

**SOCIAL MEDIA GENERIC ADVERTISEMENTS AND DEMAND FOR
CALIFORNIA WALNUTS**

A Thesis

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Master of Science

by
Hanlong Zhang
May 2022

© 2022 Hanlong Zhang

ABSTRACT

We designed an online field experiment to examine the impact of social–media generic advertising related to walnuts on consumers’ purchasing behavior and willingness to pay (WTP). Volunteers ($n = 751$) were assigned into three different groups with one control and two treatment groups, shown advertisements in the form of Twitter posts, and surveyed. The control group was shown ten coffee advertisements rather than walnut advertisements. The two treatment groups randomly received either ten posts related to the health benefits of California walnuts or recipes using walnuts. After browsing the posts, participants were asked to reveal their WTP for ten different products, including raw walnuts, salted walnuts, unsalted walnuts, raw pecans, raw cashews, and more. Our results suggested that participants in the two treatment groups had higher WTP for walnuts than participants in the control group. Moreover, posts about the health benefits of walnuts increased subjects’ WTP more than posts with recipes using walnuts. In addition, the walnut–related posts also increased participants’ WTP for pecan and cashew products. This indicates that social–media generic advertising has a positive spillover effect on pecan and cashews.

BIOGRAPHICAL SKETCH

Hanlong Zhang joined Cornell University's Applied Economics and Management program in 2020 to pursue his master's degree in science and is currently a second-year graduate student. As an undergraduate, he worked with his mentors and other Ph.D. students on various research projects and earned a bachelor's degree with honors in Agricultural and Consumer Economics from the University of Illinois at Urbana-Champaign (UIUC), with a minor in Horticulture. At UIUC, he earned first prize in the 2020 ACE Undergraduate Research Award competition. His past research projects were focused on American households' food security, international trading, agriculture development in Africa, and environmental economics.

Zhang has successfully combined his education in Agricultural Economics and Horticulture with community building and social work. He volunteered at a community farm in the Urbana area helping prepare free meals for children and worked for better local household food security. His research in environmental economics helped identify the average willingness to pay for the maintenance of native plants in the community and the factors that contribute the most. These results can help community planners create a more efficient budget. He also collaborated with classmates on extracurricular research on malnutrition in Africa. In his most recent research at Cornell, Zhang coordinated with the advertising team from the California Walnuts Board and his mentors to analyze the advertising effectiveness of generic social media advertisements related to walnuts.

ACKNOWLEDGMENTS

I cannot express enough thanks to Professor Harry M. Kaiser and Jura Liaukonyte for their precious support, advice, and instructions about the research topic, experimental design, econometric models, and writing. I offer my sincere appreciation for the learning opportunities provided by my committee.

I thank Jennifer Williams from the California Walnut Board for providing material, including information and images, for the experiment design.

TABLE OF CONTENTS

BIOGRAPHICAL SKETCH	iii
ACKNOWLEDGMENTS	iv
TABLE OF CONTENTS.....	v
LIST OF FIGURES	vi
LIST OF TABLES	vii
INTRODUCTION	1
LITERATURE REVIEW	2
PROBLEM STATEMENT	6
OBJECTIVES	8
METHODOLOGY	9
Experimental Design.....	9
Econometric Models	16
RESULTS	18
Descriptive Data.....	18
Regression Results	21
Regression with Interaction Terms	29
DISCUSSION / IMPLICATIONS.....	31
CONCLUSION.....	33
APPENDIX.....	35
REFERENCES	51

LIST OF FIGURES

Figure 1: One of the ten posts shown to participants in the health treatment group.....	11
Figure 2: One product (with description) was shown to all participants in the experiment	15
Figure 3: WTP for nut products	21
Figure 4: Regression results with 95% confidence interval (dummy variables)	25
Figure 5: Coefficients for two treatments	25
Figure 6: Female interaction terms	30

LIST OF TABLES

Table 1: Background information and instructions supplied to experiment participants	12
Table 2: Demographic questions and answer option list	14
Table 3: Consumption preference questions and answer option list.....	16
Table 4: Descriptive statistics of demographic variables by treatment	19
Table 5: OLS regression results	23
Table 6: Tobit regression results	26
Table 7: Linear regression after browsing time controlled	27
Table 8: Tobit regression after browsing time controlled.....	28

INTRODUCTION

Social media platforms have reshaped the advertising industry (Wright et al., 2001). Traditional advertising such as radio, newspaper, and television advertisements are too general to efficiently target consumers. Social media attracts a large number of users as well as the attention of business executives (Maha, 2015). Sellers have begun to move their advertising campaigns to social media platforms such as Facebook, Twitter, YouTube, and others. Hensel and Deis (2010) have pointed out that while traditional types of advertising have become less effective and popular, social media advertising has demonstrated its potential to segment the market with customized content for different groups of consumers. Social media marketing also encourages conversations between advertisers/sellers and consumers, instead of delivering content that does not allow consumers to interact with the creation or development of the content (Hensel and Deis, 2010; Berthon et al., 2012). Consumers may evaluate or discuss promoted products and be involved in the promotion of products by creating and sharing product review videos (Dao et al., 2014). Due to the characteristics of social media, some well-designed advertisements spread very effectively at a low cost to advertisers (Ferguson, 2008). In recent years, strategies such as “viral marketing” and using social media to spread “word-of-mouth” (WOM) fast and effectively became the defining marketing trend (Ferguson, 2008).

Spillover effects of advertisements (both positive and negative) in social media have been widely studied. A recent study from Thornhill, Xie, & Lee (2017) reported strong positive spillover effects on owned social media channels (i.e., social media channels fully managed and controlled by the advertiser). This study found these advertisements can boost consumer purchases for both the advertising brand and other competing brands. Another recent study focused on negative halo (spillover) effects in social media: Borah and Tellis (2016) used

autoregressive models to identify negative spillover of recall messages on social media. They found that negative information on social media about a specific automobile brand can affect consumers' attitudes toward other brands and those brands' stock performances.

In this paper, we evaluated two types of social media advertising content related to California walnuts: health facts about walnuts and recipes using walnuts as an ingredient. We used an online experiment to test the impacts of these two types of content on consumers' willingness to pay (WTP) for walnuts and also tested the potential spillover effects by asking consumers to indicate their WTP for cashews and pecans as well. We surveyed 751 adult volunteers and randomly sorted them into three different groups. Two groups each viewed ten social media advertisement posts, either in the health facts category or recipes category, and the third group was a control group that viewed advertisements for an unrelated product, coffee. We found that participants in both treatment groups had higher WTPs for walnuts than those in the control group. Participants who received health information about walnuts had higher WTPs than those viewing recipes with walnuts. In addition, both treatments had positive impacts on consumers' WTP for pecans and cashews. This suggests that there is a positive spillover effect of social media generic advertising for walnuts or pecans and cashews.

LITERATURE REVIEW

Advertising is everywhere on social media. Many studies have evaluated the effectiveness of advertising on different social media platforms, with research analyzing consumers' attitudes toward social media advertising, motivations to click on ads, and the effects of these ads on their purchasing behavior. Advertisers typically assess the effect of advertising with quantitative data and metrics, including the numbers of comments, clicks, and likes

(Voorveld et al., 2018). Lee and Hong (2016) sought to better understand the connection between the effectiveness of ads on social media and consumers' engagement with these ads. If consumers like the content in an advertisement, they can "like" or "share" it, giving an advertising campaign more exposure and making it more effective. Lee and Hong's research (2016) indicated that "informativeness" and "advertising creativity" are the two most important factors in attracting positive engagement by consumers. Furthermore, this engagement was positively associated with intentions to purchase the product. Another study found that South Asian consumers' favorable attitudes toward social media advertising could positively affect their ad clicking and purchasing behavior (Mir, 2012). This study showed that advertisements that cause consumers to have favorable attitudes are typically more effective. Additionally, advertisements that are both informative and attractive tend to generate more clicks and, therefore, more purchases. (Zhang and Mao, 2016).

One recent meta-analysis sought to analyze and elaborate on various strategies used in social media marketing (SMM) and their effectiveness (Dwivedi, Kapoor, & Chen, 2015). The authors collected 71 relevant articles on the boom in social media and SMM and identified several potential research directions. Other research has focused on the return of investment (ROI) of social media advertising; for example, one study measured the ROI of social media advertising for an ice cream retailer in India, finding that social media advertising increased sales and profits for the ice cream retailer. And the researchers measured the values of customers' WOM using unique metrics and therefore evaluated the effectiveness of the advertising. (Bhaskaran et al., 2013).

People in different stages of life respond differently to advertisements on social media (Chu, 2011). For example, college-aged people tend to have more favorable attitudes toward

advertising on social media platforms than others. Chu's (2011) study shows that people with different demographic characteristics may exhibit different reactions to the same advertising content on social media.

Recent research from Lee, Hosanagar, and Nair (2018) focused on the connection between different social media marketing content and customers' engagement (i.e., comments, shares, likes, and click-throughs). They found that creative content attracted more consumer engagement than information about prices or deals. This suggests that social media advertisements with different types of content may have different effectiveness. A similar study conducted by Ashley and Tuten (2015) concluded that consumers prefer creative advertising content and that sellers should update their ads frequently to attract more consumer engagement. In other words, consumers not only care about the ad content but also the freshness of the information. Interactivity, informativeness, and perceived relevance significantly impact consumers' intentions to purchase (Alalwan, 2018). These studies are a reminder not to focus solely on the relationship between consumers' WTP and the form of the advertising (i.e., generic advertising on social media platforms), but also on the content/themes or timing of the ads.

Agricultural products are produced by many farmers and represent a commodity category rather than a specific brand. There are generic advertising programs for almost every agricultural commodity produced in the U.S., which aim to benefit all producers of that commodity. Some well-known examples are "Got Milk?" and "Beef: it's what's for dinner" and "Pork: the other white meat." There have been thousands of research studies evaluating the effectiveness and impacts of generic advertising. Ferrero et al. (1996) documented hundreds of scholarly works focused on generic commodity advertising and promotion in multiple fields, including advertising theory; citrus produce, fluid milk, and other dairy products; econometric methods,

and more. This annotated bibliography is a comprehensive catalog of the studies assessing the impacts of generic advertising on consumer behavior.

