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Reference Price Effect on Consumer Preference: Evidence from Food Labeling

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Abstract

As consumer's interest in labeled products increases, consumer preference for labeled products garnering more attention. Understanding the factors influencing consumer preference for labeled food products can aid effective food marketing and ultimately benefit farmer profit. This study investigates how reference prices would affect consumer preference for familiar or unfamiliar labeled products. The reference price is used to provide price information for the product that consumers are interested in. The data is obtained from a 2019 online national survey via Qualtrics. The contingent valuation method (CVM) and a seemingly unrelated regression (SUR) are used to investigate the effect of different formats of reference price (i.e., low means versus high means, small intervals versus large intervals) on consumer willingness-to-pay (WTP) for conventional and labeled chips and salad. The results show that a high mean of the reference price of conventional chips has a significant positive impact on WTP for all the chips products except for the transitional organic chips. In the case of salad, a higher mean of the reference price of conventional salad has a significant impact on consumer WTP for all the alternative salads, except for organic. However, the interval of reference prices does not have a significant impact on WTP on labeled food products in either case of chips or salad. The internal reference price (the price consumers paid last time) is a significant impact on consumer WTP. The results indicate that when consumers are faced with more considerable uncertainty in the shopping environment, they become more reliant on the price they paid last time.

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Section 1: Introduction

Background

There are numerous food labels in the U.S. market, among which, Non-Genetically Modified Organism (Non-GMO) label and the United States Department of Agriculture (USDA) Organic[1] might be the two most popular ones (Mohamed et al., 2014). Organic is a USDA-certified label for grown and processed products that rely on natural substances and farming based on physical, mechanical, or biological methods to the greatest extent possible (McEvoy, 2019). For at least three years, growers cannot use any prohibited substances on lands used to grow organic food products. Prohibited substances include pesticides and fertilizers (USDA, 2019). As its name suggests, non-GMO is a third-party label in North America to designate products that have not been genetically engineered. A non-profit organization initiated this non-GMO program to verify that products are produced following strict best practices for avoiding genetically modified organisms (Non-GMO Project, 2021). Previous studies researched consumers' preferences for labeled food products, which typically focus on organic and non-GMO labels (Yiridoe, Bonti-Ankomah, and Martin, 2005; Yue et al., 2011; Sivathanu, 2015; Peschel et al., 2019; Berning and Campbell, 2017).

Consumers have become increasingly interested in purchasing food products with labels regarding the practices used in the food's production and processing (Hermawan and Yusran, 2013; Hanspal and Devasagayam, 2017). For example, organic food consumption has exhibited an increasing trend in the United States since 1990 (McFadden and Huffman, 2017; Dimitri and Dettmann, 2012; McNeil, 2020). In the past decade, organic food consumption in the U.S. has increased by $27.47 billion (from 2008 to 2018) (Statista, 2019). Meanwhile, the forecasted value of the non-GMO food market value worldwide is that the market value would

[1] In this study, "USDA Organic" is represented by "Organic".

increase to 1485.6 billion dollars in 2021 (Statista, 2018). Besides growing demand for organic food products, research finding suggests consumers would like to pay higher prices for organic and non-GMO food products compared with conventional counterparts (Marian et al., 2014; Goetzke, Nitzko, and Spiller, 2014; Suprapto and Wijaya, 2012; Rana and Paul, 2017; Bruno, and Campbell, 2016). Adopting organic practices could benefit soil health and increase food-plant quality (Reeve et al., 2016). However, less than 1% of farmland is certified as organic in the U.S. at present (Economic Research Service, 2020). Moreover, only less than 10% is non-GMO in the U.S. (Dodson, 2020). Meanwhile, the increasing demands and potentially higher revenues could motivate additional farmers to adopt organic and non-GMO practices over conventional farming methods (Niggli, Schmid, and Fliessbach, 2008; Archer et al., 2007; Mahoney et al., 2007).

Adopting organic or non-GMO practices may incur additional input costs and potentially affect yields, causing hesitation among farmers to adopt these practices (Pannell et al., 2006; Chen et al., 2018; Caldwell et al., 2014). When farmers adopt organic farming practices on the land previously farmed using conventional production methods, they have to go through at least a three-year transitional period to transform production on this land from traditional to organic. This transitional period can incur added cost, reduced yields, and ultimately farmers' profitability. In terms of the cost of producing non-GMO food products, it is higher than producing GMO food products (Kalaitzandonakes, Lusk, and Magnier, 2018). These barriers during the transitional period could cause farmers to hesitate to make the transition from conventional to organic. Because this transition could entail added costs or reduced yields, for farmers to decide to adopt organic practices, price premiums for those products may be needed to ensure farm profitability and economic returns (Reeve and Drost, 2012; Lesur-Dumoulin et al., 2017). To help potentially solve this problem, the National Certified Transitional Program (NCTP) by the Organic Trade Association (OTA) and USDA in

2017 (Organic Trade Association USDA Certified Transitional Program, 2017) created an innovative label named transitional organic. This label guides farmers transitioning to certified organic agricultural production from conventional practices. The transitional organic label is designed to help farmers distinguish their products during the transition to organic farming and potentially help farmers sell their transitional products at a premium price during the three-year transitional period (Organic Trade Association, 2017). Recent news indicates that the transitional organic label program was withdrawn. However, whether the label could help bring price premiums in products produced under the transitional period is still not well understood. In addition, other future potential labels in the pipeline would bring similar benefits in the future (Agricultural Marketing Service, 2020).

Therefore, this study measures consumers' preferences and willingness to pay premiums for a transitional organic label for different labeled food products. This research will provide information about consumer preferences and pricing information that is helpful for the future development of markets for products produced during transitional phases from conventional to organic. As points of reference, the more popular and well-known labels Genetically Modified Organisms-free (GMO-free) and organic are also considered in this study.

Previous research examined consumer preferences for labeled food products, such as apples and coffee (Loureiro, McCluskey, and Mittelhammer, 2001; Carrigan et al., 2005). Obtaining such knowledge is useful to facilitate the marketing of these products and potentially increase farmers' confidence in transforming to organic and other practices. For familiar products with familiar labels, consumers may already know the products well in their evaluation system (Rao and Monroe, 1988; Dodds, Monroe, and Grewal, 1991; Grewal et al., 1998). While for those unfamiliar products or unfamiliar labels, consumers would need to rely on other information sources to give their evaluation, such as reference prices of familiar,

similar products (Biswas, 1992; Vaidyanathan, 2000; Lemmerer and Menrad, 2015).

Consumers are likely less familiar with the transitional organic label than other popular labels such as organic and non-GMO. They may have little knowledge and reply upon reference price for transitional organic products' in stated choice decisions. This lack of familiarity may increase the importance of reference price in stated choice experiments and estimates of willingness-to-pay (WTP). In this situation, reference price may provide an informational role (LaRiviere et al., 2014; Hasselström and Håkansson, 2014; Georgantzís and Navarro-Martínez, 2010). For instance, if consumers were faced with the choice of transitional organic chips, they may value these transitional organic labeled chips according to the more familiar organic chips' and conventional chips' prices. In this case, organic and conventional chips' prices could be regarded as the reference price consumers may use in their decision-making about transitional organic chips. A consumer who is uncertain how much to pay for transitional organic chips, may use the prices of organic and conventional chips (for example, $6 and $3, respectively) as reference points, and value transitional organic chips as some value in between the two more familiar products (for example, WTP of $5).

This study aims to provide a willingness to pay for transitional organic labeled food products to provide information to this emerging market. However, to provide improved estimates, given that most consumers would not be familiar with transitional organic labels, the effects of reference price are considered. Previous studies have noted that reference prices can influence consumer preferences and measures of WTP of innovative products and labeled food products (Chen, Huang, and Zhou, 2012; Putler, 1992; Shi et al., 2014).

Prior research has examined the reference price on consumers' WTP for unfamiliar labels or products. Their findings have shown that reference price effects are particularly magnified when consumers are less familiar with the label or product (Grunert et al., 2009;

Kopalle and Lindsey-Mullikin, 2003; Biswas, 1992; Rao and Monroe, 1988). Despite literature studying the effects of reference prices on consumer preference, few studies exist focusing on the impact of different formats of reference prices on consumer WTP (e.g., different means of reference price or different range intervals of reference price). The formats of reference prices in this study are different ranges of the reference price. When consumers face a different range of reference prices, they may influence their WTP for the product being studied. Prior research has examined the effect of reference price on consumers' WTP for several familiar labeled products (Asche, 2015). They found that consumers typically have a range estimation of the reference price. For example, consumer WTP for conventional chips is about $2-$4. A knowledge gap exists regarding how reference price formats may influence consumer preferences and WTP measures for less familiar products (e.g., Transitional Organic). It is likely that when consumers are considering labeled food products they are unfamiliar with, they will likely consider a wider range of reference prices for the product than for a product with which they are much more familiar. These wider ranges of reference prices could influence estimates of willingness to pay for the product of interest (transitional organic). In addition, the means of the reference prices could influence consumers' WTP for the product of interest (transitional organic). Hence, in this study, we explore two reference price formats, means of reference price and intervals of the reference price.

Two types of reference price effects can be measured: the own-price effect and the cross-price effect (Shi et al., 2014). The own-price effect is the effect of the product's own price on the price of this product. The cross-price effect is how other product's price affects the price of the product of interest. Thaler (1985) introduced reference price as price directly into the value function for own-price effect research to know how the reference price affects WTP by incorporating the model in value elicitation procedures (Cai, 2005). The cross-price effect has also been studied. For instance, Rosas, Acerenza, and Orazem (2020) found that the existence

of the cross-price effect and unobserved pure taste for sports could support an optimal pricing strategy through an application to collegiate sports events. Arnot et al. (2006) showed that even ethical consumption choices of conventional coffee could be influenced by price and switch to fair trade coffee. Hall, Kopalle, and Krishna (2010) concluded that the own-price effect and cross-price effect interact. This study will follow methods used in Shi et al. (2014) and modifies the reference price format to explore how different patterns of reference price affect WTP by varying the reference prices of own- and cross-price.

