have been able to use revealed preference data to determine WTP for curbside recycling (e.g., Aadland and Caplan, 2003; Guagnano, Stern, & Dietz, 1995), the majority have used stated choice experiments. Aadland and Caplan (2003) test for hypothetical bias using hypothetical choice experiments and revealed preference data and find that WTP estimates for curbside recycling can range from $7.00/month to $6.71/month depending on the method used. Karousakis and Birol (2008) used a choice experiment to estimate an average consumer WTP of £2.68/month to have one additional material accepted for recycling in London. More recently, Ferreria and Marques (2015) used a consumer survey in Portugal to derive a mean WTP for monthly recycling service of €1.35 and €3.16 depending on whether protest answers were included.[1] They found that many of the protest answers were indicative of a positive WTP for recycling, but respondents noted that it was the government's duty to pay for waste management. These results on WTP for curbside recycling suggest that households may also display positive WTP for recyclable packaging materials.

[1] Protest answers are when respondents refuse to give an amount they are willing to pay for a particular reason.

Prior research has also focused on motives and barriers to collective recycling rates. Sidique, Joshi & Lupi (2009) use panel data of county-level recycling rates in Minnesota to review several policies (e.g., mandatory recycling regulations and increasing recycling education expenditures) and their effects on recycling rates over a period of eight years. The largest increase in recycling rates, they found, came from a variable pricing strategy, which is when households are charged more for larger trash cans, which decreases the relative cost of recycling bins. Higher income, older age, and larger household sizes were better predicting factors of usage of a recycling center than gender or marital status (Sidique, Joshi, & Lupi, 2009).

The majority of information available on individual preferences regarding recycling comes from self reported data. Self reported data suffers from the basic human tendency to present oneself in the best possible way and often distorts the information gained from self-reports (Fisher, 1993). Social desirability bias is the tendency of an individual to provide answers or to self-report in a way that is biased towards their perception of a socially acceptable or "correct" answer that may deviate from their true behaviors or preferences (Fisher, 1993). An important tool available to researchers to reduce the effects of social desirability bias is the use of indirect questioning, which is a projective technique that asks respondents to answer questions from the perspective of another person or group. A number of studies in the U.S. have used a "neighbor" or "average American" as the comparison group (Johansson-Stenman and Martinsoon, 2006; Olynk, Tonsor, Wolf, 2010). The underlying assumption behind this type of questioning is that although people want to make themselves look good, they are relatively unconcerned with making others look in a positive light. In response to Fisher's (1993) original validation of the indirect questioning method as a tool to mitigate social desirability bias, researchers have developed formal models of how individuals respond to direct versus indirect

questioning (Johansson-Stenman and Martinsson, 2006; Lusk and Norwood 2009) and have found that indirect questions lead to more accurate answers.

3. Economic theory and method

In order to analyze consumer preferences and demand for packaging material and recyclability, we utilize a discrete choice experiment (CE) approach. The CE methodology has been applied to a wide range of studies to better understand individual preferences for product and product attributes. The CE technique enables researchers to easily compare demand for intangible attributes, such as product recyclability, that are not revealed in markets (Mangham et al., 2009). Once researchers select which attributes are expected to affect consumers' choices and carefully design the options and levels of the choice decisions, they are able to determine which characteristics have the strongest effect on consumer utility and derived product demand.

Choice experiments are rooted in Lancastrian consumer theory (Lancaster, 1966) and random utility theory (McFadden, 1974; Manski, 1977; Hanemann & Kanninen, 1999). The Lancastrian approach to consumer theory assumes that utility is derived from the characteristics of goods rather than from the goods themselves. Subsequently, models based on random utility theory assume that decision makers or consumers seek to maximize their expected utility given a budget constraint and specifies utility as a random variable because the researcher has incomplete information (Manski, 1977).