A recent study showed that generic advertising from the Christmas Tree Promotion Board (CTPB) increased the demand for Christmas trees (Richards, 2020). For Christmas trees, social media advertising is typically more profitable than other marketing activities, with ads on video-related media performing the worst (Richards, 2020). But there are some nuances to the success of generic advertising: Bass et al. (2005) compared brand advertising and generic advertising using differential game theory and concluded that generic advertising had greater impacts on consumer demand in the short term. Schmit and Kaiser (2004) found that the elasticities of generic advertising varied over time. They studied generic advertising for cheese and fluid milk and concluded that generic advertising targeting people with specific demographic characteristics could be more effective than without targeting. For example, advertising for generic fluid milk is most effective for young children and households with young children. A general finding based on these studies is that advertising affects consumers' WTP and increases demand (Kaiser, 2011).

Although much research is focused on social media advertising, consumer attitudes and behaviors, and the relationships between generic advertising and consumers' WTP and spillovers, few studies have addressed the association between generic advertising on social media platforms in particular and consumers' WTP or the potential spillover of these advertisements. One recent study that analyzed the impacts of social media generic advertising on consumer preferences showed that there is a significant spillover from generic advertising (Chen et al., 2022). This research also showed that generic advertising on social media could

substantially increase consumers' WTP for the promoted product. Our paper seeks to contribute to knowledge about generic advertising on social media.

PROBLEM STATEMENT

This study focuses on the effect of generic advertising for walnuts on social media on consumers' WTP for various nuts. Many studies have evaluated the effectiveness and impacts of generic promotion for agricultural products (see Ferrero et al., 1996, and Kaiser, 2011, for a comprehensive review). Kaiser (2011) summarized the following findings: first, the bulk of empirical evidence supports the notion that generic advertising has a positive and statistically significant but relatively small impact on own demand for agricultural commodities. Second, own advertising effects tend to be higher from the single equation that ignores spillover than demand system models that explicitly consider them. Third, generic advertising has potentially important spillover effects on competing commodities that are, in some cases, even more important than effects on the product advertised. Fourth, there are substantial benefits to producers from these programs net of costs. Finally, and without exception, generic advertising programs are under-funded from an optimal perspective. The same finding was confirmed by one of Kaiser's earlier studies which found that generic dairy advertising can effectively increase dairy product demand. (Kaiser et al., 1992).

Despite these demonstrations of the effectiveness of generic advertising, there is more to learn about whether generic advertising on social media platforms (e.g., Twitter) can also increase consumers' WTP for specific products such as California walnuts. We, therefore, developed the following hypothesis to test:

H1₀: *The recipe-themed and nutrition-themed California walnut generic advertisements on social media do not increase consumers' WTP for walnuts compared with the control group.*

H1_a: *The recipe-themed and nutrition-themed California walnut generic advertisements on social media increase consumers' WTP for walnuts compared with the control group.*

A study by Kinnucan et al., (1997) showed that generic advertising for meat positively increased demand for meat, and more specifically, that information about the health benefits of meat had a greater impact on consumers' WTP than information about the price of meat. In other words, those consumers who received health information about meat had a higher WTP than those consumers who received information about sales or discounts. Consumers may therefore respond more positively to health facts about walnuts than recipes with walnuts. Another study has shown that, compared with advertising for healthy eating, anti-obesity advertising is more effective at increasing consumers' WTP for nutritious items (Wang, Liaukonyte, & Kaiser, 2018). This indicates that advertising content does matter for consumers and could significantly affect their WTP for products. Thus, we expected that the health facts of walnuts and walnut recipes could affect consumers' WTP for walnuts differently and developed the following null hypothesis:

H2₀: *Recipe-themed advertisements on social media do not increase walnut WTP compared with nutritional-themed advertisements.*

H2_a: *Recipe-themed advertisements on social media increase walnut WTP compared with nutritional-themed advertisements.*

Because we also wanted to know if these advertisements would affect consumers' WTP for other similar nuts, we developed one final hypothesis to test the spillover effects on pecans and cashews. Previous research suggests that generic advertising on social media can have a spillover effect (Schmit et al., 2002). Since walnuts, pecans, and cashews are all nuts, participants may believe that they all have similar health benefits or that pecan and cashews could be used as substitutes for walnuts in the exhibited recipes. The generic advertisements for walnuts may, therefore, affect not only consumers' WTP for walnuts but also their WTP for cashews and pecans. Thus, we measured consumers' WTP for these other nuts after they had viewed the generic advertising for walnuts and tested the following null hypothesis:

***H3₀:** The recipes-themed advertisements and nutrition-themed advertisements have no spillover effect on cashew and pecans.*

***H3_a:** The recipes-themed advertisements and nutrition-themed advertisements have a positive spillover effect on cashew and pecans.*

OBJECTIVES

The objective of this research was to test the three hypotheses listed above. We wanted to determine whether generic advertising for California walnuts on social media platforms such as Twitter could affect consumers' WTP for walnuts. Specifically, we wanted to learn how different generic advertising content could affect consumers' WTP for walnuts; we, therefore, used two different types of content themes—health facts about walnuts and recipes using walnuts. The objective of both content themes was to increase the demand for walnuts, which we measured by eliciting WTP. For the health category content, we shared both images and texts about walnuts to explain the health benefits of consuming walnuts. For the recipe category content, we exhibited

recipes using walnuts with images. Finally, we wanted to determine whether generic advertising related to walnuts had a spillover effect, and so after viewing the advertisements, participants were asked to share their WTP for not only walnuts but also for cashews and pecans.

METHODOLOGY

To analyze the impact of generic advertising on WTP, experiments are a useful, but not often used method. One study on the spillover effects of website advertising used a field experiment (Sahni, 2016). Another study used experiments to measure the effects of advertising on consumer behavior (Woodside, Trappey, & MacDonald, 1997). In our research, we used a controlled online experiment combined with a questionnaire to measure the effect of generic advertising on social media on consumers' WTP for walnuts, pecans, and cashews.

We tested two treatment groups and one control group. Every group received ten Twitter posts with different content; details are provided below. We randomized the subjects into control and treatment groups to make their composition similar. Time checking was implemented for every subject to require participants' ad browsing time to last at least 40 seconds in order to ensure subjects looked carefully at the ads.

Experimental Design

The survey was designed using the online survey platform Qualtrics and was implemented by the Qualtrics Project Team. All the subjects were recruited online. The Institutional Review Board (IRB) application was approved by the Cornell University IRB Office. All participants were provided an informed consent form, which they were required to read and sign before beginning the survey.

A total of 751 subjects completed the survey. All were over 18 years of age and were the primary food shoppers in their households. We imposed quotas for age, region, ethnicity, education, and household income to make the sample representative of the U.S. population. Approximately 98% of participants reported at least occasionally consuming nuts.

Participants were randomly and evenly assigned to one of three groups using Qualtrics' computer algorithm, with one control group and two treatment groups. Participants did not know which group they were in. The health fact treatment group had 253 participants, and the recipe treatment group had 246 participants. Both treatments were designed to increase demand for walnuts. Those in the "walnuts health facts treatment," were shown ten posts with images related to the health benefits of consuming walnuts. For example, one post stated that walnuts contain lots of omega-3 eicosapentaenoic acid and that "Regular consumption of foods rich in marine and plant-based omega-3s may reduce risk of death three years after suffering a heart attack." Figure 1 is one of the ten posts shown to participants in the health treatment group. The other group received the "walnut recipes treatment," which were ten posts sharing recipes for walnuts. For example, one post showed people an appetizing image of a Mediterranean farro salad with walnuts in it. Other examples of these posts and images can be found in the Appendix. Participants were told beforehand that the advertisements were not clickable.

The control group survey, which had 252 participants, was designed to be as similar as possible to the two treatments, except that the participants were not exposed to any generic advertising for walnuts. Instead, they were asked to browse ten Twitter posts with images that were promotions for a particular brand of coffee.



Figure 1: One of the ten posts shown to participants in the health treatment group

Before being assigned into a group, participants were given instructions about the survey and were prompted with the background information shown in Table 1. No information related to the content of the posts was revealed, and subjects were asked to make purchasing decisions (bids) for some set of food products. They were then invited to take a simple attention test to ensure that all responses collected were from subjects who treated the survey seriously; those who failed the test were removed from the experiment. (An attention test is frequently used in online experiments.) While additional information differed by treatment, all participants were given the same instructions in Table 1 before seeing the ten Twitter posts so that they knew that they would be shown non-clickable images instead of actual Twitter posts.

Table 1: Background information and instructions supplied to experiment participants

Item	Text
Experiment introduction	<p>In this survey, you will be given information about several food products, and you will be asked to indicate purchasing decisions and choices given a set of options. There are no correct or incorrect answers on the purchasing decisions in this survey.</p> <p>Please behave in the same way that you would if you really had to pay for the product and take it home. Please take into account how much you really want the product, as opposed to other alternatives that you like or any other constraints that might make you change your behavior, such as taste or your grocery budget. The results of this study may impact actual policy decisions in the future, so please try to put yourself in a realistic situation.</p>
Introduction for the social media posts	<p>On the next page, you will see some posts from a social media platform. To make sure that the data we collected was valid, we used images instead of actual posts. So, all the pictures and links on those posts will not be clickable. Please take your time to browse these posts as you are browsing real posts on real social-media platforms. You need to stay on the page for at least 45 seconds to move forward.</p>
Guide for the WTP section	<p>Now, we will ask you about your willingness to pay for several products. The quantity, quality, and packaging of the products are identical, and the only difference is the preparation method. Please move the lever to choose the amount of money you will pay for each product. The maximum amount you can bid on the product is \$20. You can select any amount between \$0 and \$20, and your selection will be shown above the lever. Notice that if you would not buy the product, leave the lever at 0.</p>

All participants were asked to browse and examine these posts closely and rate the quality of the posts on a scale from 1 to 8. The posts related to recipes received the highest rating

(6.43 out of 8 on average) for their quality among the three groups. The complete average quality rating for advertisements in all three groups can be found in Table 1. As previously mentioned, to make sure all participants paid enough attention to the posts, we set a minimum browsing time, forcing them to stay on the page for at least 40 seconds before they could move forward. Some people's attention spans may be short as they browse Twitter, but we could not observe participants' attention and status in this online experiment. After testing the survey and recording several Cornell students' and faculty members' browsing time, we determined that 40 seconds was a reasonable time limit. However, for technical reasons, 36 participants did not browse for at least 40 seconds, a problem which we addressed by including the results of time-controlled regressions in the appendix for robustness. In the time-controlled regressions, we filtered out these 36 participants and the results were not significantly different than the original regression results. This procedure is explained further below.