Therefore, this study presents a detailed empirical analysis of whether various patterns of reference price (i.e., high means versus low means, large intervals versus small intervals) affect consumer WTP for food labels that are both more familiar to consumers, Non-GMO and organic labels, and those less familiar ones, such as the transitional organic label. In addition, several previous studies have also researched consumer WTP for different product categories. Shen (2012) explored consumers' WTP for labeled food products by analyzing a variety of different kinds of products. Similarly, Biswas and Roy (2016) also estimated consumer WTP for different kinds of green products. This multiple-product type of analysis can illustrate how consumers may pay differing premiums for the same label across different products. Hence, this study also provides estimates of WTP for the transitional organic label across multiple products. In this study, WTP for and effects of reference prices on WTP for the transitional organic label are compared across two representative healthy and unhealthy food products (Grebitus and Davis, 2017; Van Loo et al., 2018). Two representative products, chips (unhealthy) and salad (healthy), are chosen as the focal subject in this study to obtain estimates of WTP for the transitional organic label and to explore how different formats of reference prices affect preferences for food products with more familiar and less unfamiliar labels (Grebitus and Davis, 2017; Van Loo et al., 2018). The WTP in this study is measured by the payment card of the Contingent Valuation Method (CVM). The analytical framework is

summarized in Figure 1.

Objectives

This study has several objectives. First, because consumers may be less familiar with innovative or not that popular labels than other labels, such as organic and non-GMO, this study investigates whether WTP measures for two food products with more and less familiar labels will differ. Second, because consumers may have little knowledge about the price information for transitional labeled products, this study will examine how reference prices influence WTP for the transitional label. Though several studies have investigated the effect of reference price effect on consumers' WTP, only a few studies have focused on how different formats of reference price influence consumer WTP. Therefore, in this study, we help advance the theoretical knowledge of reference price effect on consumer preference by providing a more holistic analysis of how different reference price patterns (e.g., different means and different ranges) affect consumer preference for labeled food products systematically. The reference price formats include two forms in this study, high means of reference price range versus low means of reference price ranges and large intervals of reference price range versus small intervals of the reference price ranges. Prices of the organic and conventional alternatives serve as reference prices, as these products already exist in the marketplace and are likely to be familiar to consumers. By giving respondents different reference price formats, we could observe how consumers responded by estimating their WTP with these different information treatments. Thirdly, the WTP for a transitional organic label and effects of reference prices are investigated across two representative products (chips and salads), which represent unhealthy and healthy food choices.

Based upon the previous literature findings and research objectives, we propose five hypotheses in this thesis:

Hypothesis 1: *Consumer WTP for transitional organic food products is between that for*

conventional and organic food products.

Hypothesis 2: *Reference price will influence consumer WTP for labeled food products.*

Hypothesis 3: *High means of reference prices will increase consumers' WTP for the labeled food products of interest.*

Hypothesis 4: *Consumers will have a lower WTP for food products, given greater uncertainty of reference prices.*

Hypothesis 5: *The effect of reference price formats on consumer preferences and WTP for labels in healthy and unhealthy food products differs.*

By answering questions in objectives and testing the hypotheses above, this study contributes to the literature in three aspects. First, different from previous research that solely focuses on the effect of reference price on consumer preference and WTP (Monroe, 1973; Putler, 1992; Chen, Huang, and Zhou, 2012; Asche, 2015), this study measures how different formats of reference price could affect consumer preference. People who face different means or intervals of reference prices may have different preferences and WTP for the product of interest. Secondly, this study's results would contribute to the theoretical knowledge of how different reference prices might influence consumers' WTP for food labels when they are more and less familiar with these labels. Third, this study could advance the empirical knowledge in the literature about the reference price and its impacts on consumer preference for labeled foods.

Furthermore, the results from this study will provide estimates to help inform an emerging market for transitional organic labeled products. Information about premiums could help guide retailers, processors, farmers, and policymakers about the value this label holds to consumers (Schäufele and Hamm, 2017; Tsakiridou, Zotos, and Mattas, 2006). This information is important since the decision was made to discontinue the transitional organic labeling program, yet this label may be valued by some consumers, and could ultimately bring

product price premiums. However, the question of consumers' WTP premiums for transitionally labeled products is an empirical question to be answered in this study. Such information could help inform pricing strategies for the food industry and provide implications for policymakers to form regulations that improve the efficiency of food labeling systems so that consumers would gain more information from the labels (Krystallis, Fotopoulos, and Zotos, 2006; Balogh et al., 2016). This research could also be meaningful for private sectors and companies to help design innovative labels that can facilitate the marketing of new products. When they develop new labels, it could consider some other factors, such as the competitiveness of the similar products, the mean of the competitors' price, the interval of the reference price, and even whether the food product is healthy or not. In this case, the government could have enough information about food marketing and food labels to avoid the failure of designing new labels, such as transitional organic.

The remaining sections of this thesis are as follows. First, a literature review is presented, followed by the data and methods section. Then, results are presented and discussed. Finally, a discussion and conclusions section is provided with implications from the study and suggestions for future research.

Section 2: Literature Review

Familiar Verses Unfamiliar Labeled Food Products

Consumers always have different responses to familiar and unfamiliar products (Tuorila et al., 2001; Colla et al., 2020). For instance, Tuorila et al. (2001) proposed that consumers have different willingness to try unfamiliar and familiar food products. Moreover, Colla et al. (2020) found that the consumption of unfamiliar snacks is significantly lower than familiar snacks. Therefore, it is important to identify consumer preferences for familiar and unfamiliar products or labels. Besides, previous studies found when the alternative product's information is provided, consumers will have different ratings for familiar and unfamiliar products (Cooke et al. 2002). Tuorila et al. (1998) showed that the correlation between unfamiliar and familiar products would impact consumer's acceptance of unfamiliar products. Tuorila and Hartmann (2020) also mentioned that consumers' understanding of product perception and consumer traits are important, influential factors for rejecting or accepting unfamiliar products. Since the reference price can always be considered information about alternative products, consumers may react differently to this information when facing familiar and unfamiliar products. In this study, most consumers are already familiar with organic and non-GMO labels, which often appear in daily life. However, the transitional organic label is a certified transitional label between conventional and organic, a relatively unfamiliar label. As a result, we are interested in exploring how the reference price information would play a different role in affecting the consumer preferences for familiar (organic and non-GMO) and unfamiliar (transitional organic) labels. Thus, three food labels, organic, non-GMO, and transitional organic, are analyzed in this study (See Figure 2 for label details). The results of his study aim to provide information about consumer preference for familiar and unfamiliar with the influence of reference price, and provide pricing strategy to food label agencies.

Food Products with Different Labels and WTP

Consumer preference for value-added food products has always been a heated topic for food marketing research, and several influential factors for consumer preference have been concluded by previous literature (Orth, Wolf, and Dodd, 2005; Gao et al., 2011). Previous studies have shown that the effect of reference price on consumer preference is significant and premium exists for organic and non-GMO food products (Marian et al., 2014; Chen et al., 2018; McFadden and Huffman, 2017; Gil and Soler, 2006; Soler, Gil, and Sanchez, 2002). Not only the reference price but also the demographics, such as gender, age, and education level, could impact consumer preference (Girard, Korgaonkar, and Silverblatt, 2003; Hanspal and Devasagayam, 2017; Vecchio, Van Loo, and Annunziata, 2016). Wang and Sun (2003) concluded that age, income, family size, and the number of children in the family could significantly influence consumer WTP for organic food products. Health concerns and educational levels have a significant relationship with consumer preference for non-GMO food products (Onyango et al., 2004; Yuan et al., 2018). Also, Williams found that consumers who are less influenced by price and have strong healthiness beliefs would be more likely to purchase transitional organic food products. Loureiro, McCluskey, and Mittelhammer (2002) concluded that the bid amount, number of children in the family and gender, could significantly affect labeled apple, which is certified by TFA. Mohamed et al. (2014) also showed a significant association between consumer WTP for labeled food products and social demographics, such as past purchase experience, attitude, and knowledge.

Furthermore, since the concern for the environment could impact consumer WTP (Liu, Yan, and Zhou, 2017), consumers may have different WTP for familiar and unfamiliar labels. Hence, this study will focus on consumer WTP for food products with familiar existing labels (i.e., Non-GMO, organic food products) and an unfamiliar potential product: transitional organic products. When consumers are shopping for an innovative product or label that they

are not familiar with, the reference price becomes a more critical information source that consumers can rely upon (Hofstetter et al., 2013). However, we did not find research on whether the way that preference price was presented (e.g., formats) may bring various impacts on consumer preference for those products. Thus, we want to estimate the consumer preference for food products with different labels in this study and evaluate how different reference price formats would affect consumer WTP obtained using a contingent valuation method.

Contingent Valuation Method

Contingent valuation methods (CVM) are often used to estimate WTP for non-market food products and public products (Brox, Kumar, and Stollery, 2003; Hu et al., 2011). CVM can be divided into two major categories, continuous methods, and discrete methods. The former includes open-ended questions and a payment card approach. The latter, the discrete method, is the most popular approach, which can be used to check the consistency of WTP estimated with continuous methods (Ready, Buzby, and Hu, 1996). The payment card method allows respondents to choose the value of their maximum WTP from a range of WTP (Venkatachalam, 2004). Since the payment card method limits the amounts of WTP in a range, there is no boundary issue existing (Hu et al., 2011).