Within the discrete choice literature, there are several ways of accounting for and modeling preference heterogeneity. A common method of evaluating preference heterogeneity is estimation of random parameters logit (RPL) models, also called mixed logit. Following standard practice, we assume that indirect utility is linear, where each individual's indirect utility function

can be written as

$$V_{ijt}^{*} = \beta_i{}' X_{ijt} + \varepsilon_{ijt} \quad \textbf{(1)}$$

where X_{ijt} is a vector of attributes for the j^{th} alternative, $\beta_i \sim f(\beta|\Omega)$ is a vector of the i^{th} individual-specific taste parameters and ε_{ijt} is a stochastic component of utility that is independently and identically distributed across individuals and alternative choices, and takes a known (type-one extreme value or Gumbel) distribution. This stochastic component of utility captures unobserved variations in tastes and errors in consumer's perceptions and optimization.

Indirect utility V_{ijt}^{*} is not directly observed; what is observed is the actual choice V_{ijt}, where $V_{ijt} = 1$ if $V_{ijt}^{*} = \max(V_{i1t}^{*}, V_{i2t}^{*}, \dots, V_{iKt}^{*})$, and 0 otherwise.

Following the RPL specification in Train (2009), the probability that individual i chooses alternative j from the choice set $\mathcal{S}$ in situation t is given by

$$\text{Prob}\left(V_{ijt} = 1 | X_{i1t}, X_{i2t}, \dots . X_{iKt}, \Omega\right) = \int \frac{\exp(\beta_i{}' X_{ijt})}{\sum_{k=1}^{K} \exp(\beta_i{}' X_{ikt})} f(\beta|\Omega) d\beta \quad \textbf{(2)}$$

where the vector Ω defines the parameters characterizing the distribution of the random parameters. Because the integral in equation (2) lacks a closed form solution the model is typically estimated via simulated maximum likelihood estimation techniques.

Operationalizing the model in equation (2) requires specification of the family of distributions from which to draw the random parameters. Typically, researchers allow for most non-price parameters to be distributed normally, allowing for potentially positive and negative preferences. Specifying the distribution of the price parameter, however, requires some careful consideration. Allowing the price coefficient to be distributed normally is problematic for several

reasons, including potential violations of downward-sloping demand curves and deriving distributions of WTP measures with infinite variances. Historically, researchers have simply restricted the price coefficient to be constant (e.g., Revelt and Train, 1998). This is analogous to assuming that preferences over prices are homogeneous in the population, and "implies that the standard deviation of unobserved utility or the scale parameter is the same for all observations" (Scarpa, Thiene, and Train, 2008). Louviere (2003) convincingly argues that the scale parameter can, and indeed often does, vary randomly over observations, and ignoring this variation can result in erroneous conclusions. In the context of product choice modeling, if the price coefficient is constrained to be fixed, when in fact scale varies over observations, then the variation in scale will be incorrectly attributed to variation in WTP for product characteristics. One potential solution is to introduce heterogeneity and restrict the sign of the price coefficient by specifying a distribution whose domain lies strictly on one side of zero (e.g. log normal distribution). While congruent with demand theory, empirically amenable distributions of utility coefficients do not necessarily imply convenient distributions for WTP, and vice versa (Scarpa, Thiene, and Train, 2008).

An alternative solution is to estimate the model in WTP-space, where the model is re-parameterized such that the estimated parameters are the WTP for each attribute rather than the marginal utility coefficients (Train and Weeks, 2005). To illustrate, we specify utility in equation (1) to be separable in price, *p,* and non-price, *x*, attributes. Dividing this utility function by a scale parameter, k_i, yields

$$V^{*}_{ijt} = -\left(\frac{\alpha_i}{k_i}\right) p_{ijt} + \left(\frac{\beta_i}{k_i}\right)' x_{ijt} + v_{ijt} \qquad \textbf{(3)}$$

where $v_{ijt} = \frac{\varepsilon_{ijt}}{k_i}$. Noting that WTP for an attribute is the ratio of the attribute's coefficient to the

price coefficient, $w_i = {}^{\beta_i}/_{\alpha_i}$, then equation (3) becomes

$$V_{ijt}^{*} = -\lambda_i \, p_{ijt} + (\lambda_i w_i)' \, x_{ijt} + v_{ijt}, \quad \textbf{(4)}$$

where $\lambda_i = \frac{\alpha_i}{k_i}$, and w_i is a vector of WTP for the product attributes that is independent of scale.