Participants' demographic information was collected before they entered their assigned groups through a questionnaire with eight questions. The questions and answer options provided are listed in Table 2. After viewing the ten posts to which they had been assigned, all participants were moved to the final part of the survey. In this part, participants were provided with instructions to bid on (give their WTP for) ten nut products, including walnuts, pecans, and cashews. Participants were told that the quantity, quality, and packaging of the products were identical. These ten products included four walnut products, three cashew products, and three pecan products. The four walnut products had the same quantity, quality, and packaging, but they had different preparation: raw walnuts, salted roasted walnuts, unsalted roasted walnuts, and maple glazed walnuts. The same was true for all the pecan and cashew products. No brand was indicated on the packaging of any of the product, as we wanted to avoid brand effects in the

WTP. Figure 2 is an example of one product (image and description) shown to all participants.
(See the Appendix for more images and details.)

Table 2: Demographic questions and answer option list

Question	Answer options/description
1. Are you the primary food shopper of your household?	Yes/No
2. Are you vegetarian?	Yes/No
3. Please specify your ethnicity.	<ul style="list-style-type: none"> – Non-Hispanic White – Non-Hispanic Black – Hispanic – Asian – Other
4. Where is your home located?	<ul style="list-style-type: none"> – Midwest – Northeast – South – West
5. What is your annual household income?	<ul style="list-style-type: none"> – \$0–<\$25K – \$25K–<\$50K – \$50K–<\$75K – \$75K–<\$100K – \$100K–<\$150K – \$150K+
6. What is your gender?	<ul style="list-style-type: none"> – Male – Female – Other (enter): ___ / Prefer not to say
7. What is your age?	<i>Let participant enter integers</i>
8. What is the highest level of education you have completed?	<ul style="list-style-type: none"> – Less than high school – High school graduate – Some college – 2-year degree – Bachelor's – Master's – Doctoral degree – Other advanced degrees



Roasted California Walnuts (salted) 16oz

Figure 2: One product (with description) was shown to all participants in the experiment

Participants were then required to move a lever (between \$0.00 and \$20.00) to choose their maximum WTP for each product. The range was large enough to accommodate people who do and do not like nuts. In this part of the experiment, participants in each group (including the control group) were given identical product pictures and descriptions in the same sequence. The descriptions for products included information about each product's name, preparation method, and weight. Participants were required to bid separately for each of the ten nut products (a list of these products can be found in the Appendix). After that, participants answered three questions about their preferences for nuts: whether they were allergic to nuts (Yes / No), the frequency of their consumption of nuts (options provided), and their reasons for consuming nuts (options provided included taste, the nutritional profile of nuts, and other reasons). The questions and options are given in Table 3.

Table 3: Consumption preference questions and answer option list

Question	Answer options/description
Are you allergic to nuts?	Yes/No
On average, how often do you consume nuts?	<ul style="list-style-type: none"> – Never – Monthly or more rarely – Once a week – More than once a week
What attract(s) you most about consuming nuts? (<i>Allow multiple answers</i>)	<ul style="list-style-type: none"> – Nutritional profile of nuts – Taste – Others

Econometric Models

We used two different models to analyze the results: an ordinary least squares (OLS) regression model and a Tobit regression model. We included fixed effects for both regressions to control for the bias that could be caused by differences in participants’ demographic characteristics and socioeconomic status, as well as systematic valuation differences across different items. We applied fixed effects for products and demographic characteristics including “location,” “educational level,” “income,” and “ethnicity” by generating categorical variables and grouping them. The OLS model was first used to estimate how demographic characteristics, the treatments, and the varying products affected participants’ WTP.

Second, we used a Tobit regression model for the left-censored dependent variables, using the same data, including participants’ demographic characteristics, because, in our experiments, participants were allowed to submit bids of \$0.00, although only 7.78% of participants did so. The same process as above was used to apply the fixed effect to the Tobit model. We estimated the following Tobit model:

$$\begin{cases} WTP_{ij}^* = \alpha_j + \beta_j treatment_{health_{ij}} + \beta_k treatment_{recipe_{ij}} + BX + \varepsilon_{ij} \\ WTP_{ij} = \max(WTP_{ij}^*, 0) \end{cases}$$

The subscript i refers to the i th participant, and j to the j th product among the ten products shown to participants. The constant term is α_j and $\beta_j treatment_{health_{ij}}$ is equal to 1 when the participants belong to the health treatment group. Conversely, if participants belong to the recipe treatment group, $\beta_k treatment_{recipe_{ij}}$ equals 1. X is a vector of demographic variables and B is a vector of regression coefficients. Finally, the error term is ε_{ij} and we assumed a normal distribution.

In addition, we also used an OLS regression model with interaction terms on the treatments and some of the demographics to identify any demographic groups who were more or less responsive to the treatments. For example, the OLS model including the variable “treatment * vegetarian” as interaction terms is listed below:

$$WTP_{ij} = b_0 + b_1 treatment_{health} + b_2 treatment_{recipe} + b_3 treatment_{health} * vegetarian + b_4 treatment_{recipe} * vegetarian + b_5 products_j + \varepsilon_{ij}$$

Here, both $treatment_{health} * vegetarian$ and $treatment_{recipe} * vegetarian$ are interaction terms, and $treatment_{health}$ or $treatment_{recipe}$ is a regular dummy variable for the treatment. If a given participant was assigned to the health treatment group, the $treatment_{health}$ would be 1 and $treatment_{recipe}$ would be 0. The variable $products_j$ is a categorical variable that contains the ten products in the experiment. In this case, the WTP of non-vegetarians who received the health treatment for product j is simply expressed as $b_0 + b_1 + b_5$, while the WTP for vegetarians who also received the health treatment is $b_0 + b_1 + b_3 + b_5$. Additionally, the

coefficients for the interaction terms b_3 tell us if vegetarians responded differently to the treatments than non-vegetarians, and for vegetarians, the effect is $b_0 + b_3$ or b_4 , depending on which treatment they received.

Following the similar structure of the OLS model above, we did several separate OLS regressions with different interaction terms such as “treatment * female.” We did not put all the interactions into one regression because there were not enough degrees of freedom to estimate all interactions at one time.

RESULTS

Descriptive Data

Table 4 provides a detailed summary of the participants’ social–demographic characteristics. Of the 751 valid responses in total, 61.5% were female, the largest fraction was non-Hispanic whites (66.4%), and regionally, the largest fraction was from the South (42.6%). Most of the respondents had earned a 2-year college or bachelor’s degree (61.8%), 7.3% had earned a master’s degree, and 2.1% had earned a doctoral degree and above. Most households’ income fell between \$25,000 to \$100,000 per year. More than 98% consumed nuts regularly, with only 0.93% of respondents being allergic to nuts. All respondents were primary food shoppers in their households (because any who were not the primary food shoppers were automatically filtered out by the quotas). 15.3% of participants gave the “nutritional profile of nuts” as the only reason they consume nuts, while 37% of participants stated that they consume nuts only for “taste.”

Table 4: Descriptive statistics of demographic variables by treatment

	All	Control	Health group	Recipe group
WTP (Raw Walnut)	6.66 (4.07)	6.42 (4.04)	7.07 (4.10)	6.47 (4.04)
(Salted Walnut)	7.04 (4.26)	6.57 (4.36)	7.39 (4.21)	7.17 (4.19)
(Unsalted Walnut)	6.71 (4.31)	6.49 (4.43)	6.96 (4.17)	6.69 (4.32)
(Maple glazed Walnut)	7.49 (4.73)	7.19 (4.79)	7.64 (4.73)	7.65 (4.67)
(Raw cashews)	6.55 (4.44)	6.39 (4.50)	6.81 (4.32)	6.45 (4.50)
(Salted cashews)	7.44 (4.73)	7.24 (4.68)	7.54 (4.16)	7.54 (4.57)
(Unsalted cashews)	6.82 (4.64)	6.63 (4.66)	7.04 (4.48)	6.78 (4.78)
(Raw pecans)	6.25 (4.40)	5.97 (4.42)	6.45 (4.39)	6.33 (4.40)
(Salted pecans)	6.67 (4.64)	6.37 (4.58)	6.69 (4.42)	6.96 (4.92)
(Unsalted pecans)	6.45 (4.43)	6.14 (4.32)	6.59 (4.33)	6.63 (4.62)
Age	40.67 (13.73)	41.00 (13.74)	40.00 (13.43)	41.02 (14.04)
Female (%)	61.52	63.1	58.89	62.60
Primary food shopper (%)	100	100	100	100
Vegetarian (%)	12.65	13.10	10.67	14.23
Non-Hispanic White (%)	66.44	66.67	66.80	65.85
Non-Hispanic Black (%)	14.25	14.29	13.04	15.45
Hispanic (%)	10.79	10.32	13.04	8.94
Asian (%)	5.33	3.57	5.53	6.91
Midwest (%)	21.04	23.02	19.37	20.73
Northeast (%)	17.98	20.24	18.18	15.45
South (%)	42.61	41.27	40.71	45.93

Table 4 continued				
	All	Control	Health	Recipe
West (%)	18.38	15.48	21.74	17.89
Income \$0–\$25,000 (%)	20.24	19.84	20.55	20.33
Income \$25,000–\$50,000 (%)	25.30	25.79	24.90	25.20
Income \$50,000–\$75,000 (%)	19.44	16.27	20.95	21.14
Income \$75,000–\$100,000 (%)	14.11	12.70	15.42	14.23
Income \$100,000–\$150,000 (%)	14.51	17.46	11.86	14.23
Income over \$150,000 (%)	6.39	7.94	6.32	4.88
College or bachelor's degree (%)	61.78	63.49	57.70	64.23
Master's degree (%)	7.32	5.16	10.28	6.50
Doctoral degree (%)	2.13	1.59	1.98	2.84
Consume nuts monthly or more rarely (%)	29.16	30.56	27.67	29.27
Consume nuts once a week (%)	34.89	34.52	35.97	34.15
Consume more than once a week (%)	34.22	33.73	34.78	34.15
Rating for posts/advertisements (scale from 1 to 8)	6.27	6.21	6.17	6.43
Allergic to nuts (%)	0.93	0.79	1.19	0.81
Average posts browsing time (seconds)	66.92	69.73	62.69	68.40
Number of subjects	751	252	253	246

The WTP of all participants for 16 ounces (about 450 grams) of raw walnuts, on average, was \$6.66, with a standard deviation of \$4.07, and the average WTP for raw cashews and raw pecans was \$6.55 and \$6.25, respectively. Participants in different groups had different average WTP for different products, as shown in Table 5 and Figure 3. Generally speaking, consumers in the health treatment group had the highest average WTP for most products. The average rating score for all 30 posts (10 posts for each group) was 6.27, with a range from 1 (lowest rating) to 8

(highest rating). The recipes treatment group received the highest average rating, while the health treatment group received the lowest average score. The average time participants (in all groups) spent viewing all their assigned ten posts was 66.92 seconds (with 40 as a minimum browsing time limit), with participants in the health fact control group spending slightly less.