Mitchell and Carson (1989) first used the payment card approach to address survey bias in evaluating WTP toward public environmental and resource projects. Currently, many studies about WTP for food products and labeled food products used the payment card method. Tian, Yu, and Holst (2011) adopted the payment card approach to estimate WTP for green food. Hu (2006) elicited WTP for non-GMO vegetable oil using this method. Yu, Gao, and Zeng (2014) also estimated consumer WTP for "Green food" in China using the payment card approach. Hu et al. (2011) modified this approach by giving reference intervals under the WTP questions and covering breaks on a wide scale so that respondents could obtain an accurate price without inferring it from the data. Furthermore, the distribution of values chosen by respondents could

also show the spread of consumer WTP. In addition to the previous research above, several studies used the payment card method to estimate WTP. This method is widely used because it could reduce the estimation bias to a certain extent and include both advantages of the dichotomous choice and the open-ended approach (Yu, Gao, and Zeng, 2014).

The previous studies explain several benefits of using the payment card method. First, it could avoid the boundary problem in open-ended CVM because of the limited value offered in the payment card approach (Hu et al., 2011). Second, WTP is answered so that it could be obtained directly from the first-hand dataset (Tian, Yu, and Holst, 2011; Ready, Buzby, and Hu, 1996). Furthermore, according to the study of Donaldson, Thomas, and Torgerson (1997), the payment card approach is more valid and has a higher answer rate than an open-ended approach because a payment card causes fewer zero values and makes the question easily understood. Therefore, this research will obtain consumers' WTP for food products with different labels using a payment card CVM.

Reference Price and WTP

Based on the assimilation-contrast theory, previous research showed that consumers have their ranges of the price that they could accept, which could be regarded as consumer WTP (Sherif and Hovland, 1961). However, when the product price exceeds the acceptable range, it will contrast with the price in this range, and consumers will perceive the price out of this range as unacceptable (Raman and Bass, 2002). The adaptation-level theory showed that the relationship between the stimuli level and adaptation level could affect the response to a new stimulus (Helson,1964). In terms of price response, the adaptation level could be called the standard price or the regular price (Emory, 1970). For example, if a consumer has bought an apple at a specific price. This consumer would then form an adaptation level (i.e., standard price or reference price) for the apple. When he/she wants to buy another apple, his/her price response (i.e., WTP) will depend on the reference price and the previous price paid. The

reference price was first proposed to be influential in determining the price of products by Monroe (1973). This theory was adopted by Niedrich, Sharma, and Wedell (2001) using the experimental study of the reference price.

Several studies have also demonstrated that a reference price has an impact on consumer price expectations and purchase decisions (Jacobson and Obermiller, 1990; Kopalle and Lindsey-Mullikin, 2003), especially when consumers are not familiar with the products. For example, Shi et al. (2014) found that cross-price affects consumer WTP estimates using CVM for different orange juice products. Greenleaf (1995) found that the reference price could affect promotion profits because it can help retailers determine the most profitable promotion strategy. Cai (2005) also concluded that many types of reference prices (e.g., the price paid last time, the average price of similar products) affect consumer's value elicitations and price perceptions. Reference prices examined in this study include external reference price, the price of other products (e.g., the mean of reference price and the interval of reference price), and internal reference price, the price of the product itself (e.g., the price paid last time).

According to Shi et al. (2014), the different reference price formats could affect consumer WTP collected by an open-ended method. When people structure their preferences, the assessment of their choices depends on the choice context (Bettman, Luce, and Payne,1998). The reference price is exogenously formed and given before consumers make purchasing decisions, influencing consumer behavior (Putler, 1992). Chernev (2003) showed that compared to "price selection" (i.e., "select your price"), "price generation" (i.e., "name your price") is not preferred when the reference price range is absent, which is consistent with the recommendations of Donaldson, Thomas, and Torgerson (1997). Furthermore, the reference price was more often used to assess innovative products (Lowe and Alpert, 2010). Thus, giving a reasonable reference price range could help consumers make more consistent decisions and enable researchers to assess a more accurate measure of WTP for innovative products with an

unknown market.

Studies on communication discrepancy (Aronson et al., 1963; Bochner and Insko, 1966; Kopalle and Lindsey-Mullikin, 2003) suggested that consumer's price expectation (i.e., WTP) will change if the reference price is not equal to the original price expectation (e.g., communication discrepancy exists). Furthermore, the prospect theory (Kahneman and Tversky, 1979) shows that the effect of loss (i.e., price is higher than reference price) and gain (i.e., price is lower than reference price) on consumer's price response are different, and the effect of loss is stronger than the impact of gain (Mayhew and Winer 1992; Raman and Bass, 2002). This indicates that the reference price's value could largely affect the consumer's utility, correlated to consumer WTP.

Section 3: Data and Methods

Data

This research was collected via an online survey from January to March 2019 across the United States. The survey was designed and administrated by Qualtrics, an international professional market research company. The survey was administrated by the company and distributed to the national representative consumer panels via online invitations. The survey data was also compared with the U.S. Census data which was collected during the year of the survey (Table 1). Primary household grocery shoppers, who were older than 18 years old, were qualified to participate in the survey. The survey consisted of four parts, focusing on, 1) participants' knowledge and perception of Conventional and three different kinds of labels (i.e., non-GMO, transitional organic, organic), 2) internal reference price (the last purchased price of the product that respondents recall), 3) consumers' WTP for two food products with different labels, and 4) demographics (age, gender, and educational level). The WTP for different labeled food products is answered in the payment card approach given two ranges of reference prices of conventional and organic food products. Furthermore, before respondents answer their WTP, we provide information about each label to help respondents understand each label's meaning and avoid invalid WTP answers. Two products (salad and chips) were chosen as the focal subjects to identify the representative of healthy (salad) and unhealthy (chips) food because both salad and chips are common food with all kinds of labels in real life. Respondents were randomly assigned to one of the groups so that they would answer the questions for one group only. A total of 2,268 valid responses were collected and used in this study.

Table 1 summarizes the demographics of survey respondents and the U.S. Census statistics in 2019. Female respondents account for 67.95%, which is higher than the general population (51.51%). The discrepancy between responses and the general population is that this survey is aimed at household grocery buyers, so the proportion of women is larger

(Schaefer, 2019). This sample's age distribution is slightly older than the general population, which may be because this study only focuses on 18 years or older people and the household's primary shopper. Respondents aged 18 to 24 account for 7.89%, which is less than the general population (8.12%). However, those aged over 65 account for 20.24% of the sample, which is more than the Census data percentage. As for the educational level, more respondents have some college and above in the survey than the general population since the survey is an online survey. Respondents whose academic levels are lower than high school and higher than master's degrees account for 20.86% and 18.22%, respectively. In terms of weekly food expenditure, only 11.02% of respondents spent less than $49 per week on food. Respondents with weekly food expenditures between $50 and $199 accounted for 69.14% of the sample. In addition, less than 20% of respondents spent more than $200 on food per week. Female respondents with higher educational levels account for higher percentages of the sample than the U.S. Census data. This is consistent with the results of online survey statistics in previous research about consumer food preferences (Heng, Peterson, and Li, 2013; Gao, House, and Xie, 2016; Chen et al., 2016; Chen, Gao, and McFadden, 2020).

Figures 3 and 4 show the percentages of consumers who would pay for the chips and salads with different labels. Figure 3 reflects many zero WTP values for GMO-free, transitional organic, and organic chips, accounting for around 10% of total responses. The distribution of consumers' WTP for chips shows a normal distribution. Most consumers would like to pay $2.99 for conventional chips (20.88%) and $3.99 for GMO-free chips (15.51%), transitional organic chips (14.56%), and organic chips (13.95%). Table 3 shows the mean WTP values for conventional, GMO-free, transitional organic, and organic chips are $2.88, $3.32, $3.24, and $3.62, respectively. As shown in Figure 4, consumer zero WTP for GMO-free, transitional organic, and organic salad accounts for 6.76%, 7.66%, and 6.40%, respectively. Consumer WTP for salads is very similar to consumer WTP for chips, which are also distributed normally.

The most responses of willingness to pay for the conventional salad are $2.99, $3.49 for transitional organic salad, and $3.99 for GMO-free and organic salad. Table 3 shows the mean consumer WTP values for the conventional and three labeled salads are $3.02, $3.57, $3.56, and $3.95, respectively.

Methods

I. Experimental and Survey Design

To test the impacts of different formats of reference prices, we used two versions of reference prices in the survey. In each version, the prices are generated using a two-by-two design. In the design of the first price version, the design factors are the means of conventional and organic reference prices, respectively (low means of reference price versus high means of reference price). In the second price version design, the design factors are intervals of conventional and organic reference prices, respectively (small intervals of reference price versus large intervals of reference price). The design results in a total of four different combinations of reference prices for each price version (or eight total). For the first price version, the four cases are: 1) low means of both conventional and organic; 2) a low mean of conventional and a high mean of organic; 3) a high mean of conventional and a low mean of organic; 4) high means of both conventional and organic. For the second price version, the four cases are: 1) small intervals of both conventional and organic; 2) a small interval of the conventional and a large interval of organic; 3) a large interval of the conventional and a small interval of organic; 4) large intervals of both conventional and organic. Detailed information on the different formats of reference prices in the survey is illustrated in Table 2.

Since two products were studied, there are a total of 16 versions of the survey were offered (two products * two price versions using means or intervals of the reference prices * four cases = 16 versions of the survey). A between-subject design is used to randomly assign each respondent to one of 16 surveys and ask respondents their willingness to pay for the

conventional and three labeled alternative products, non-GMO, transitional organic, and organic. As stated earlier, the prices of conventional and organic food products are used as the reference prices in this study, as they are products that consumers are more familiar with. The organic product is likely the most well-known label of the three examined. An example question of Case 1) of the first version for chips in the survey is shown in Figure 5. The other cases of two versions for two products are the same except for the reference price information and the product.