4. Choice experiment design, survey and data

The design of the choice experiment survey began with a review of the literature and identification of the main attributes and levels involved in product packaging recycling decisions. The survey was reviewed by executives of major food product and packaging companies in the U.S. to ensure the choice scenarios were realistic and relevant to the packaging industry. The survey was then tested with a group of twenty students and young professionals making home purchasing decisions. We revised the survey to ensure comprehension of the choice scenarios. The revised survey was piloted with 200 respondents to determine minimal completion times.

The choice experiment focused on the purchase of fruit juice drink products. Three attributes were used to describe the product and were chosen based on their relevancy to consumers as well as sustainability and packaging executives of major companies: packaging material, product recyclability and price (Figure 1). Attention was given to ensure that the attributes chosen for the study were realistic and relevant to consumers making the purchasing decision. Respondents were informed that the characteristics of the fruit juice itself (e.g. volume and quality) were identical across alternatives; juice drink products differed only along the three mentioned attributes. The first attribute, packaging material, was comprised of four levels that always appeared as an option to the consumers: glass, aluminum, plastic and carton. Product recyclability was a binary attribute: the product was either recyclable or not recyclable. Consumers were given instructions to view the packaging as recyclable by the given label, not by

whether that material was recyclable in their community. Product price was included as a money metric measure to derive consumer demand and willingness-to-pay values. The levels of the price attributes were constructed based on observed market prices for fruit juice drink products: $0.75, $1.00, $2.00 and $3.00 for a 12-ounce single serve container.

Characteristics	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Material	Plastic	Glass	Carton	Aluminum can	I would not purchase any of these products
Recyclable	No	Yes	No	Yes	
Price ($/12-oz container)	$0.75	$3.00	$1.00	$2.00	
I would choose	○	○	○	○	○

Figure 1: Example of choice situation

The choice sets were created using a simultaneous orthogonal design in Ngene (ChoiceMetrics, 2011), where each option contained the four types of packaging material alongside a no purchase option. With this type of labeled design, orthogonally holds within and across alternatives. The experimental design consisted of a total of 20 choice scenarios that were orthogonally blocked so that each respondent evaluated five choice sets. To mitigate the effects of hypothetical bias, a cheap talk strategy was employed prior to the choice experiments (Cummings and Taylor, 1999) (a copy of the script is available in the appendix).

In addition to the choice experiment questions, data were also collected on the social and economic characteristics of the respondents and their household; their current recycling behavior; as well as their perceived barriers and drivers to recycling. To test for the presence of social desirability bias and the effects of information on consumer behavior, we utilized a between subject design with three treatment groups. The first group (33% of respondents) evaluated the standard choice experiment questions (direct question format) without exposure to information; this will be refereed to as the control group. The second group received a set of indirect questions regarding the choice experiment, where they were instructed to assess the choice sets as "the average American" would. The third group assessed the standard choice experiment (direct questioning) after viewing a video on recycling (a script of the video is available in the appendix). Each treatment group received the same set of demographic and recycling behavior questions in the survey.

The survey was conducted online through a marketing research and survey company; Decipher Inc. Invitations to participate in the study were sent out from a consumer database maintained by Survey Sampling International (SSI). Several choice experiment studies have relied on SSI as a sample provider (Loureiro and Umberger, 2007; Olynk Tonsor and Wolf, 2010; Tonsor and Shupp, 2010). Based on the results from the pilot survey, we rejected observations that were completed in less than 10 minutes. A subset of survey questions was used to set quotas on completed responses and ensure that our sample was reflective of the broader U.S. population; these variables included gender, age, income level, education level, and geographic region (within the United States). Our total sample is comprised of 1500 observations, with 500 responses in each treatment group. Our sample is representative of the 2010 census in terms of most demographic characteristics; however, respondents reported slightly higher levels of

education than the national average (Table 2). A series of statistical tests were conducted to compare the sample characteristics between the three groups and no statistical differences were found at the ten percent confidence level.