As described above, the 751 participants were randomly and evenly assigned into three groups so that the number of subjects in each group was similar. We did not find a significant imbalance between the control group and the two treatment groups. The descriptive statistics of demographics were similar for each group. Indeed, those characteristics are not correlated with the assignment to treatments.

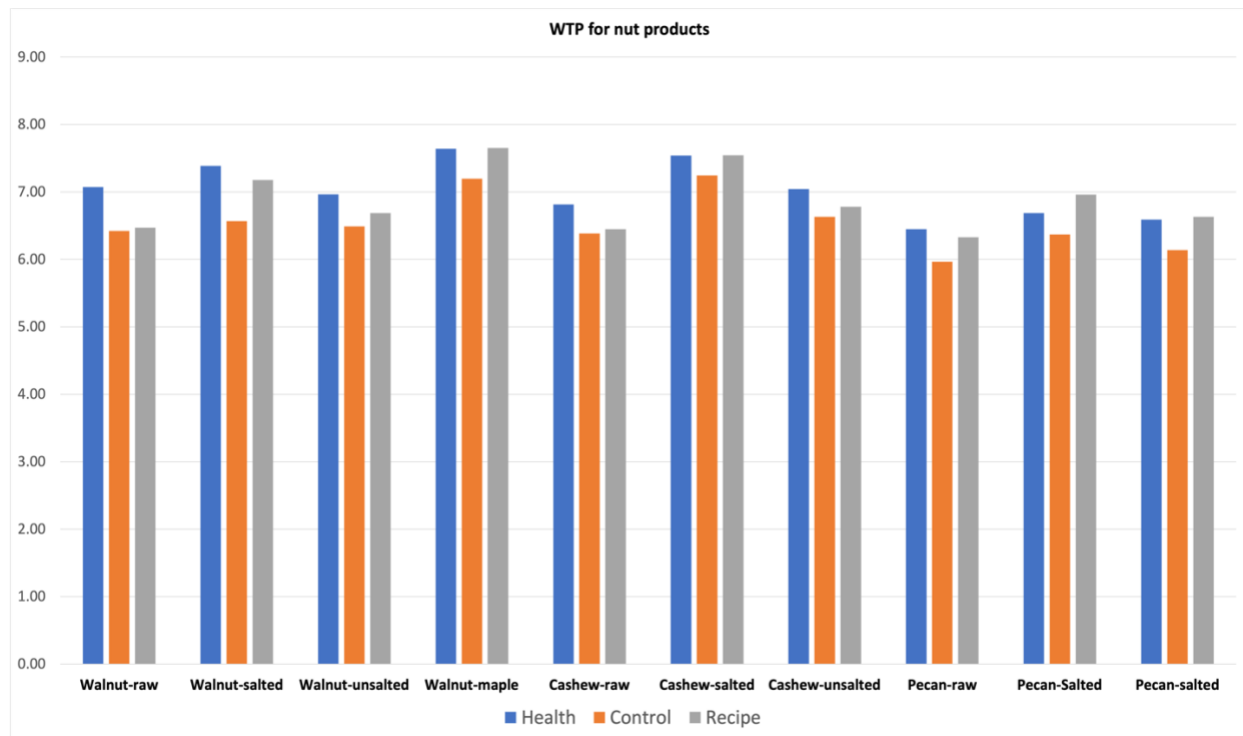


Figure 3: WTP for nut products

Regression Results

The OLS regression result includes all 751 participants and is shown in Table 5. The excluded categories (base) in subsets in Tables 5, 6, 7, and 8 were “Ethnicity – Asian,” “Education level – Precollege/preuniversity,” “Household income – Less than \$50K,” “Location – Midwest,” and “Products – Raw cashews.” In the questionnaire, there was no option for “Precollege/preuniversity” for education level and “Less than \$50K” for household income. This is because we decided to reduce the number of options when doing the regressions to improve the significance of our regression results. In the end, there were three levels for the income variable: “Less than \$50K,” “\$50K–\$100K,” and “Over \$100K,” and three levels for the education variable: “Precollege/preuniversity,” “College/university,” and “Postgraduate.” The Tobit regression model was also used in our analysis for robustness, and the results are presented in Table 6.

We also conducted two regressions for the time-controlled dataset. The time-controlled dataset is the same as the original dataset, except that all participants who had a post browsing time of less than 40 seconds were dropped ($n=36$). We used the remaining 715 participants’ data as a controlled dataset for our OLS and Tobit regression. The results for the controlled and original regression were not significantly different, and we only found some minor differences for variables’ coefficients. This suggested that the 36 participants we filtered out did not have a significant impact on the overall regression results. Results for the controlled OLS regression and Tobit regression can be found in Tables 7 and 8, respectively.

Based on the result of our OLS regression in Table 5 (time not controlled), participants in the recipe treatment group did not have significantly higher WTPs for products compared with participants in the control group. But participants who received the health treatment did show significantly higher WTPs than those in the control group. The health treatment group had a

coefficient significantly greater than the control group (base level) by 0.435, or a higher WTP by about \$0.435. In other words, subjects exposed to the generic health advertising had 8.25% higher bids than the control group on average (Table 4). Furthermore, participants in the health treatment group had the highest WTP in general. This result suggests that generic advertising increases consumers' WTP for products, which is consistent with the vast majority of the literature. Figure 4 shows how different dummy variables contribute to the increase in participants' WTP, and Figure 5 shows the percentage of increase in WTP in the two treatment groups compared to the control group given the regression estimates.

There are a few more findings of interest. Participants' ratings for the ten advertisements they saw was positively related to their WTP for products. Vegetarian participants tended to bid higher than non-vegetarians. And ages of participants were negatively correlated with their WTP for products. Compared with Asians, white participants had a significantly higher WTP. But based on the p-values, it is not possible to identify statistically significant relationships between Asian participants' WTP for the following ethnicities: Black, Hispanic, and Native Americans.

Also, participants with postgraduate educational levels generally had a higher WTP. Participants with college/university degrees did not exhibit significantly higher WTP compared with others. In addition, participants with a higher household income have higher WTP than others. We found a significant relationship showing that participants' household income was positively related to their WTP for nut products. Generally, participants were willing to pay more for salted and maple glazed walnuts and salted cashews. Additionally, the participants living in the southern United States had the highest WTP. A possible explanation for this might be that the South is the main producing region of various tree nuts, and people in the South are more familiar with nuts and tend to have more nuts in their diets.

Table 5: OLS regression results

WTP	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
Health treatment	.4350721	.1233894	3.53	0.000	.1931941	.6769501
Recipe treatment	.1857875	.1234545	1.50	0.132	-.056218	.4277931
Vegetarian	1.204592	.1543114	7.81	0.000	.9020982	1.507086
Age	-.0180821	.0038264	-4.73	0.000	-.025583	-.0105813
Female	-.1345673	.104873	-1.28	0.199	-.3401479	.0710133
Rate	.39926	.0349494	11.42	0.000	.3307494	.4677706
<i>Ethnicity</i>						
Black	.2840682	.2699054	1.05	0.293	-.2450222	.8131585
Hispanic	.3684037	.2703119	1.36	0.173	-.1614836	.898291
White	.5120161	.2398491	2.13	0.033	.0418445	.9821878
Other	-.5366463	.3584061	-1.50	0.134	-1.239223	.1659303
<i>Education level</i>						
College/university	.1989027	.1159953	1.71	0.086	-.0284806	.426286
Postgraduate	.981661	.2029495	4.84	0.000	.583823	1.379499
<i>Household income</i>						
\$50K-<\$100K	.7917726	.1166191	6.79	0.000	.5631664	1.020379
Over \$100K	1.105222	.1501308	7.36	0.000	.8109237	1.399521
<i>Location</i>						
Northeast	.6733295	.1607893	4.19	0.000	.3581374	.9885217
South	.8918206	.1367193	6.52	0.000	.6238123	1.159829
West	.5591749	.1699521	3.29	0.001	.226021	.8923289
<i>Products</i>						
Cashew salted	.8925433	.2222069	4.02	0.000	.4569552	1.328131
Cashew unsalted	.2688415	.2222069	1.21	0.226	-.1667465	.7044296
Walnut maple	.9443409	.2222069	4.25	0.000	.5087528	1.379929
Walnut raw	.1079893	.2222069	0.49	0.627	-.3275987	.5435774
Walnut salted	.492277	.2222069	2.22	0.027	.0566889	.927865
Walnut unsalted	.1635153	.2222069	0.74	0.462	-.2720727	.5991034
Roast pecan salted	-.0985353	.2222069	-0.44	0.657	-.5341233	.3370528
Roast pecan salted	.1213049	.2222069	0.55	0.585	-.3142831	.556893
Pecan raw	-.3033289	.2222069	-1.37	0.172	-.7389169	.1322591
_cons	2.786374	.421987	6.60	0.000	1.959161	3.613587