II. Model Specification

From the survey above, we collected consumer WTP for conventional and three kinds of labeled food products ($WTP_{conventional}$, $WTP_{gmofree}$, $WTP_{transitional}$, and $WTP_{organic}$). We used paired t-test for each two labeled food products to check whether consumer WTP for food products with different labels are significantly different.

Let $WTP_{mean,conventional}$ and $WTP_{mean,organic}$ be consumer WTP for a labeled food product given the different means of reference prices of conventional and organic food products, collected from survey data using a payment card contingent valuation method (Hu et al., 2011; Yu et al., 2014). Let $WTP_{high\ mean,conventional}$, $WTP_{low\ mean,conventional}$, $WTP_{high\ mean,organic}$ and $WTP_{low\ mean,organic}$ represent the WTP given the high and low means of reference prices for conventional and organic foods, respectively. The t-test is used to check the effect of different reference price formats on WTP for each labeled food product. If the impact of different mean patterns of reference price on consumer WTP for food products exists, the equation (1) and (2) will be the following:

$$WTP_{high\ mean,conventional} \neq WTP_{low\ mean,conventional} \quad (1)$$

$$WTP_{high\ mean,organic} \neq WTP_{low\ mean,organic} \quad (2)$$

Furthermore, let $WTP_{interval,conventional}$ and $WTP_{interval,organic}$ be consumer's

willingness-to-pay for labeled food products given the different interval patterns of conventional and organic reference prices. Besides, let $WTP_{large\ interval,conventional}$, $WTP_{small\ interval,conventional}$, $WTP_{large\ interval,organic}$ and $WTP_{small\ interval,organic}$ represent the WTP given the large- and small-interval of reference prices for conventional and organic food products. If the effect of the different interval formats of reference price on WTP exists, then equation (3) and (4) will be the following:

$$WTP_{large\ interval,conventional} \neq WTP_{small\ interval,conventional} \quad (3)$$

$$WTP_{large\ interval,organic} \neq WTP_{small\ interval,organic} \quad (4)$$

Given different formats of conventional and organic reference prices, different consumer WTPs for labeled food products are obtained. To avoid the correlation of errors between four different labels, seemingly unrelated regression (SUR) models are used in this study. Equations (5) and (6) are estimated by SUR models with four equations to obtain the effect of different formats of the reference price. Equation (5) was estimated with respondents who were given the different mean patterns of reference prices, and equation (6) was estimated with respondents who were given the different interval patterns of reference prices.

$$WTP_{mean} = \beta_{mc}Conventional_m + \beta_{mo}Organic_m + \beta_{mr}internal_{mk} + \beta_{mk}X_{mk} + \varepsilon_m \quad (5)$$

$$WTP_{interval} = \beta_{ic}Conventional_i + \beta_{io}Organic_i + \beta_{ir}internal_{ik} + \beta_{ik}X_{ik} + \varepsilon_i \quad (6)$$

where β are the unknown parameters. ε_m and ε_i are random errors for each equation. $internal_{mk}$ and $internal_{ik}$ are the internal reference prices for each response *k* in mean and interval formats, respectively. X_{mk} and X_{ik} are demographics vectors for each response k in mean and interval formats, respectively. Since previous research showed that the internal reference price could impact consumer preference, we also include it in the equation (Nieto-García, Muñoz-Gallego, and González-Benito, 2017; Pedrajaiglesias and Guillén, 2000). As for the patterns of the reference price of conventional and organic food products, the value of indicator functions is summarized below.

$$Conventional_m = \begin{cases} 1 & if\ given\ high\ mean\ conventional\ reference\ price \\ 0 & otherwise \end{cases} \quad (7)$$

$$Organic_m = \begin{cases} 1 & if\ given\ high\ mean\ organic\ reference\ price \\ 0 & otherwise \end{cases} \quad (8)$$

$$Conventional_i = \begin{cases} 1 & if\ given\ large\ interval\ conventional\ reference\ price \\ 0 & otherwise \end{cases} \quad (9)$$

$$Organic_i = \begin{cases} 1 & if\ given\ large\ interval\ organic\ reference\ price \\ 0 & otherwise \end{cases} \quad (10)$$

To check the robustness of this research, an ordinary least square (OLS) regression, Tobit regression, and SUR Tobit regression are provided. The SUR regression enables correlations between equations to be estimated and improves estimation efficiency. In some cases, the percentage of zero consumer WTP is greater than 5%, so the Tobit model is estimated. To account for the correlation of errors and zero WTP comprehensively, we used a mix-processed model SUR tobit regression that is estimated in Stata 15.

Section 4: Empirical Results

Chips

The statistics of WTP estimates for chips are summarized in Table 3 and Table 4. Table 3 shows the paired t-test results for chips with different labels. We can know that consumer WTP for organic chips is significantly higher than other kinds of chips. The order of consumer WTP for different labeled chips is: organic chips, non-GMO chips, transitional chips, and conventional chips. In this case, consumer WTP for non-GMO chips is higher than transitional chips at 95% confidence. Hence, the first hypothesis (Hypothesis 1: *Consumer WTP for transitional organic food products is between that for conventional and organic food products*) for chips cannot be rejected at the 99 percent confidence level no matter given the format of the reference prices. Regarding the mean of reference price effect, the statistical summary in Table 4 shows that the WTP for all products in Case 1 is relatively higher than those in Case 2. This indicates that a higher mean of organic reference price may negatively impact consumer WTP. Moreover, in Case 1, consumer WTP is lower than in Case 3, which means the conventional product's reference price potentially positively correlates with consumer WTP. Besides, when WTP in Case 2 and Case 3 compare with that in Case 4, we can see that the former is lower than WTP in Case 4, but the latter shows a similar WTP as Case 4. Hence, the conventional product's reference price may positively influence consumer WTP, and the organic product's reference price might have no impact on consumer preference. However, from the T-test results, we notice that the mean WTP for all types of chips in each case is not significantly different at the 95% confidence level.

Regarding the effect of the interval of reference prices, the results in Table 4 show that the mean WTP estimates with smaller intervals of reference prices are relatively lower than those with larger intervals, except for transitional organic labeled products. This may be because the transitional food product is innovative; it already has considerable uncertainty.

However, the t-test does not show significant differences between the WTP for all products of each case.

The SUR model results in equation (5) for WTP of different kinds of labeled chips are presented in Table 5. The high mean of the conventional product's reference price has a significantly positive impact on consumer WTP for conventional, non-GMO, and organic products, consistent with the statistical summary of the WTP in Table 2. Thus, Hypothesis 2: *Reference price will influence consumer WTP for labeled food products* cannot be rejected. Although the mean of the organic product's reference price has no impact on consumers' WTP for any chips, we would still not reject Hypothesis 3: *High means of reference prices will increase consumers' WTP for the labeled food products of interest* because of the effect of the conventional reference price.

The internal reference price, age, educational level, and gender could also impact consumer WTP for chips. For the effect of internal reference price, the price that consumers paid previously could positively affect consumer WTP for all products. Consumers who paid a higher price for chips would be willing to purchase the same or similar products at a higher price. This result is consistent with previous research (Ranyard, Charlton, and Williamson, 2001; Nieto-García, Muñoz-Gallego, and González-Benito, 2017). However, the respondents' age shows a negative impact on consumer WTP, which indicates that younger people tend to have higher WTP for chips. Furthermore, consumers with a higher educational level are more likely to have higher WTPs for non-GMO and organic chips. Meanwhile, women respondents typically have higher WTP for conventional chips. The most special product is transitional organic products. Both the reference prices of conventional and organic products do not influence it. This may be because transitional organic is an unfamiliar label, and people are not familiar with it. Thus, the mean of conventional reference price could affect consumer WTP

for conventional products, non-GMO products, and organic products. Still, the mean of organic reference price has no impact on consumer WTP. These results mean that consumers measure their WTP according to the mean of conventional reference price instead of the mean of the organic reference price. Based on the principle of profit maximization, consumers would like to get the product at a minimum price. Therefore, they would consider their WTP based on low-priced products (the mean of conventional reference price), which is consistent with the results.

In this study, the different interval patterns of conventional and organic reference prices are indicated as different levels of uncertainties (i.e., smaller interval means a lower level of uncertainty, and large interval means a higher level of uncertainty). The effects of different interval patterns of conventional and organic reference prices on consumer WTP are shown in Table 6. It shows that neither the interval pattern of conventional product's reference price nor the interval pattern of organic product's reference price significantly impacts consumer WTP. Thus, this result suggests rejection of Hypothesis 4: *Consumers will have a lower WTP for food products, given greater uncertainty of reference prices*. This may be because respondents are familiar with the prices of conventional and organic labeled chips. Even though the survey provides them with larger and smaller intervals of reference price, they are still not affected by it. However, the internal reference price has a significant positive influence on consumer WTP for all four kinds of products. Therefore, when people face uncertainty in the reference price, they would be more reliant on the price they paid last time. In this case, the information of the reference price is becoming no influential. Moreover, younger consumers always have higher WTP for all kinds of food products in the study.

Salads

For the healthy food product representative, salad, the means of WTP given different

reference prices are shown in Tables 3 and 4. Table 3 shows that organic and conventional salads have the highest and lowest consumer WTP, respectively. Moreover, consumer WTP for non-GMO and transitional salads are between conventional and organic salads, but they do not have significant differences. Hence, in the case of salad, the first hypothesis (Hypothesis 1: *Consumer WTP for transitional organic food products is between that for conventional and organic food products*) cannot be rejected. For the survey versions with different means of reference prices, consumer WTP for non-GMO products of Case 3 is significantly higher than Case 1. However, consumer WTP for other products of each case is not significantly different. Combining a high mean of conventional and a low mean of organic reference price leads to the highest WTP for non-GMO salads among all reference price combinations. Thus, conventional reference price means have a more substantial positive impact on consumer WTP for healthy non-GMO food products than the mean of the organic reference price. For the second price version with different reference price intervals, the smaller interval reference price pattern shows relatively higher WTP. From the T-test results, there is no difference between WTP for all products of each case. Larger intervals of reference prices provide more uncertainties for respondents. Thus, the uncertainty may decrease respondents' confidence in the products and the WTP, which is consistent with the results from previous studies (Shi et al., 2014; Caputo, Lusk, and Jr, 2018).