Table 2: Sample demographic characteristics (in percentage)

Variable		2010 Census	Control Group (n=500)	Indirect Questioning (n=500)	Video Treatment (n=500)
Age					
	18 to 24 years	13	14	10	11
	25 to 44 years	35	34	35	38
	45 to 64 years	35	39	38	37
	65 to 13 years	17	13	17	14
Gender					
	Male	49	46	49	54
	Female	51	54	51	46
Education					
	Did not graduate from high school	12	3	4	4
	Graduated from high school	31	31	30	32
	Attended College, no degree earned	26	30	28	26
	Attended college, degree earned	19	31	35	34
	Graduate/Advanced Degree	11	5	3	4
Household Income					
	<$20,000	20	21	18	23
	$20,000-$59,999	40	42	44	37
	$60,000-$99,999	20	22	25	26
	$100,000-$200,000	17	12	12	13
	>$200,000	3	3	1	1
Region of the U.S.					
	South	37	35	35	33
	West	23	26	24	23
	Northeast	18	17	19	21
	Midwest	22	22	22	23
Urban Rural Continuum					
	1) Counties of 1 million or more	55	51	55	57
	2) 250,000 to 1 million population	21	27	23	20
	3) metro area (MA) < 250,000	9	8	8	8
	4) population > 20,000 adjacent to MA	4	4	5	5

5) population > 20,000 not adjacent to MA	2	2	1	2
6) 2,500 < population <19,999 adjacent to MA	5	4	5	3
7) 2,500 < population <19,999 not adjacent to MA	3	2	1	3
8) population< 2,500 adjacent to MA	1	1	0	1
9) population< 2,500 not adjacent to MA	1	1	1	1

5. Results

Demand for Packaging Recyclability

Random parameter logit models were estimated for the control group and each of the treatment groups. In every group, all of the estimated coefficients were statistically significant at the five percent level and had the expected signs. Coefficients for recyclability and material were positive, suggesting respondents received positive utility from recyclability and packaging materials. We present derived WTP results of the model in preference-space, followed by the WTP-space specification as well as model fit criterion (Tables 3 and 4). Confidence intervals for the coefficients estimated in preference-space were derived using the Krinsky-Robb method with 1000 random draws.[2]

[2] The Krinsky-Robb approach is used to simulate an asymptotic distribution of the WTP by randomly drawing from a multivariate normal distribution, constructed by the combination of the coefficient estimated and the associated variance-covariance matrix from the RPL model.

Table 3: WTP results for models estimated in preference-space and WTP-space

		Preference-space		WTP-space	
		Mean	95% CI	Mean	95% CI
Control					
	Packaging Recyclability	1.46	[1.27, 1.65]	1.31	[1.14, 1.48]
	Plastic Packaging	2.19	[2.02, 2.37]	2.10	[1.96, 2.24]
	Glass Packaging	2.03	[1.85, 2.21]	2.10	[1.94, 2.25]
	Carton Packaging	1.79	[1.61, 1.96]	1.79	[1.64, 1.94]
	Aluminum Packaging	1.46	[1.28, 1.65]	1.52	[1.67, 1.37]
Indirect Questioning					
	Packaging Recyclability	0.54	[0.40, 0.67]	0.49	[0.40, 0.57]
	Plastic Packaging	2.8	[2.61, 2.99]	2.86	[2.64, 3.09]
	Glass Packaging	2.2	[2.01, 2.39]	2.29	[2.07, 2.51]
	Carton Packaging	2.12	[1.93, 2.31]	2.16	[1.93, 2.39]
	Aluminum Packaging	2.32	[2.13, 2.53]	2.39	[2.17, 2.60]
Video Treatment					
	Packaging Recyclability	1.67	[1.44, 1.90]	1.62	[1.45, 1.78]
	Plastic Packaging	2.13	[1.94, 2.33]	2.05	[1.92, 2.18]
	Glass Packaging	1.98	[1.79, 2.16]	2.03	[1.90, 2.17]
	Carton Packaging	1.71	[1.51, 1.92]	1.64	[1.49, 1.78]
	Aluminum Packaging	2.32	[2.13, 2.53]	1.59	[1.46, 1.73]

Table 4: Model fit criteria

	Control	Indirect Questioning	Video Treatment
Preference Space			
Log-likelihood	-3246	-3235	-3409
Pseudo R-Squared	0.16	0.14	0.13
AIC	2.60	2.59	2.72
WTP-Space			
Log-likelihood	-2992	-2940	-31353.2
Pseudo R-Squared	0.26	0.27	0.22
AIC	2.41	2.37	2.53