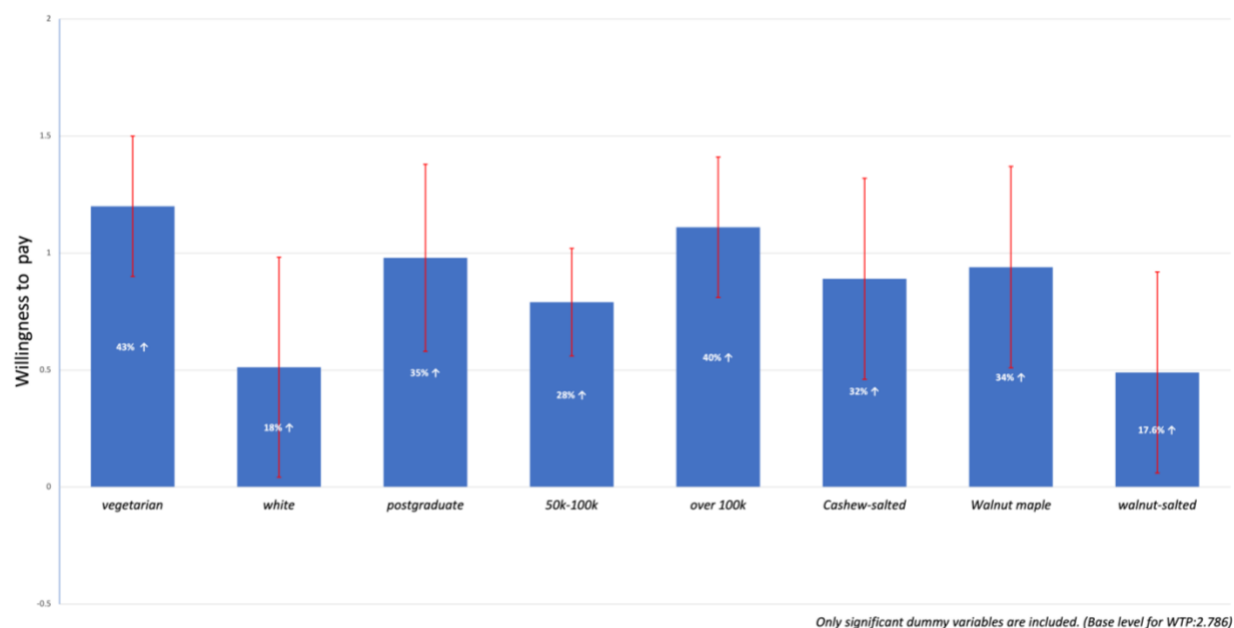


Figure 4: Regression results with 95% confidence interval (dummy variables)

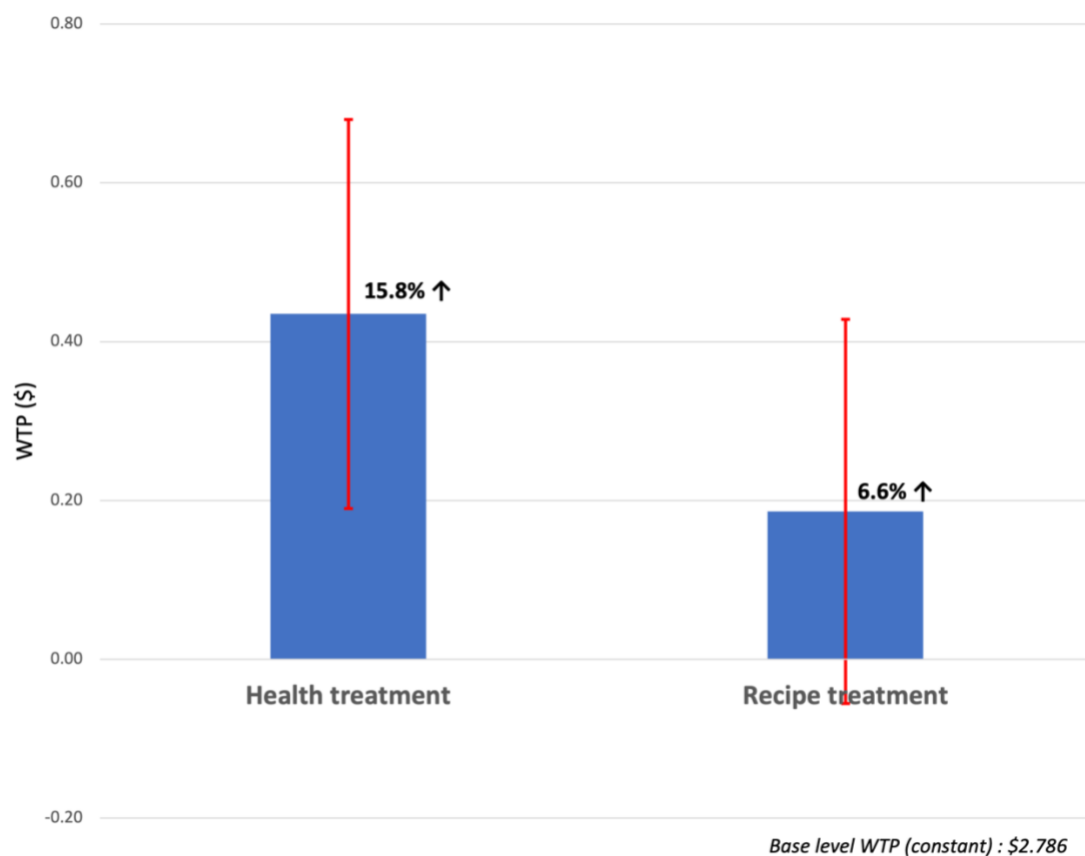


Figure 5: Coefficients for two treatments

Table 6: Tobit regression results

WTP	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
Health treatment	.4350721	.1231674	3.53	0.000	.1936293	.6765149
Recipe treatment	.1857875	.1232324	1.51	0.132	-.0557826	.4273576
Vegetarian	1.204592	.1540337	7.82	0.000	.9026424	1.506541
Age	-.0180821	.0038195	-4.73	0.000	-.0255695	-.0105948
Female	-.1345673	.1046844	-1.29	0.199	-.3397781	.0706434
Rate	.39926	.0348865	11.44	0.000	.3308727	.4676474
<i>Ethnicity</i>						
Black	.2840682	.2694198	1.05	0.292	-.2440703	.8122066
Hispanic	.3684037	.2698255	1.37	0.172	-.1605302	.8973376
White	.5120161	.2394176	2.14	0.033	.0426904	.9813418
Other	-.5366463	.3577612	-1.50	0.134	-1.237959	.1646662
<i>Education level</i>						
College/university	.1989027	.1157866	1.72	0.086	-.0280715	.4258769
Postgraduate	.981661	.2025843	4.85	0.000	.5845388	1.378783
<i>Household income</i>						
\$50K-<\$100K	.7917726	.1164093	6.80	0.000	.5635777	1.019968
Over \$100K	1.105222	.1498607	7.37	0.000	.8114532	1.398991
<i>Location</i>						
Northeast	.6733295	.1605	4.20	0.000	.3587045	.9879546
South	.8918206	.1364734	6.53	0.000	.6242945	1.159347
West	.5591749	.1696463	3.30	0.001	.2266204	.8917294
<i>Products</i>						
Cashew salted	.8925433	.2218071	4.02	0.000	.457739	1.327348
Cashew unsalted	.2688415	.2218071	1.21	0.226	-.1659628	.7036459
Walnut maple	.9443409	.2218071	4.26	0.000	.5095366	1.379145
Walnut raw	.1079893	.2218071	0.49	0.626	-.326815	.5427937
Walnut salted	.492277	.2218071	2.22	0.026	.0574726	.9270813
Walnut unsalted	.1635153	.2218071	0.74	0.461	-.271289	.5983196
Roast pecan salted	-.0985353	.2218071	-0.44	0.657	-.5333396	.336269
Roast pecan salted	.1213049	.2218071	0.55	0.584	-.3134994	.5561092
Pecan raw	-.3033289	.2218071	-1.37	0.171	-.7381332	.1314754
_cons	2.786374	.4212277	6.61	0.000	1.960649	3.612099
var(e.WTP)	18.474	.3014783			17.89237	19.07454

Table 7: Linear regression after browsing time controlled

WTP	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
Health treatment	.4119109	.125287	3.29	0.001	.1663112	.6575106
Recipe treatment	.0434571	.1249283	0.35	0.728	-.2014395	.2883538
Vegetarian	1.330414	.1581648	8.41	0.000	1.020364	1.640464
Age	-.017146	.003855	-4.45	0.000	-.0247029	-.009589
Female	-.2014011	.1066636	-1.89	0.059	-.4104935	.0076912
Rate	.4218258	.0359331	11.74	0.000	.3513863	.4922654
<i>Ethnicity</i>						
Black	.5121208	.2697019	1.90	0.058	-.0165751	1.040817
Hispanic	.3400281	.2703437	1.26	0.209	-.1899259	.8699821
White	.461339	.2385284	1.93	0.053	-.0062475	.9289254
Other	-.5449608	.3554633	-1.53	0.125	-1.241774	.1518529
<i>Education level</i>						
College/university	.2168375	.1181515	1.84	0.067	-.0147745	.4484494
Postgraduate	1.012699	.2033444	4.98	0.000	.6140832	1.411314
<i>Household income</i>						
\$50K-<\$100K	.8020369	.1193956	6.72	0.000	.567986	1.036088
over \$100K	1.121553	.1504179	7.46	0.000	.8266889	1.416416
<i>Location</i>						
Northeast	.4446846	.1626459	2.73	0.006	.1258502	.763519
South	.7998683	.1382799	5.78	0.000	.5287986	1.070938
West	.4786788	.1705267	2.81	0.005	.1443958	.8129618
<i>Products</i>						
Cashew salted	.9106294	.22575	4.03	0.000	.4680923	1.353166
Cashew unsalted	.2885315	.22575	1.28	0.201	-.1540056	.7310685
Walnut maple	.9823776	.22575	4.35	0.000	.5398406	1.424915
Walnut raw	.1262937	.22575	0.56	0.576	-.3162433	.5688308
Walnut salted	.5173427	.22575	2.29	0.022	.0748056	.9598797
Walnut unsalted	.1823776	.22575	0.81	0.419	-.2601594	.6249147
Roast pecan salted	-.0721678	.22575	-0.32	0.749	-.5147049	.3703692
Roast pecan salted	.1383217	.22575	0.61	0.540	-.3042154	.5808587
Pecan raw	-.2890909	.22575	-1.28	0.200	-.731628	.1534461
_cons	2.721288	.4266981	6.38	0.000	1.884833	3.557743