Table 5 summarizes the SUR results of the effect of mean patterns of reference prices on consumer WTP. The higher mean of the conventional product's reference price has a significantly positive impact on consumer WTP for conventional, non-GMO, and transitional organic products. This means that consumer WTP for conventional, non-GMO, and transitional organic salads with the higher mean of conventional products' reference price is higher than with the lower mean of a conventional product's reference price. Therefore, the result fails to reject the second hypothesis (Hypothesis 2: *Reference price will influence consumer WTP for*

labeled food products) and the third Hypothesis (Hypothesis 3: *High means of reference prices will increase consumer's WTP for the labeled food products of interest*).

Like the WTP for chips, consumer WTP for salads is influenced by internal reference price, age, gender, and educational attainment. The WTP for conventional, non-GMO, and organic salads strongly correlates with their internal reference prices. However, there is no impact of internal reference price on consumer WTP for transitional organic salads because transitional organic is not a widely used label and not familiar to consumers. Hence, most consumers do not have an accurate internal reference price for transitional organic salads, and the internal reference price cannot impact consumer WTP for transitional organic salads. Furthermore, young people who received more education are more likely to give higher WTP for the study's salad. Also, female consumers are more likely to show higher WTPs for conventional salads. Thus, the mean of conventional products' reference price but not the mean of the organic products' reference price could impact consumer WTP for conventional, non-GMO, and transitional organic salads.

As shown in Table 6, the different interval patterns of reference price have no impact on consumer WTP for conventional or other three labeled food products, which have the same result as unhealthy food products. Therefore, we would reject Hypothesis 4: *Consumers will have a lower WTP for food products, given greater uncertainty of reference prices*. Similar to the results of chips, consumers can avoid the uncertainty of reference prices from their life experiences. Hence, the intervals of reference prices have no correlation with consumer WTP for salads with any label. The WTP for a conventional salad could be impacted by internal reference price significantly. Moreover, older females are more likely to give lower WTP for conventional salad. This may be because older females are the primary grocery shopper, and they are more familiar with the price of conventional salad. For non-GMO and organic food products, only age has a negative influence on consumer WTP. To some extent, consumer WTP

for transitional organic salad is influenced by the last purchased price. This result of intervals of reference price is different from the results of means of reference price, which may be because when consumers buy unfamiliar products with different uncertainty information, they would like to rely on the price they paid last time. As a result, consumers have to rely on the internal reference price to bid for this new product. Also, younger people have higher WTP.

Comparisons of Different Models

Based on Table 3, the average consumer WTP for chips with different labels is slightly lower than salads. Moreover, the SUR results in Table 5 show that conventional mean effects on consumer WTP for chips and salads are similar; their differences are less than $0.1 per $1 change of conventional product's reference price. The high mean organic does not significantly influence consumer WTP for any products. However, in terms of different reference price means, the internal reference price effect on consumer WTP for chips is relatively magnified, compared to WTP for salads. Interestingly, neither of the large intervals of conventional nor the large intervals of organic affect consumer WTP for both chips and salads. Besides, in the SUR results of the reference price interval effect, the internal reference price effects of chips and salads are similar. Hence, the results above indicate that the reference price formats effect does not differ between healthy and unhealthy food products, which fails to reject Hypothesis 5: *The effect of reference price formats on consumer preferences and WTP for labels in healthy and unhealthy food products differs* at the 95 percent confidence level. Nevertheless, given different reference price means, internal reference price will have a more massive effect on consumer WTP for chips than salads.

Section 5: Discussion and Implications

Robustness Check

To check the correlation between each equation in the SUR regression, we used the Breusch-Pagan test. Table 7 in the Appendix shows that the relationship between each equation in the SUR model exists statistically. In addition, we conduct some other different models in this study to make the major results more robust, such as the OLS regression, the Tobit regression, and the SUR Tobit regression. The OLS regression results (See Table 8-9) are very similar to the results of SUR regression. Since the OLS regression results are the same as the SUR regression result, the SUR model is still robust, and the OLS model is more efficient than the SUR. Furthermore, the Tobit regression results (See Table 10-11) are similar to the SUR results. Besides, we also conducted a mixed-process model, the SUR Tobit regression, to check the SUR regression's robustness. Similarly, the SUR Tobit regression results (See Table 12-13) are also very close to the results of SUR regression. Therefore, SUR regression is suitable and robust in this analysis.

Implications

This study explored the effects of different reference price formats on consumer preference and decision-making for the products with the same or similar labels. The results showed that people are more likely influenced by the conventional reference price's mean than the mean of the organic reference price or the intervals of reference prices (the uncertainty of reference price). When provided a higher mean reference price of conventional products, consumers were more likely to bid a higher WTP for labeled food products. Because the effect of the conventional mean reference price is significant on consumer WTP for both familiar and unfamiliar labeled healthy food products. Besides, when consumer WTP does not change when the consumer faces different uncertainty of reference price. A direct and important implication is that the reference price would change consumer preference. Providing consumers with a

higher reference price would easily raise their WTP for products with the same or similar labels. This is consistent with the fact that in premium grocery markets, when consumers observe a higher price for conventional products, it would become easier for consumers to accept the price premium charged for both conventional and more premium products such as organic. This is also one of the reasons that premium grocery markets usually would have more options of more premium products, and at the same time, conventional products sold at those places would charge higher prices than those same products in the generic markets. Retailers and marketers could potentially alter consumers' preferences for those premium products by simply manipulating prices for those conventional counterparts within certain ranges, while have to be careful to use this strategy by remaining competitive as a whole market. Otherwise, consumers may choose to shop elsewhere. In addition, farmers can also get an implication from these results. Before they make their decision to transfer from conventional to organic practice, they could calculate and estimate profits or losses with the price information about food products with different labels so that they can make their optimal decision.

From another perspective, policymakers and companies could predict the price strategy for food products with potential labels according to conventional food products' mean price in the market. For instance, when the policymaker or companies plan to launch an innovative label or an unfamiliar product with a familiar label, they may target the prices of the products according to the mean price of the related conventional products. However, based on our study, the conventional mean reference price only significantly influences consumer WTP for familiar labeled unhealthy food products. As a result, it seems to be more effective and beneficial to rely on the reference prices of those unhealthy food products. Since the reference price formats impact consumer WTP for healthy and unhealthy food products differently. Hence, policymakers and marketers should be careful when developing pricing strategies for different food categories.

Moreover, the reference price intervals' impact was not significant for any case, which suggests consumer WTP will be relatively stable regardless of the reference price uncertainty they faced. Consumers would like to rely on their price last time, suggesting that consumers will count on the internal reference price when facing a large uncertainty of reference price. Besides, consumer WTP is also influenced by demographics. Therefore, when marketers make the pricing prediction strategy of labeled food products, they would better consider the consumer segment groups that are easier to be influenced, including younger or older consumers and female or male consumers.

Conclusion

Our study provides additional information by designing different treatments on reference prices to see how these different reference prices affect consumer WTP. The results of this study could provide information to farmers, market managers, and policymakers. Furthermore, transitional organic is an unfamiliar label, which is rarely studied in previous research. In this study, we include WTP for conventional and WTP for three different kinds of labeled food products: non-GMO, transitional organic, and organic food products. The transitional organic label is not only a label between conventional and organic labels, but also its consumer WTP is between consumer WTP for conventional and organic food products.

Moreover, we designed four reference price formats, including higher means, lower means, larger intervals, and smaller intervals of reference prices, to estimate the impacts on consumer WTP for chips and salad. Different reference price means of conventional and organic products could affect consumer WTP for conventional food products and three other labeled food products (i.e., non-GMO, transitional organic, and organic food products). The mean of the conventional reference price could significantly positively impact consumer WTP, indicating consumers have higher WTP given a higher mean of the conventional product's reference price than given a lower mean of the conventional product's reference price. To be

more specific, the effect of the reference price means of conventional chips on consumer WTP is similar for chips with familiar labels (i.e., non-GMO and organic). For the case of salad, the effect of conventional reference price means is similar for both familiar and unfamiliar labeled salad (i.e., non-GMO and transitional organic). However, the effect of reference price intervals is not significant on consumer WTP. Interestingly, when consumers face different uncertainty on reference prices, they would like to rely on the internal reference price, which is the price they paid last time. In this study, the treatments on the reference price intervals are not statistically influential. The preference is not homogenous as among demographics, age, gender, education can also influence consumer WTPs for different food products. Generally, younger males with higher education levels are more likely to provide higher WTP. In addition, there is no significant difference between the impact of the reference price formats on consumer WTP of healthy and unhealthy food products.

Limitations and Future Research

There are some points that could be improved in the future. This study uses chips and salad as objects to represent unhealthy and healthy food products, which may cause limitations to generalization. Future researchers could focus on additional products to make the results of this study more general. While this study used the payment card CVM to elicit WTP in this study, future research could test the results' reproducibility under various WTP estimation methods (i.e., choice experiments) to see whether the WTP estimation method has impacts on the results. Furthermore, this study only considers the treatment of reference prices on high mean versus low mean and large interval versus small interval. Other treatments for reference prices should likely be investigated as well as other design elements. For example, the difference between low mean and high mean is one U.S. dollar, and the interval patterns of reference prices are also not very large in this study. Future studies could design treatments on reference prices that might compare variations in both means and intervals to their effects on

WTP so that they can contribute literature to the relationship between the reference price and consumer preference.