Both sets of result indicate positive average WTP for packaging recyclability for a 12-ounce juice drink in all treatment groups. While derived WTP estimates from both specifications fall within each other's 95%-confidence intervals, the density graph in Figure 2 depicts that

results from WTP-space tend to be more normally distributed and report less extreme values than estimates in preference space. Model fit criteria (Table 4) show that the WTP-space specification is superior to estimation in preference-space. This is in line with past research (Scarpa, Thiene, & Train, 2008), which has found that estimating choice data in WTP-space addresses the "fat tail" problem of extreme values that frequently occurs in preference-space estimation. For the remainder of our analysis we primarily focus on the results obtained from the model specified in WTP-space.

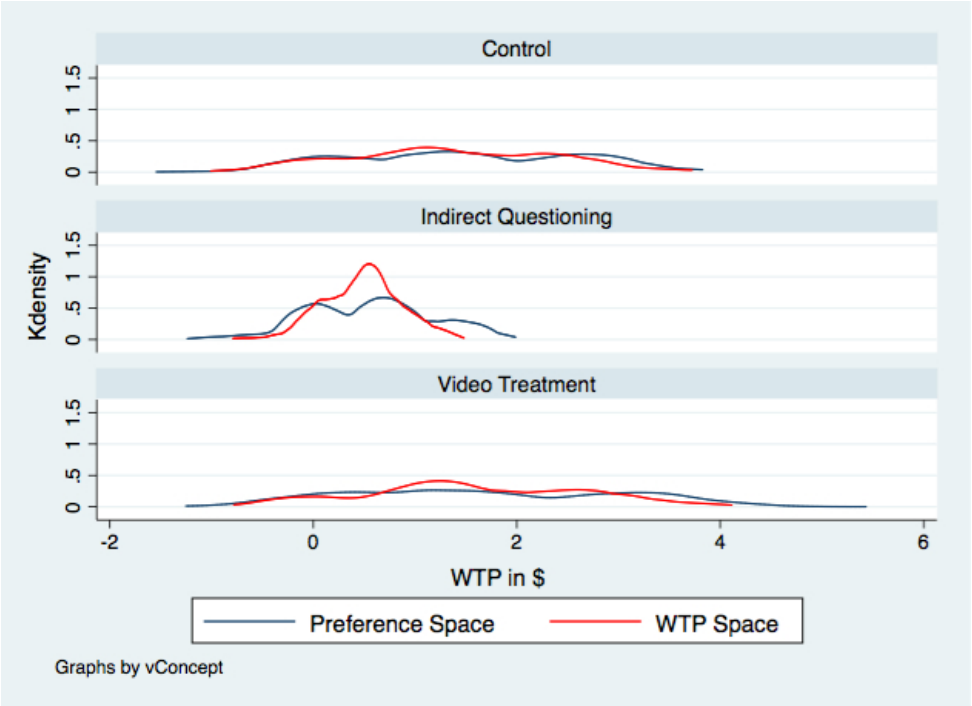

Figure 2: Density of WTP estimates for packaging recyclability in preference-space and WTP-space

In comparison to the control group, the indirect questioning treatment group reported a dramatically lower mean WTP for packaging recyclability. We find this difference to be statistically significant (p-value <0.01) suggesting the potential for social desirability bias. Given that our sample comes from an opt-in panel, we cannot rule out that consumers with unobservable characteristics related to a higher-than-average WTP for recyclability were over

sampled. However, the large discrepancy in the estimates, coupled with the representativeness of our sample based on observable demographic characteristics, suggest that this result is at least partially driven by socially desirable behavior.

A t-test reveals significant positive effect from the video treatment on demand for packaging recyclability (p-value < 0.01). We find that exposure to the video treatment increased consumer WTP by an average of 31 cents or 24% compared to the average price in the control group (Table 3). Furthermore, WTP for aluminum packaging increased relatively to those of other material, in particular plastic, suggesting the targeted video treatment on the benefits on recycling aluminum cans was effective at changing consumer relative preferences for packaging material. These results are congruent with other studies, which have found significant effects of information treatments on consumer preferences and demand for goods (Lusk et al., 2004; Ortega et al., 2015).