Table 8: Tobit regression after browsing time controlled

WTP	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
Health treatment	.4119109	.1250502	3.29	0.001	.1667754	.6570465
Recipe treatment	.0434571	.1246922	0.35	0.727	-.2009767	.287891
Vegetarian	1.330414	.1578659	8.43	0.000	1.02095	1.639878
Age	-.017146	.0038477	-4.46	0.000	-.0246887	-.0096033
Female	-.2014011	.106462	-1.89	0.059	-.4100983	.007296
Rate	.4218258	.0358652	11.76	0.000	.3515194	.4921323
<i>Ethnicity</i>						
Black	.5121208	.2691922	1.90	0.057	-.0155759	1.039817
Hispanic	.3400281	.2698328	1.26	0.208	-.1889243	.8689805
White	.461339	.2380776	1.94	0.053	-.0053638	.9280417
Other	-.5449608	.3547915	-1.54	0.125	-1.240458	.150536
<i>Education level</i>						
College/university	.2168375	.1179282	1.84	0.066	-.0143368	.4480117
Postgraduate	1.012699	.2029601	4.99	0.000	.6148365	1.410561
<i>Household income</i>						
\$50K-<\$100K	.8020369	.11917	6.73	0.000	.5684283	1.035645
over \$100K	1.121553	.1501336	7.47	0.000	.8272462	1.415859
<i>Location</i>						
Northeast	.4446846	.1623386	2.74	0.006	.1264528	.7629164
South	.7998683	.1380186	5.80	0.000	.5293109	1.070426
West	.4786788	.1702044	2.81	0.005	.1450275	.81233
<i>Products</i>						
Cashew salted	.9106294	.2253233	4.04	0.000	.4689287	1.35233
Cashew unsalted	.2885315	.2253233	1.28	0.200	-.1531692	.7302322
Walnut maple	.9823776	.2253233	4.36	0.000	.5406769	1.424078
Walnut raw	.1262937	.2253233	0.56	0.575	-.315407	.5679944
Walnut salted	.5173427	.2253233	2.30	0.022	.075642	.9590433
Walnut unsalted	.1823776	.2253233	0.81	0.418	-.2593231	.6240783
Roast pecan salted	-.0721678	.2253233	-0.32	0.749	-.5138685	.3695329
Roast pecan salted	.1383217	.2253233	0.61	0.539	-.303379	.5800224
Pecan raw	-.2890909	.2253233	-1.28	0.200	-.7307916	.1526098
_cons	2.721288	.4258917	6.39	0.000	1.886413	3.556162
var(e.WTP)	18.15049	.3035641			17.56507	18.75543

The Tobit model largely followed the same result and pattern as the OLS model, as did the OLS model and Tobit model using the time-controlled data. The regression results derived from the controlled data have the same pattern as the previous regression results, except for some minor differences in coefficient and p values. However, those differences are not significant enough for us to change our previous conclusions.

Regression with Interaction Terms

To test if any demographic interaction effect exists, we did several OLS regressions with interaction terms using demographic factors including vegetarian (yes or no), age (continuous variable), gender, educational level, income, and ethnicity. We treated “education” as a continuous variable instead of a categorical variable and then assigned value 1 to the lowest educational level (precollege) and 3 to the highest level (postgraduate). We repeated the same process for “income” by assigning 1 to the lowest income level and 3 to the highest level. Other variables except “age” were dummy variables.

We expected that vegetarians may be more likely to eat nuts than non-vegetarians and would therefore pay more attention to walnut recipes. We also expected that older consumers would be more responsive to health information, as would wealthier consumers; research has suggested that American households with higher incomes consume more nuts (Lin, Frazao, & Allshouse, 2001). Based on the results and coefficients for interaction terms, we did not find that either treatment was significantly more effective for vegetarians than non-vegetarians. The coefficients for both interaction items are not statistically significant. Our regression also showed that both walnut and recipes were more effective for older participants, and health information more than recipes. Additionally, we found that health information increased female participants’

WTP by 18.7% (see Figure 6), while no significant interaction effect could be found between gender and recipe treatments.

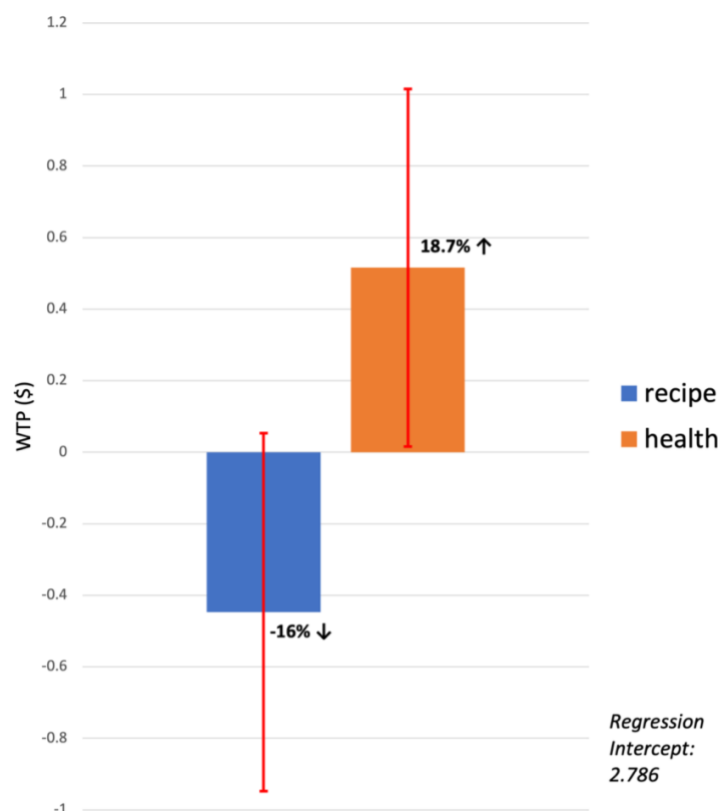


Figure 6: Female interaction terms

The negative coefficient for “health * education” indicates that health treatment was not as effective for consumers with higher educational levels. This result was not statistically significant, but the p value for the interaction term (0.06) was close to 0.05. Results also showed that advertisements with both health information and recipes were more effective for wealthier participants. This is consistent with our previous expectations.

“Asian” was selected as the base level for the categorical variable “ethnicity,” and the regression result gave us two relationships: first, posts with health information were more effective for Asian participants than Hispanic and other (mostly Native American) participants.

Second, Asian participants were more responsive to posts with walnut recipes than African–American participants. Based on the p value, we did not find other significant relationships.

DISCUSSION / IMPLICATIONS

As described above, 36 participants' data were dropped because they did not view the posts for at least 40 seconds, the minimum time limit. But the regression results with and without those participants were not significantly different. Despite some minor differences in factors' coefficients and p values, the general pattern held in all the regression results. The results from all of our OLS and Tobit regression models, before and after we dropped 36 participants, all indicated that those participants in the two treatment groups had higher WTP for products compared with participants in the control group. Thus, we reject our null hypothesis that generic advertising on the social media platform Twitter does not affect consumers' WTP for advertised products.

In addition, participants who viewed the posts related to health facts about walnuts had the highest WTP among all three groups. Based on this result, we reject our second null hypothesis that different advertisement contents have the same effect on consumers' WTP. In this case, health information more effectively increased consumers' WTP for walnuts than recipes. This suggests that potential consumers of walnuts care more about the health benefits of consuming walnuts than walnut recipes, and advertisers could focus more on health information to make their advertising more effective. In general, the results of our regressions with interaction terms suggested that ads with health information worked better with older consumers. One possible explanation is that elderly people may have more time for cooking. So, they are more responsive to recipes. They also care more about health than younger people. Also,

females, Asians, and wealthier consumers were more responsive to health information. However, consumers with higher educational levels were less responsive than those with less education in our experiment.

A positive spillover effect was found for relevant nut products such as pecans and cashews. Our regression showed that health facts (not recipes) increased consumers' WTP for not only walnuts but also pecans and cashews. This means we reject our third null hypothesis that generic walnut advertising on Twitter does not generate spillover benefits. Our results also indicated that white participants had the highest WTP for nuts in general, followed by African-American and Hispanic participants. The different WTP for nuts may be caused by differences in diet cultures.

Participants with doctoral degrees had the highest WTP for walnuts, followed by those with bachelor's and/or master's degrees. It is notable that participants with other advanced degrees, including J.D.s, M.D.s, and other professional degrees, had the lowest WTP for nuts. Because of this, it is difficult to identify a clear pattern indicating the relationship between WTP and educational levels, but generally speaking, our advertisements worked more effectively on participants with bachelor's, master's, and doctoral degrees as their highest degrees.

Results further showed that participants with all income levels had a higher WTP than the base income level (less than \$25,000). This suggests that consumers with higher annual household incomes tend to bid higher for nut products. However, those with the highest income did not have the highest WTP for nuts; rather, those with a household income between \$75,000 to \$100,000 did. On the other hand, after including interaction terms, our results showed that health information could improve wealthier consumers' WTP more than others. Our result also

showed that product preparation methods (e.g., salted, unsalted, maple glazed, raw, etc.) could affect consumers' WTP.

CONCLUSION

Our results show that many factors can affect the effectiveness of generic advertising on social media on consumers' WTP for nut products. Content matters: while both walnut recipes and health facts about walnuts increased consumers' WTP, health facts worked better than recipes. Nuts have well-known nutritional benefits, with 96% of consumers surveyed believing that nuts oils are healthy (Lee et al., 2011). This widely known information about nuts may contribute to the effectiveness of the health-related advertisements.

As described previously, demographic-treatment interactions provided interesting information: that different posts can be more effective on consumers with different characteristics. This suggests that advertisers should target certain consumer groups in order to generate more impact with their advertisements. Meanwhile, we found that vegetarians had a higher WTP for nuts than non-vegetarians in the beginning. However, the results from our regressions with interaction showed that neither health information nor recipes worked better on vegetarians than others.

We found that the generic walnut advertising also benefited pecans and cashews by increasing consumers' WTP for these products. Thus, generic advertising for walnuts also had a positive spillover effect and may also be considered by advertisers of pecans and cashews. When running social media advertising for walnuts, advertisers could pay more attention to those factors that were discussed above that could affect the effectiveness of their advertisements. They could also focus on their target consumer groups to make their advertising campaign more

effective. Overall, there are not many recent research studies that focus on the check-off program on social media platforms such as Twitter and Facebook. This research should help farmers/ranchers or advertisers of generic agricultural products to better understand how social media generic advertising impacts consumers' purchasing behaviors and WTPs.

APPENDIX

Online survey sample:

Consent Form for the Economic Decision-Making Study

You are invited to take part in a research study of economic decision making. Please read this form carefully before agreeing to take part in the study. This study is being led by Harry Kaiser, Jura Liaukonyte, Dyson School of Applied Economics and Management, Cornell University

What the study is about

The purpose of this research is to understand how different social media posts contents influence people's economic decision making. The information from this study may benefit researchers and policy advocates in the future.

What we will ask you to do

You will be asked to make a series of economic decisions about food products. The study will take approximately 10 minutes.

Risks and discomforts

We anticipate that your participation in this survey presents no greater risk than your everyday use of the internet.

Compensation for participation

You will be compensated the amount you agreed upon before you entered into the survey.