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Appendix

Tables

Table 1. Demographics of Survey Participants (N=2,268)

Independent variable	Sample (%)	Population[a] (%)
Female	67.95	51.51
Age (18-24)	7.89	8.12
Age (25-34)	18.43	12.81
Age (35-44)	15.83	13.80
Age (45-54)	20.24	12.48
Age (55-64)	17.37	11.96
Age (65 and over)	20.24	12.60
Education (Some High school)	2.29	1.32
Education (High school/GED)	18.47	21.16
Education (Some college)	20.94	13.20
Education (2-year college degree)	12.21	7.35
Education (4-year college degree)	27.87	15.12
Education (Master's degree)	13.98	6.44
Education (Doctoral degree)	1.59	1.32
Education (Professional degree (JD, MD))	2.65	0.94
Weekly Food Expenditure (Less than $49)	11.02	
Weekly Food Expenditure ($50-$99)	29.37	
Weekly Food Expenditure ($100-$149)	25.93	
Weekly Food Expenditure ($150-$199)	13.84	
Weekly Food Expenditure ($200-$249)	6.97	
Weekly Food Expenditure ($250-$299)	3.70	
Weekly Food Expenditure ($300-$349)	2.34	
Weekly Food Expenditure ($350-$399)	1.72	
Weekly Food Expenditure ($400-$449)	1.68	
Weekly Food Expenditure ($450-$499)	1.10	
Weekly Food Expenditure (Above $500)	1.06	
Weekly Food Expenditure (Not Sure)	1.28	

Note: [a] Population data source: U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplement (2019).

Table 2. Reference Price in Each Survey Version

Survey version	Case	Reference price treatment	Reference price	
			Conventional ($)	Organic ($)
Version 1	1	Low Conventional Low Organic	2-4 (L)	4-6 (L)
	2	Low Conventional High Organic	2-4 (L)	5-7 (H)
	3	High Conventional Low Organic	3-5 (H)	4-6 (L)
	4	High Conventional High Organic	3-5 (H)	5-7 (H)
Version 2	1	Small Conventional Small Organic	3-5 (S)	5-7 (S)
	2	Small Conventional Large Organic	3-5 (S)	4-8 (L)
	3	Large Conventional Small Organic	2-6 (L)	5-7 (S)
	4	Large Conventional Large Organic	2-6 (L)	4-8 (L)

Notes: The L and H in parentheses in version 1 are abbreviations of Low and High; in version 2, S and L in parentheses are abbreviations of Small and Large.

Table 3. Paired T-test Results for Consumer WTP for Food Products with Different Labels

Case	Mean Difference	Std Dev	t-value	Pr > |t|
		Chips		
Conventional - Non-GMO	-0.44	1.60	-9.41	<0.0001
Conventional - Transitional	-0.36	1.61	-7.53	<0.0001
Conventional - Organic	-0.74	1.74	-14.35	<0.0001
Non-GMO - Transitional	0.09	1.23	2.37	0.0178
Non-GMO - Organic	-0.29	1.07	-9.32	<0.0001
Transitional - Organic	-0.38	1.17	-10.97	<0.0001
		Salad		
Conventional - Non-GMO	-0.55	1.47	-12.55	<0.0001
Conventional - Transitional	-0.54	1.52	-11.86	<0.0001
Conventional - Organic	-0.93	1.63	-18.97	<0.0001
Non-GMO - Transitional	0.01	1.29	0.37	0.7118
Non-GMO - Organic	-0.38	1.19	-10.60	<0.0001
Transitional - Organic	-0.39	1.19	-10.95	<0.0001

Notes: The unit for reference price and mean WTP is U.S. dollars.

Table 4. Summary of WTPs in Each Survey Version

Survey version	Case	WTP Conventional	WTP Non-GMO	WTP Transitional	WTP Organic
			Chips		
1	1) Low Low (N=213)	2.82 (1.22)	3.25 (1.62)	3.24 (1.63)	3.44 (1.76)
	2) Low High (N=223)	2.74 (1.20)	3.19 (1.66)	3.19 (1.67)	3.57 (1.84)
	3) High Low (N=216)	3.01 (1.41)	3.46 (1.55)	3.23 (1.61)	3.75 (1.81)
	4) High High (N=224)	2.99 (1.29)	3.56 (1.66)	3.31 (1.64)	3.79 (1.73)
2	1) Small Small (N=69)	2.98 (1.38)	3.38 (1.85)	3.24 (2.04)	3.51 (2.04)
	2) Small Large (N=70)	2.91 (1.63)	3.13 (1.94)	3.30 (1.95)	3.57 (2.01)
	3) Large Small (N=68)	2.69 (1.39)	3.06 (2.09)	2.97 (1.84)	3.48 (2.21)
	4) Large Large (N=71)	2.81 (1.50)	3.18 (1.91)	3.33 (1.98)	3.62 (1.98)
	Total	2.88 (1.33)	3.32 (1.71)	3.24 (1.72)	3.62 (1.85)
			Salad		
1	1) Low Low (N=206)	2.81 (1.39)	3.25[a] (1.51)	3.25 (1.59)	3.61 (1.58)
	2) Low High (N=215)	2.89 (1.27)	3.41 (1.58)	3.43 (1.75)	3.88 (1.82)
	3) High Low (N=205)	3.07 (0.97)	3.68[a] (1.51)	3.56 (1.34)	3.92 (1.48)
	4) High High (N=204)	2.96 (1.17)	3.61 (1.61)	3.54 (1.60)	3.98 (1.72)
2	1) Small Small (N=71)	3.31 (1.42)	4.18 (1.87)	4.24 (1.89)	4.62 (2.10)
	2) Small Large (N=69)	3.37 (1.77)	3.85 (2.30)	3.95 (2.27)	4.22 (2.36)
	3) Large Small (N=68)	3.12 (1.36)	3.54 (1.99)	3.56 (1.98)	4.05 (2.04)
	4) Large Large (N=72)	3.25 (1.50)	3.73 (1.91)	3.81 (2.04)	4.10 (2.12)
	Total	3.02 (1.30)	3.57 (1.70)	3.56 (1.72)	3.95 (1.81)

Notes: The unit for reference price and mean WTP is U.S. dollars. The numbers in parentheses are standard deviation.

[a] indicates that the mean WTP for Non-GMO salads of Case 3) is significantly higher than that of Case 1) at 95% level in version 1.

Table 5. SUR Estimation Results: Lower Mean Versus Higher Mean

Independent variables	Dependent variable: WTP for Conventional products, Non-GMO products, Transitional Organic products, Organic products							
	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$
	Chips				Salad			
Intercept	2.75***	3.08***	3.14***	3.31***	3.17***	3.70***	3.89***	4.15***
High mean Conventional	0.19**	0.23**	0.004	0.20*	0.15*	0.29***	0.19*	0.17
High mean Organic	-0.01	0.10	0.09	0.17	-0.002	0.06	0.10	0.17
Internal reference price	0.18***	0.23***	0.23***	0.25***	0.07***	0.07**	0.04	0.06*
Age	-0.05*	-0.17***	-0.14***	-0.19***	-0.15***	-0.19***	-0.19***	-0.20***
Gender	-0.25***	-0.05	-0.14	-0.06	-0.18**	-0.15	-0.13	-0.08
Education	0.001	0.09***	0.05	0.11***	0.08***	0.11***	0.08**	0.10***
Observations	876	876	876	876	830	830	830	830

Notes: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01.

Table 6. SUR Estimation Results: Smaller Interval Versus Larger Interval

Independent variables	Dependent variable: WTP for Conventional products, Non-GMO products, Transitional Organic products, Organic products							
	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$
	Chips				Salad			
Intercept	3.15***	3.65***	3.63***	3.97***	4.67***	6.22***	5.56***	6.46***
Large interval Conventional	-0.26	-0.22	-0.20	-0.08	0.05	-0.07	-0.10	-0.004
Large interval Organic	0.05	-0.06	0.24	0.14	0.01	-0.14	-0.04	-0.21
Internal reference price	0.13***	0.19***	0.14**	0.18***	0.19***	0.09	0.14**	0.11
Age	-0.13**	-0.20***	-0.20**	-0.22***	-0.30***	-0.49***	-0.46***	-0.52***
Gender	-0.15	-0.35	-0.12	-0.16	-0.51***	-0.38	-0.04	-0.14
Education	0.04	0.09	0.05	0.05	-0.05	0.0001	0.05	0.03
Observations	278	278	278	278	280	280	280	280

Notes: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01.

Table 7. Correlation Matrix of Residuals for SUR Regression

	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$
(1) WTP for Chips Given Different Means of Reference Prices				
$WTP_{Conventional}$	1.0000			
$WTP_{GMOfree}$	0.4329	1.0000		
$WTP_{Transitional}$	0.3779	0.7237	1.0000	
$WTP_{Organic}$	0.4041	0.8022	0.7641	1.0000
(2) WTP for Chips Given Different Intervals of Reference Prices				
$WTP_{Conventional}$	1.0000			
$WTP_{GMOfree}$	0.4172	1.0000		
$WTP_{Transitional}$	0.5418	0.7227	1.0000	
$WTP_{Organic}$	0.3833	0.8080	0.7792	1.0000
(3) WTP for Salads Given Different Means of Reference Prices				
$WTP_{Conventional}$	1.0000			
$WTP_{GMOfree}$	0.4881	1.0000		
$WTP_{Transitional}$	0.5002	0.6695	1.0000	
$WTP_{Organic}$	0.4037	0.7255	0.7220	1.0000
(4) WTP for Salads Given Different Intervals of Reference Prices				
$WTP_{Conventional}$	1.0000			
$WTP_{GMOfree}$	0.5065	1.0000		
$WTP_{Transitional}$	0.4329	0.7131	1.0000	
$WTP_{Organic}$	0.4921	0.7915	0.8022	1.0000

Breusch-Pagan test of independence: (1) chi2(6) = 1966.406, Pr = 0.0000; (2) chi2(6) = 666.363, Pr = 0.0000; (3) chi2(6) = 1782.194, Pr = 0.0000; (4) chi2(6) = 690.088, Pr = 0.0000.