Table 5: WTP for recyclability by material and treatment

	Control		Indirect Questioning		Video Treatment	
	Mean	95% CI	Mean	95% CI	Mean	95% CI
Plastic	1.54	[1.30, 1.80]	0.60	[0.46, 0.72]	1.64	[1.42, 1.86]
Glass	1.12	[0.94, 1.32]	0.18	[0.02, 0.32]	1.24	[1.08, 1.42]
Carton	1.10	[0.88, 1.34]	0.22	[0.10, 0.34]	1.06	[0.82, 1.32]
Aluminum	1.34	[1.08, 1.56]	0.60	[0.44, 0.72]	1.28	[1.06, 1.48]
N	2500		2500		2505	
Log-likelihood	-2992		-2940		-3153	
Pseudo R^2	0.256		0.269		0.218	
AIC	2.41		2.37		2.53	

Breaking down WTP for packaging recyclability by material (Table 5) shows that WTP for recyclability for plastic was significantly higher than glass and carton for all treatment groups (p-value < 0.10). A possible explanation for this is that consumers are more concerned about plastic packaging ending up in a landfill rather than carton or glass. Moreover, consumers may

believe that plastic is the most important material to recycle.

Determinants of Demand for Packaging Recyclability

A better understanding of the determinants of WTP for packaging recyclability is important for packaging companies and policy makers to effectively promote recycling in the U.S. We obtained individual-level conditional estimates of WTP from our model estimates. Individual WTP for packaging recyclability was regressed on socio-demographic variables, as well as stated motives and perceived barriers to recycling. To gain insights into how motives affect demand for packaging recyclability, the following variables were included: "Energy Conservation" captures respondents indicating that their main reason for recycling was because recycling materials requires less energy than creating new materials. "Water Reasons" denotes respondents indicating that their main reason for recycling was for water related reasons, including keeping plastics out of oceans or reducing water pollution associated with mining new materials. "Environmental Warm-glow" denotes respondents' attitude to the statement "I feel good when I take steps to help the environment" from completely disagree (1) to completely agree (7). We also examined how perceived barriers to recycling affected individual WTP: "Price sensitive" denotes that the respondent stated that price was an important barrier to recycling (on a scale from least important (1) to most important (5)). Similarly, "Time sensitive" indicates that the respondent noted that time was a major barrier to recycling. The variable "Bottle Return States" is a dummy variable that captures states with a current refundable deposit system on certain containers. In addition, dummy variables controlling for the indirect questioning and video treatment groups were included in the regression model.

Table 6: Determinants of individual WTP ($/12-ounce container) for packaging recyclability

Variable	Coefficient	Robust St. Errors
Indirect Questioning	-0.874***	(0.058)
Video	0.263***	(0.058)
Female	0.044	(0.042)
Age	-0.018**	(0.008)
Age Squared	1.68E-04**	(0.000)
Education	0.01	(0.012)
White	0.027	(0.053)
Income	0.008	(0.012)
Democratic Voters	0.025	(0.049)
Republican Voters	-0.095*	(0.053)
Urban Continuum	0.019	(0.013)
Time Sensitive	-0.059***	(0.021)
Price Sensitive	-0.013	(0.021)
Bottle Return States	-0.028	(0.046)
Environmental Warm-glow	0.098***	(0.018)
Water Reasons	0.073**	(0.029)
Energy Conservation	-0.003	(0.029)
Constant	0.985***	(0.203)
Observations	1500	
R-squared	0.225	

Note: ***, **, and * indicates statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

Regression results (Table 6) suggest that recycling motives play a significant role in determining individual WTP for packaging recyclability. Respondents reporting recycling to improve water quality and energy conservation, as well as respondents reporting a warm-glow from participating in environmentally friendly activities, exhibited a higher WTP for recyclable packaging. Furthermore, results are consistent with past research suggesting socio-economic demographics are not highly correlated with recycling behavior (Rokka and Uusitalo, 2008). Age and identifying as a republican voter were the only socio-economic demographic characteristics significantly affecting WTP, albeit to a smaller extent than motives. Age was found to exhibit a U-shaped effect on demand for recyclability. Individual WTP for packaging

recyclability was the highest for young and elder consumers, while it was the lowest at age 59. Republican voters reported a slightly significant decrease in WTP for packaging recyclability in comparison to individuals self-identifying as independents. Time sensitivity was found to be a deterrent to recycling, with time-sensitive consumers exhibiting a lower demand for packaging recyclability. It is noteworthy that consumers living in bottle return states did not report higher WTP for packaging recyclability relative to consumers in non-bottle return states. This may result from consumers living in bottle return states being accustomed to higher prices for recyclable packaging or an inherent expectation of receiving a small refund once the consumer returns the packaging.