Confidentiality and data sharing

Your decisions during the experiment will be kept confidential. All data will be recorded so that no individual participant can be identified with the results from the study. Please note that if you were recruited for this experiment via e-mail there is a chance that the information you communicated could be read by a third party. De-identified data from this study may be shared with the research community at large to advance science and health. By current scientific standards and known methods, no one will be able to identify you from the information we share.

Taking part is voluntary

Taking part in this study is completely voluntary. You are free to withdraw at any time.

If you have questions

The main researchers conducting this study are Harry Kaiser and Hanlong (Eric) Zhang at Cornell University. If you have questions about the study, you may contact Hanlong Zhang at hz563@cornell.edu. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) for Human Participants at 607-255-5138 or access their website at <http://www.irb.cornell.edu>. You may also report your concerns or complaints anonymously through Ethicspoint online at www.hotline.cornell.edu or by calling toll-free at 1-866-293-3077. Ethicspoint is an independent organization that serves as a liaison between the University and the person bringing the complaint so that anonymity can be ensured.

Statement of Consent

If you consent to participate in the proposed study, please click on the "I approve" box below.

- ☐ I approve
- ☐ I disapprove

SECTION I: Demographic questions

(Question for all participants)

1. Are you the primary food shopper of your household?

☐ No☐ Yes

2. Are you vegetarian or vegan?

☐ No☐ Yes

3. Please specify your ethnicity:

☐ Non-Hispanic White☐ Non-Hispanic Black☐ Hispanic☐ Asian☐ Other

4. Where is your home located?

☐ Midwest☐ Northeast☐ South☐ West

5. What is your annual household income?

☐ \$0 – 25k☐ \$25k – 50k

- ☐ \$50k – 75k
- ☐ \$75k – 100k
- ☐ \$100k – 150k
- ☐ \$150k +

6. What is your gender?

- ☐ Male
- ☐ Female
- ☐ Other _____
- ☐ Prefer not to say

7. What is your age? _____

8. What is the highest level of education you have completed?

- ☐ Less than high school
- ☐ High school graduate
- ☐ Some college
- ☐ 2 year degree
- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ Doctoral Degree
- ☐ Other advanced degrees (such as JD or MD)

SECTION II: Introduction & posts

Part I. Introduction

In this survey, you will be given information about several food products and you will be asked to indicate purchasing decisions and choices given a set of options. There are no correct or incorrect answers on the purchasing decisions in this survey. Studies show that people tend to act differently when they face hypothetical decisions. In other words, they say one thing and do something different. For example, some people state that they would pay for an item at a given price, but they would not actually pay that price for the item when they see the product in the grocery store.

Please behave in the same way that you would if you really had to pay for the product and take it home. Please take into account how much you really want the product, as opposed to other alternatives that you like or any other constraints that might make you change your behavior, such as taste or your grocery budget. The results of this study may impact actual policy decisions in the future, so please try to put yourself in a realistic situation. To verify that you have read this introduction, please select the scalar below at Level three. This is to screen out random clicking. Your honest and thoughtful responses are important to us and to the study. Thank you very much for participating.

0 1 2 3 4 5 6 7 8 9 10


On the next page, you will see some posts from a social media platform. To make sure that the data we collected is valid, we used images instead of actual posts. So, all the pictures and links on those posts **will not be clickable**. Please do take your time to **browse these posts as you are browsing real posts on real social-media platforms**. You need to stay on the page for at least 45 seconds to move forward.

Ten posts showed to the control group:

La Colombe Coffee @LaColombeCoffee · Aug 30

Today and tomorrow only: 25% off all roasted coffee + Fridge packs

*Must use code STOCKUP25 at checkout to redeem. Not eligible on subscriptions or previous orders.




La Colombe | Fresh Roasted Coffee, and the First-Ever Draft Latte Specialty coffee roaster dedicated to making your coffee life better, and introducing the first ever Draft Latte cold latte in a can.

lacolombe.com

1 retweet 7 likes

La Colombe Coffee @LaColombeCoffee · Aug 26

Meet The New Yorker Blend - our special new coffee made in partnership with @NewYorker. \$2 of every box sold will help feed hungry New Yorkers by supporting @CityHarvest and @FoodBank4NYC. Grab a box today.



La Colombe x The New Yorker


La Colombe and The New Yorker are celebrating the resilience of New York City and its residents with this special blend. The roast revels in ...

lacolombe.com

1 comment 7 retweets 20 likes

La Colombe Coffee @LaColombeCoffee · Aug 23


Meet Nitro Extra Bold Cold Brew. A can of rich and smooth tasting coffee with foamy nitro texture and a little extra caffeine to help you make the most of your day. lacolombe.com/products/nitro...



2 comments 2 retweets 16 likes

La Colombe Coffee @LaColombeCoffee · Aug 18

A plant based-spin on a fall favorite.



Plant-Based Taste of Fall in the Summer: Oatmilk Pumpkin Spice Draft...


It's officially pumpkin spice season. You know, that time of year when you're still soaking in summer but secretly can't wait to break out that ...

blog.lacolombe.com

1 comment 2 retweets 7 likes

La Colombe Coffee @LaColombeCoffee · Jul 26


Our Cold Brew Tour is making its way down south to Virginia, North Carolina and Florida. Find a stop near you below. #ColdBrewComebackTour lacolombe.com/pages/cold-bre...



1 comment 1 retweet 8 likes

La Colombe Coffee @LaColombeCoffee · May 24

Stock up for the long weekend ahead. All 12-packs \$25 today and tomorrow only. lacolombe.com/collections/co...



1 retweet 12 likes



La Colombe Coffee @LaColombeCoffee · May 19

This [#MentalHealthAwarenessMonth](#) we're proud to partner with our friends at The Loveland Foundation who work tirelessly to provide access to healing and therapy services for Black women and girls across the country. Learn more at the link.



Black Girls Shine: La Colombe x Loveland Foundation - 1335 Frankford
LA COLOMBE X THE LOVELAND FOUNDATION \$2 of every box of our special-edition Lyon coffee and Black Girls Shine mug sold helps to ...
blog.lacolombe.com



La Colombe Coffee @LaColombeCoffee · May 10

Summer Haze is back. A medium-roasted daydream made to start your summer early. Grab a box today. bit.ly/3o8NMpp



La Colombe Coffee @LaColombeCoffee · May 3

Have you tried Ever Wild yet? Our Rainforest Alliance™ made for a healthier planet and a happier morning. bit.ly/2RZgq01



La Colombe Coffee @LaColombeCoffee · Apr 22

Introducing Ever Wild, our new Rainforest Alliance Certified™ medium roast. Grown in ways that benefit farm families, wildlife, and the environment. bit.ly/2RZgq01 #EarthDay



Ten posts showed to the health treatment group:

California Walnuts @CaWalnuts

This [#heartsmart](#) tip is courtesy of [#teamgoodfat](#)! ❤️ Replace saturated fats with good fats by incorporating foods like walnuts, avocados, and fish into your diet. Stay tuned for more tips from California Walnuts this [#AmericanHeartMonth](#): bit.ly/36pV8gK

1 5

California Walnuts @CaWalnuts

A handful of walnuts is a simple snack for any activity—whether that's an essential job, virtual meetings, chasing around a toddler, or some combination. Walnuts offer a powerhouse of important nutrients, like omega-3 ALA (2.5g/oz). Get snack inspiration: bit.ly/3aUsLGM

5 8

California Walnuts @CaWalnuts

See how people around the world are getting the power of omega-3 ALA found in walnuts (2.5 g/oz)! Whether you're enjoying them at breakfast, lunch, dinner, or in between, it's as simple as three handfuls of walnuts per week. [#thepowerof3](#): bit.ly/2UsJnB7.

2 5

California Walnuts @CaWalnuts

A new study has found that consumption of foods rich in omega-3 eicosapentaenoic acid, found in marine foods, and alpha-linolenic acid, found in plant foods like walnuts, was associated with improved outcomes in individuals who suffered a heart attack. prn.to/366FjdF

2 9

California Walnuts @CaWalnuts

Snack smart this summer by choosing a handful of walnuts for a nutrient-rich option that will keep you full and fuel your mind and body. bit.ly/3ffioiQ

7 17







California Walnuts @CaWalnuts

[#AmericanHeartMonth](#) is almost over, but these made-with-walnut foods will help keep you heart-healthy all year long! bit.ly/2TnD8vX

1 5



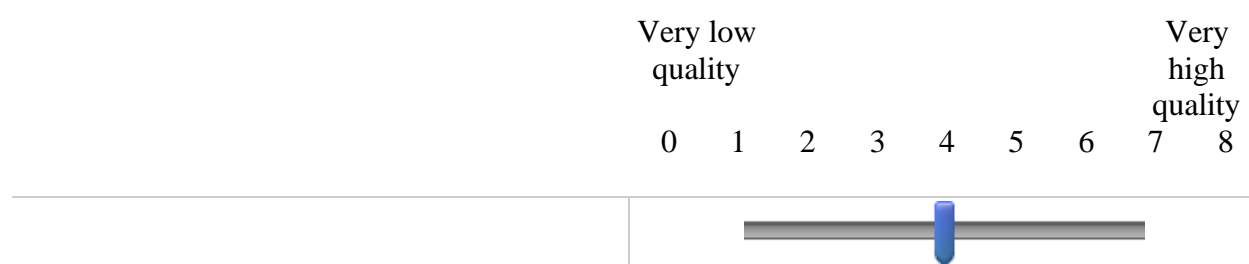
Ten posts showed to the recipe treatment group:

<p>California Walnuts @CaWalnuts</p> <p>Celebrate #NationalIceCreamDay by making your own at home! Get the scoop on how to make our favorite ice creams with walnuts in our latest blog post: bit.ly/2Tbaltl.</p>  <p>2 6</p>	<p>California Walnuts @CaWalnuts</p> <p>Cool off with a satisfying summer snack! This Strawberry Walnut Date Smoothie has it all: refreshing, delicious, and nutritious. 🍓 Get the recipe: bit.ly/2UglFtO.</p>  <p>4 8</p>
<p>California Walnuts @CaWalnuts · Jun 18</p> <p>Treat the dad in your life to a meal he'll love! Our latest blog post has all the recipes you need for the ultimate #FathersDay cookout: bit.ly/3z4ex3D</p>  <p>1 1</p>	<p>California Walnuts @CaWalnuts</p> <p>Keep it light and fresh this summer with a Mediterranean Farro Salad with Arugula and Walnuts by The Mediterranean Dish. Get the recipe: bit.ly/3ioJhq4</p>  <p>1 9</p>
<p>California Walnuts @CaWalnuts</p> <p>Start summer early with this refreshing banana, cacao, and walnut butter smoothie bowl! Perfect for breakfast or a midday pick me up. Get the recipe: bit.ly/34offuf</p>  <p>1</p>	<p>California Walnuts @CaWalnuts</p> <p>According to @realfoodbydad, the key to muhammara is the roasted bell peppers and walnuts! Try out his recipe for these Muhammara Wraps this #MedDietMonth: bit.ly/3gMNHwy</p>  <p>1</p>



(Question for all groups)

9. How would you rate the quality of the social media posts?



SECTION III: Willingness to pay & nuts consumption preferences

Please read this guide carefully:

Now, we will ask you about your willingness to pay for several products. *The quantity, quality and package of the products are identical, and the only difference is the preparation method.* Please move the lever to choose the amount of money you will pay for each product. The maximum amount you can bid on the product is \$20. You can select any amount between \$0 and \$20, and *your selection will be shown above the lever*. Notice that if you would not buy the product, leave the lever at 0.