Table 8. OLS Estimation Results: Lower Mean Versus Higher Mean

Independent variables	Dependent variable: WTP for Conventional products, Non-GMO products, Transitional Organic products, Organic products							
	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$
	Chips				Salad			
Intercept	2.75***	3.08***	3.14***	3.31***	3.17***	3.70***	3.89***	4.15***
High mean Conventional	0.19**	0.23**	0.004	0.20*	0.15*	0.29***	0.19*	0.17
High mean Organic	-0.01	0.10	0.09	0.17	-0.002	0.06	0.10	0.17
Internal reference price	0.18***	0.23***	0.23***	0.25***	0.07***	0.07**	0.04	0.06*
Age	-0.05*	-0.17***	-0.14***	-0.19***	-0.15***	-0.19***	-0.19***	-0.20***
Gender	-0.25***	-0.05	-0.14	-0.06	-0.18**	-0.15	-0.13	-0.08
Education	0.001	0.09***	0.05	0.11***	0.08***	0.11***	0.08**	0.10***
Observations	876	876	876	876	830	830	830	830

Notes: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01.

Table 9. OLS Estimation Results: Smaller Interval Versus Larger Interval

Independent variables	Dependent variable: WTP for Conventional products, Non-GMO products, Transitional Organic products, Organic products							
	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$
	Chips				Salad			
Intercept	3.15***	3.65***	3.63***	3.97***	4.67***	6.22***	5.56***	6.46***
Large interval Conventional	-0.26	-0.22	-0.20	-0.08	0.05	-0.07	-0.10	-0.004
Large interval Organic	0.05	-0.06	0.24	0.14	0.01	-0.14	-0.04	-0.21
Internal reference price	0.14***	0.19***	0.14**	0.18***	0.19***	0.09	0.14**	0.11
Age	-0.13**	-0.20***	-0.20**	-0.22***	-0.30***	-0.49***	-0.46***	-0.52***
Gender	-0.15	-0.35	-0.12	-0.16	-0.51***	-0.38	-0.04	-0.14
Education	0.04	0.09	0.05	0.05	-0.05	0.0001	0.05	0.03
Observations	278	278	278	278	280	280	280	280

Notes: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01.

Table 10. Tobit Estimation Results: Lower Mean Versus Higher Mean

Independent variables	Dependent variable: WTP for Conventional products, Non-GMO products, Transitional Organic products, Organic products							
	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$
	Chips				Salad			
Intercept	2.75***	3.06***	3.13***	3.27***	3.17***	3.69***	3.89***	4.15***
High mean Conventional	0.19**	0.24**	0.004	0.22*	0.15*	0.30***	0.20*	0.19
High mean Organic	-0.01	0.10	0.10	0.19	-0.002	0.05	0.09	0.17
Internal reference price	0.18***	0.24***	0.24***	0.26***	0.07***	0.06**	0.03	0.05
Age	-0.05*	-0.18***	-0.15***	-0.21***	-0.15***	-0.20***	-0.20***	-0.21***
Gender	-0.26***	-0.06	-0.15	-0.08	-0.18**	-0.16	-0.14	-0.09
Education	-0.001	0.10***	0.06	0.12***	0.09***	0.12***	0.09**	0.11***
Observations	876	876	876	876	830	830	830	830

Notes: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01.

Table 11. Tobit Estimation Results: Smaller Interval Versus Larger Interval

Independent variables	Dependent variable: WTP for Conventional products, Non-GMO products, Transitional Organic products, Organic products							
	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$
	Chips				Salad			
Intercept	3.18***	3.79***	3.73***	4.08***	4.72***	6.28***	5.59***	6.48***
Large interval Conventional	-0.26	-0.23	-0.18	-0.06	0.06	-0.07	-0.11	-0.01
Large interval Organic	0.05	-0.07	0.28	0.14	-0.01	-0.18	-0.11	-0.28
Internal reference price	0.12***	0.19***	0.14**	0.19***	0.18***	0.08	0.14**	0.11
Age	-0.14**	-0.24***	-0.24***	-0.26***	-0.31***	-0.53***	-0.50***	-0.56***
Gender	-0.15	-0.39	-0.17	-0.22	-0.52***	-0.34	-0.03	-0.09
Education	0.04	0.07	0.04	0.04	-0.05	0.01	0.06	0.05
Observations	278	278	278	278	280	280	280	280

Notes: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01.

Table 12. SUR Tobit Estimation Results: Lower Mean Versus Higher Mean

Independent variables	Dependent variable: WTP for Conventional products, Non-GMO products, Transitional Organic products, Organic products							
	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$
	Chips				Salad			
Intercept	2.76***	3.07***	3.14***	3.28***	3.17***	3.71***	3.91***	4.17***
High mean Conventional	0.19**	0.24**	0.01	0.22*	0.15*	0.30***	0.20*	0.19
High mean Organic	-0.01	0.10	0.10	0.19	-0.001	0.05	0.08	0.16
Internal reference price	0.18***	0.24***	0.24***	0.26***	0.07***	0.05**	0.02	0.04
Age	-0.05*	-0.19***	-0.16***	-0.22***	-0.15***	-0.20***	-0.21***	-0.22***
Gender	-0.26***	-0.06	-0.15	-0.08	-0.18**	-0.16	-0.14	-0.09
Education	-0.001	0.09***	0.06	0.12***	0.09***	0.12***	0.10**	0.11***
Observations	876	876	876	876	830	830	830	830

Notes: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01.

Table 13. SUR Tobit Estimation Results: Smaller Interval Versus Larger Interval

Independent variables	Dependent variable: WTP for Conventional products, Non-GMO products, Transitional Organic products, Organic products							
	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$	$WTP_{Conventional}$	$WTP_{GMOfree}$	$WTP_{Transitional}$	$WTP_{Organic}$
	Chips				Salad			
Intercept	3.19***	3.84***	3.83***	4.16***	4.72***	6.30***	5.57***	6.51***
Large interval Conventional	-0.26	-0.23	-0.20	-0.06	0.06	-0.06	-0.11	0.01
Large interval Organic	0.05	-0.07	0.26	0.16	-0.01	-0.19	-0.11	-0.27
Internal reference price	0.12***	0.19***	0.12*	0.18**	0.19***	0.07	0.13*	0.09
Age	-0.14**	-0.25***	-0.24**	-0.28***	-0.31***	-0.54***	-0.52***	-0.58***
Gender	-0.15	-0.39	-0.16	-0.20	-0.52***	-0.30	0.07	-0.05
Education	0.04	0.07	0.03	0.03	-0.05	0.02	0.08	0.05
Observations	278	278	278	278	280	280	280	280

Notes: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01.

Figures

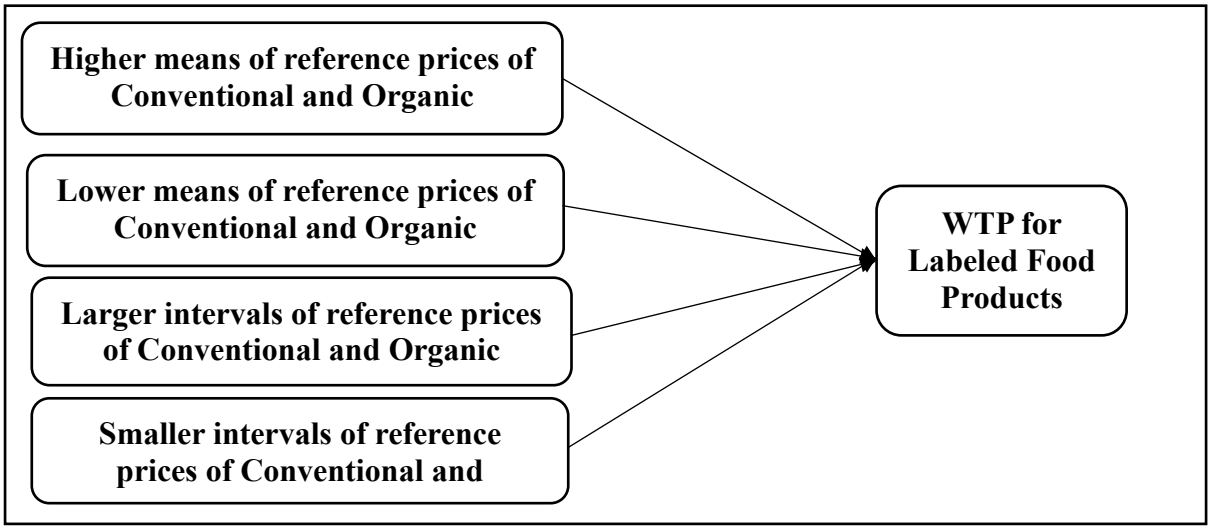

Figure 1. The diagram of the analytical framework

Figure 2. USDA Organic label, Non-GMO label, and Transitional Organic label (from left to right, respectively)