5. Discussion and conclusions

Average estimated WTP for packaging recyclability is positive for all materials; however, it is the highest for plastic, followed by aluminum, glass, and then carton. One hypothesis is that consumers may be willing to pay the most for plastic packaging recyclability because they view plastic as more detrimental for the environment if it is not recycled. Future research could investigate the motives for recycling specific packaging materials. Although WTP for aluminum recyclability was lower than that of plastic (p-value <0.10), it should be noted that aluminum packaging was valued the least, providing evidence that consumers value packaging materials and their recyclability differently. Average estimated WTP for glass and carton recyclability was the lowest. These results may be driven by consumers viewing these materials as relatively innocuous for the environment, despite both packaging materials being valued above that of aluminum. These findings can help inform packaging industry decisions to develop recyclable packaging for specific materials.

The effect of the video treatment on consumer WTP is two-fold. First, consumer WTP for aluminum, the packaging material depicted in the video, increased relative to that of other packaging materials, demonstrating that targeted information treatments affect consumer preferences for packaging material. Second, the video treatment had a positive effect on WTP for packaging recyclability regardless of the packaging material, albeit the effect was greater for plastic, suggesting video treatments can be effective at promoting recycling in general.

Findings reveal that consumers' WTP for packaging recyclability is influenced by socio-demographic variables such as age and political party affiliation, as well as motives and barriers to recycling. Consumers who reported recycling for water reasons were likely to have a higher WTP for packaging recyclability. Since recycling primarily reduces landfill waste and only indirectly contributes to decreasing water pollution, packaging companies may choose to further educate consumers on the benefits of recycling on the environment and/or highlight water-related benefits to enhance recycling. Consumers reporting time sensitivity as a deterrent to recycling were likely to have a lower WTP for packaging recyclability. Consumers with a high opportunity cost of time may have less time for recycling, despite potentially earning relatively high incomes. This is an important finding for the industry suggesting high-earners face a trade-off and may be willing to pay more for packaging recyclability as long as recycling time of packaging material is reduced. Future research is needed to explore the role of time and effort as barriers to recycling and low WTP for packaging recyclability.

As with any stated preference experiment there are limitations to this study. Since the preferences elicited in this study were stated and not revealed, there exists the potential for hypothetical bias with this survey. It can be assumed that the cheap talk before the experiments reduced some of the hypothetical bias, but may not have eliminated all of the bias. Additional

work is needed to examine the efficacy of hypothetical bias mitigation techniques such as cheap talk, and to determine which packaging attributes consumers consider when purchasing a product, as this can affect choice model estimates.

As the quantity of packaging sold in the U.S. increases, packaging waste has also increased. Because of growing environmental concerns in the U.S., governmental agencies and consumer groups have increasingly pressured companies to produce more environmentally friendly products. Companies have responded with marketing campaigns to enhance recycling. Our results show that consumers already place positive utility on packaging recyclability and that providing additional information may nudge individuals to purchase recyclable packaging; we find this to be the case with video information.

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Appendix

Cheap Talk Script: "The experience from previous similar surveys is that people often state a higher willingness to pay than what one actually is willing to pay for the good. It is important that you make your selections like you would if you were actually facing these choices in your retail purchase decisions, noting that allocation of funds to these products means you will have less money available for other purchases."

Video Treatment Script: "Recycling does not only save space in landfills, but also conserves energy and it is surprising how everyday items can really add up. Recycling one soup can saves enough energy to power a laptop for two hours. What if we recycled more? Recycling one 20 ounce plastic bottle can save enough energy to power an hour of TV. It's our planet, our stuff, and our choice." Source: Green Sky Video, EPA 2015