Raw California Walnut (16oz)


10. Here is one bag of 16 ounces (about 450g) of raw walnuts with no shell from California. What is your maximum willingness to pay (\$) for this product?

	0	20
Willingness to pay ()		



Roasted California Walnuts (salted) 16oz


11. Here is one bag of 16 ounces (about 450g) of roasted walnuts (salted) with no shell from California. What is your maximum willingness to pay (\$) for this product?

	020
Willingness to pay ()	



Roasted California Walnuts (unsalted) 16oz


12. Here is one bag of **16 ounces (about 450g)** of roasted walnuts (unsalted) with no shell from California. What is your maximum willingness to pay (\$) for this product?

	020
Willingness to pay ()	



California Walnuts (maple glazed) 16oz


13. Here is one bag of **16 ounces (about 450g)** of maple glazed walnuts with no shell from California. What is your maximum willingness to pay (\$) for this product?

	020
Willingness to pay ()	



Raw cashews (16oz)


14. Here is one bag of **16 ounces (about 450g)** of raw cashews with no shell. What is your maximum willingness to pay (\$) for this product?

	0	20
Willingness to pay ()		



Roasted cashews (salted) 16oz


15. Here is one bag of **16 ounces (about 450g)** of roasted cashews (salted) with no shell. What is your maximum willingness to pay (\$) for this product?

	0	20
Willingness to pay ()		



Roasted cashews (unsalted) 16oz


16. Here is one bag of **16 ounces (about 450g)** of roasted cashews (unsalted) with no shell. What is your maximum willingness to pay (\$) for this product?

	0	20
Willingness to pay ()		



Raw pecan (16oz)

17. Here is one bag of **16 ounces (about 450g)** of raw pecan with no shell. What is your maximum willingness to pay (\$) for this product?

	0	20
Willingness to pay ()		



Roasted pecan (salted) 16oz

18. Here is one bag of **16 ounces (about 450g)** of roasted pecan (salted) with no shell. What is your maximum willingness to pay (\$) for this product?

	0	20
Willingness to pay ()		



Roasted pecan (unsalted) 16oz

19. Here is one bag of **16 ounces (about 450g)** of roasted pecan (unsalted) with no shell. What is your maximum willingness to pay (\$) for this product?

	0	20
Willingness to pay ()		

20. Are you allergic to nuts?

☐ Yes

☐ No

21. On average, how often do you consume nuts?

☐ Never

☐ Monthly or more rarely

☐ Once a week

☐ More than once a week

22. What attract(s) you most about consuming nuts? (Allow multiple selections)

☐ Nutritional profile of nuts

☐ Tastes

☐ Others

REFERENCES

- Alalwan, A. A. (2018). Investigating the impact of social media advertising features on customer purchase intention. *International Journal of Information Management*, 42, 65–77.
- Ashley, C., & Tuten, T. (2015). Creative strategies in social media marketing: An exploratory study of branded social content and consumer engagement. *Psychology & Marketing*, 32(1), 15–27.
- Bass, F. M., Krishnamoorthy, A., Prasad, A., & Sethi, S. P. (2005). Generic and brand advertising strategies in a dynamic duopoly. *Marketing Science*, 24(4), 556–568.
- Berthon, P. R., Pitt, L. F., Plangger, K., & Shapiro, D. (2012). Marketing meets Web 2.0, social media, and creative consumers: Implications for international marketing strategy. *Business Horizons*, 55(3), 261–271.
- Bhaskaran, V., Mirchandani, R., & Shah, M. (2013). Creating a Measurable Social Media Marketing Strategy: Increasing the value and ROI of intangibles and tangibles for Hokey Pokey. *Marketing Science*, 32(2), 194–212.
- Borah, A., & Tellis, G. J. (2016). Halo (spillover) effects in social media: Do product recalls of one brand hurt or help rival brands? *Journal of Marketing Research*, 53(2), 143–160.
- Chen, X., Heng, Y., Gao, Z., & Jiang, Y. (2022). Impacts of duo-regional generic advertising of social media on consumer preference. *Agribusiness*.
- Chu, S. C. (2011). Viral advertising in social media: Participation in Facebook groups and responses among college-aged users. *Journal of Interactive Advertising*, 12(1), 30–43.
- Dwivedi, Y. K., Kapoor, K. K., & Chen, H. (2015). Social media marketing and advertising. *The Marketing Review*, 15(3), 289–309.
- Ferguson, R. (2008). Word of mouth and viral marketing: taking the temperature of the hottest trends in marketing. *Journal of Consumer Marketing*, 23(3), 179–182.
- Ferrero, J., Boon, L., Kaiser, H. M., & Forker, O. D. (1996). Annotated Bibliography of Generic Commodity Promotion Research: Revised. Cornell University, College of Agriculture and Life Sciences, Department of Agricultural. Resource and Managerial Economics.
- Hensel, K., & Deis, M. H. (2010). Using social media to increase advertising and improve marketing. *The Entrepreneurial Executive*, 15, 87–97.
- Kaiser, H. M. (2011). Effects of generic advertising on food demand. In J. L. Lusk, J. Roosen, & J. F. Shogren (Eds.), *The Oxford Handbook of the Economics of Food Consumption and Policy*. Oxford University Press.

- Kaiser, H. M., Forker, O. D., Lenz, J. E., & Sun, C. H. (1992). Evaluating generic dairy advertising impacts on retail, wholesale, and farm milk markets. *Journal of Agricultural Economics Research*, 44(1491–2016–130218).
- Kinnucan, H. W., Xiao, H., Hsia, C. J., & Jackson, J. D. (1997). Effects of health information and generic advertising on US meat demand. *American Journal of Agricultural Economics*, 79(1), 13–23.
- Lee, D., Hosanagar, K., & Nair, H. S. (2018). Advertising content and consumer engagement on social media: Evidence from Facebook. *Management Science*, 64(11), 5105–5131.
- Lee, J., & Hong, I. B. (2016). Predicting positive user responses to social media advertising: The roles of emotional appeal, informativeness, and creativity. *International Journal of Information Management*, 36(3), 360–373.
- Lee, L. E., Metz, D., Giovanni, M., & Bruhn, C. M. (2011). Consumer knowledge and handling of tree nuts: Food safety implications. *Food Protection Trends*, 31(1), 18–27.
- Lin, B. H., Frazao, E., & Allshouse, J. (2001). US consumption patterns of tree nuts. *Food Review/National Food Review*, 24(1482–2016–121504), 54–58.
- Maha, A. (2015). The challenges and opportunities of social media in the hospitality industry: A study of the north east region of Romania. *EIRP Proceedings*, 10.
- Messer, K. D., Kaiser, H. M., & Schulze, W. D. (2008). The problem of free riding in voluntary generic advertising: parallelism and possible solutions from the lab. *American Journal of Agricultural Economics*, 90(2), 540–552.
- Mir, I. A. (2012). Consumer attitudinal insights about social media advertising: A South Asian perspective. *The Romanian Economic Journal*, 15(45), 265–288.
- Richards, T. J. (2020). Christmas Tree Promotion Board Evaluation Report. Arizona State University and Badger Metrics.
- Sahni, N. S. (2016). Advertising spillovers: Evidence from online field experiments and implications for returns on advertising. *Journal of Marketing Research*, 53(4), 459–478.
- Schmit, T. M., Dong, D., Chung, C., Kaiser, H. M., & Gould, B. W. (2002). Identifying the effects of generic advertising on the household demand for fluid milk and cheese: A two-step panel data approach. *Journal of Agricultural and Resource Economics*, 165–186.
- Schmit, T. M., & Kaiser, H. M. (2004). Decomposing the variation in generic advertising response over time. *American Journal of Agricultural Economics*, 86(1), 139–153.
- Thornhill, M., Xie, K., & Lee, Y. J. (2017). Social media advertising in a competitive market: Effects of earned and owned exposures on brand purchase. *Journal of Hospitality and Tourism Technology*, 8(1), 87–100.

- Van-Tien Dao, W., Nhat Hanh Le, A., Ming-Sung Cheng, J., & Chao Chen, D. (2014). Social media advertising value: The case of transitional economies in Southeast Asia. *International journal of Advertising*, 33(2), 271–294.
- Voorveld, H. A., Van Noort, G., Muntinga, D. G., & Bronner, F. (2018). Engagement with social media and social media advertising: The differentiating role of platform type. *Journal of Advertising*, 47(1), 38–54.
- Wang, R., Liaukonyte, J., & Kaiser, H. M. (2018). Does advertising content matter? Impacts of healthy eating and anti-obesity advertising on willingness to pay by consumer body mass index. *Agricultural and Resource Economics Review*, 47(1), 1–31.
- Woodside, A. G., Trappey, R. J. III., & MacDonald, R. (1997). Measuring linkage-advertising effects on customer behaviour and net revenue: Using quasi-experiments of advertising treatments with novice and experienced product-service users. *Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration*, 14(2), 214–228.
- Wright, E., Khanfar, N. M., Harrington, C., & Kizer, L. E. (2010). The lasting effects of social media trends on advertising. *Journal of Business & Economics Research (JBER)*, 8(11), 73–80.
- Zhang, J., & Mao, E. (2016). From online motivations to ad clicks and to behavioral intentions: An empirical study of consumer response to social media advertising. *Psychology & Marketing*, 33(3), 155–164.