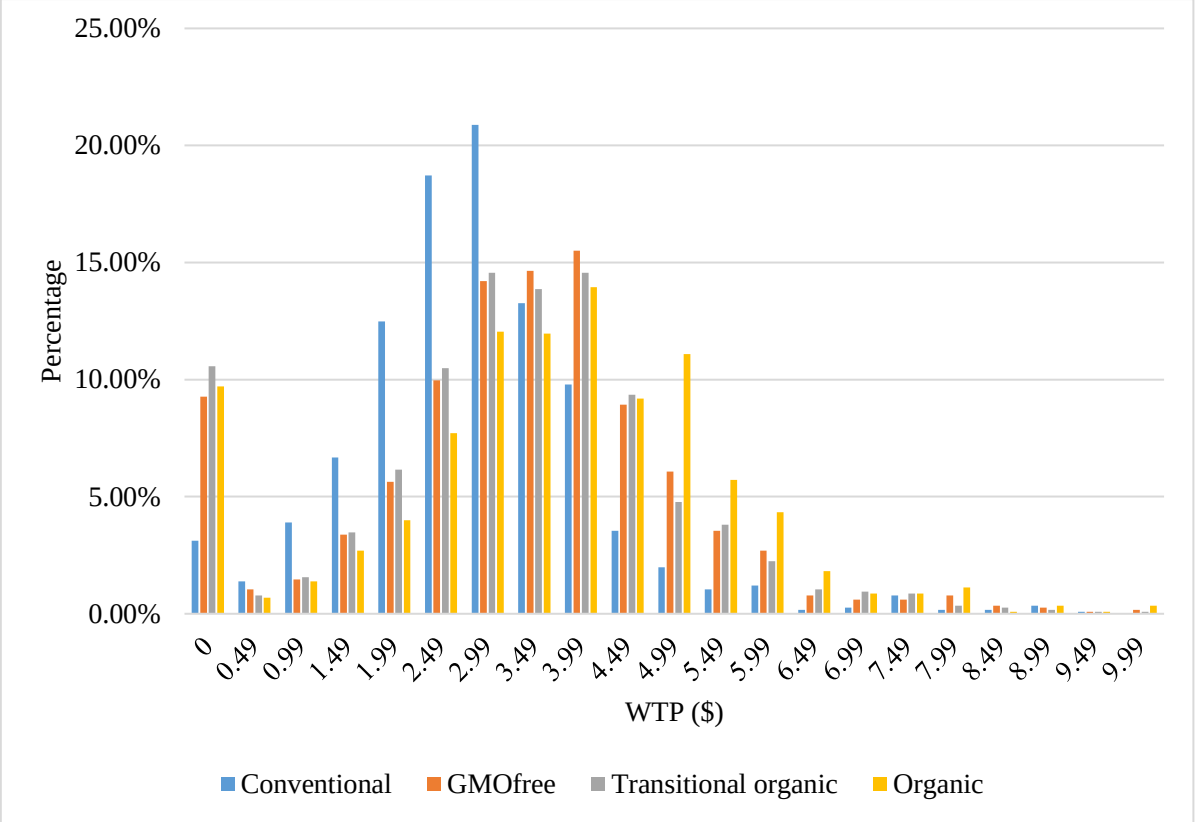

Figure 3. The Distribution of Consumers' WTP for Chips with Different Labels

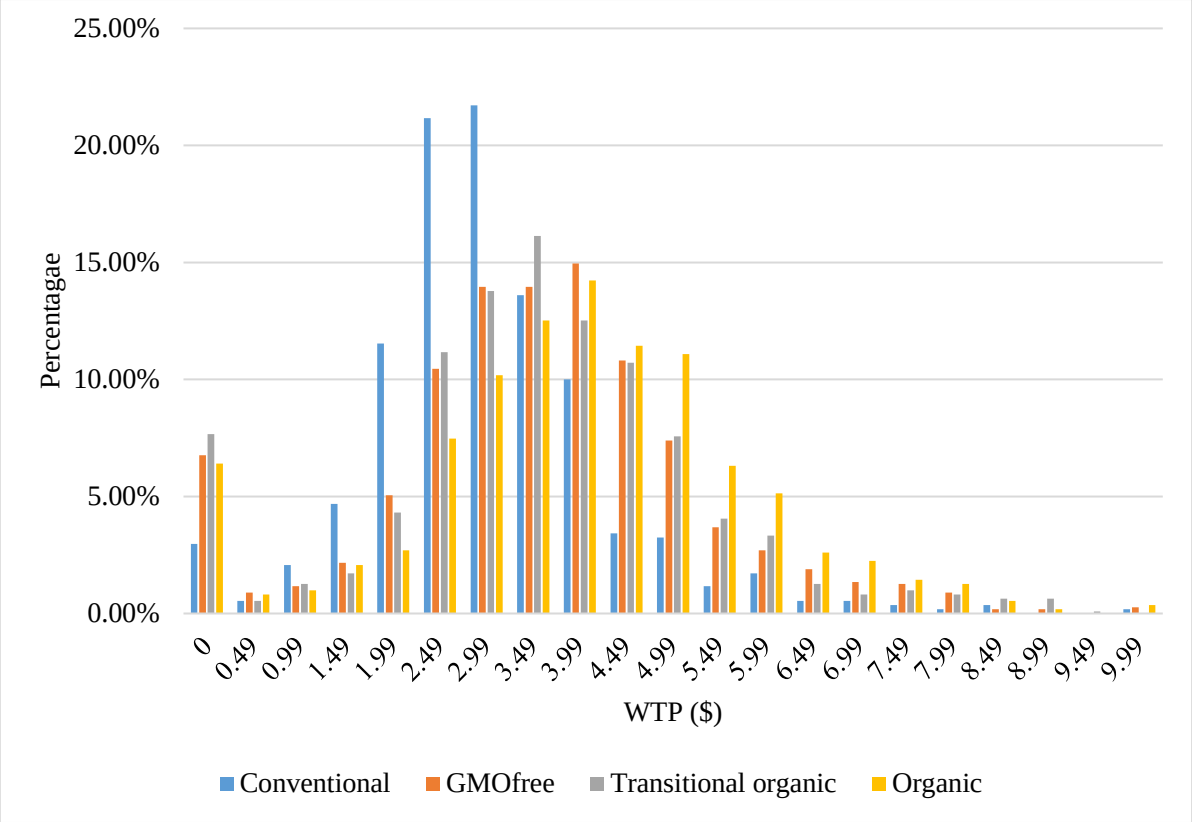

Figure 4. The Distribution of Consumers' WTP for Salads with Different Labels

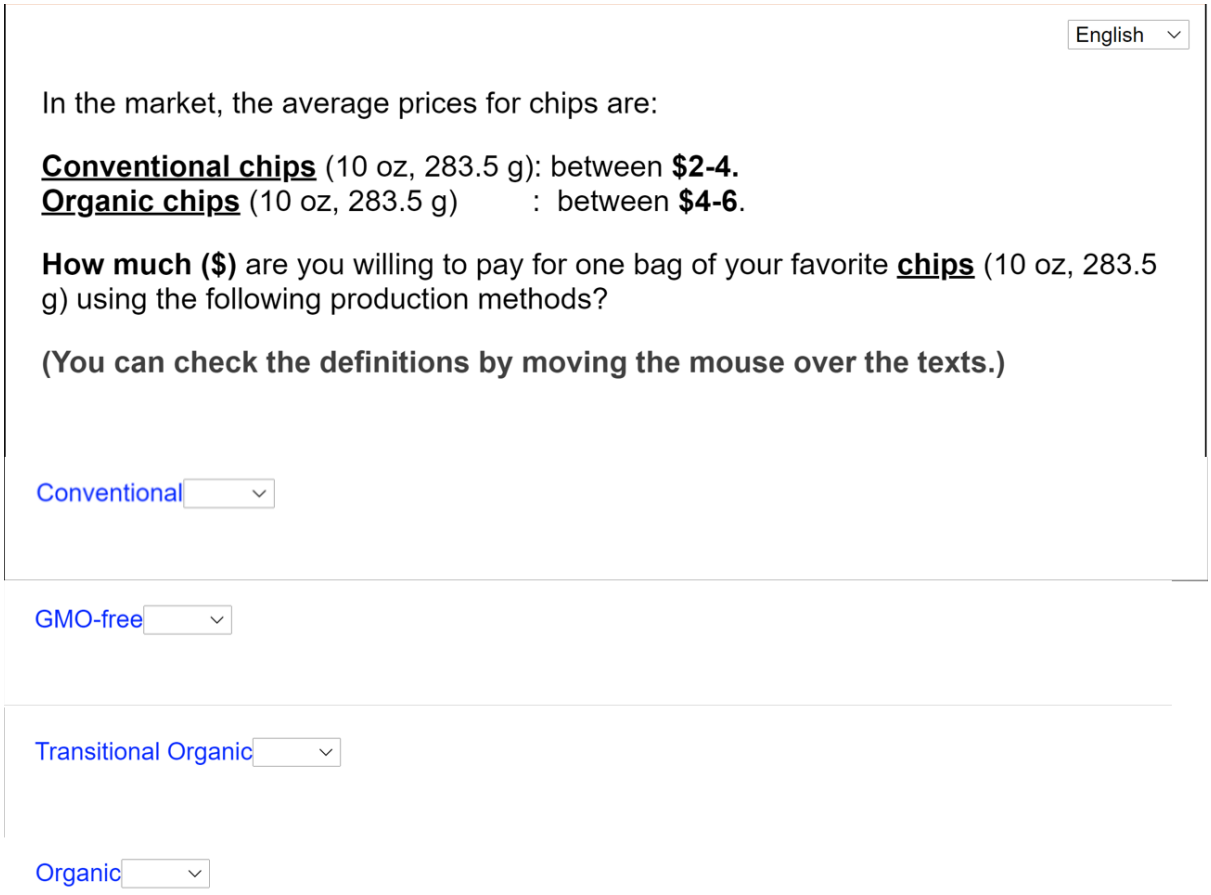

Figure 5. An Example Survey Question

Vita

Xiaohan Wei is originally from Liaoning Province, China, and grew up in Beijing, China. After graduating from high school, she studied at Shenyang Agricultural University and received a Bachelor of Management degree in Economics and Management of Agriculture and Forestry. Before graduating with her undergraduate degree, she wanted to attend graduate school. She chose to attend the University of Tennessee, Knoxville to pursue a Master of Science degree in Agricultural and Resource Economics with a concentration in Agricultural Economics. Her research interest includes studying consumer economics, consumer behavior, and food marketing. After graduation, she will begin her Ph.D. study at Texas A&M University. She is incredibly grateful for all the support and encouragement from her professors, family, and friends.