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# Can Biased Taste Perceptions of Organic Specialty Bakery Products Be Mitigated?

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This study examines consumer perceptions and willingness to pay for organic specialty bakery products by incorporating prior taste beliefs, given product taste attributes, and information on organic production practices. Hypothetical choice experiments for three specialty bakery products were conducted via a nationwide online Qualtrics survey with 721 respondents. Results indicate that, on average, respondents believe that organic specialty bakery products are less tasty than conventional products. Notably, taste beliefs significantly influence their willingness to pay and utility. Providing product taste information dampened the effects of negative taste biases but improving consumer organic knowledge did not. Industry implications are discussed.

*Key words*: organic knowledge, organic labeling, stated choice experiments, taste beliefs, taste information, willingness to pay

## Introduction

Taste is one of the most important food attributes noted in the literature on consumer food preferences (Lusk and Briggeman, 2009; Sajdakowska et al., 2019; Drugova, Curtis, and Akhundjanov, 2020; Kuhar et al., 2020). In forming expectations about product taste and overall quality, consumers often draw from past experiences and intrinsic cues like color and freshness (Bello Acebrón and Calvo Dopico, 2000). The influence of product labeling, such as organic, on taste expectations is notable, regardless of any discernable taste difference. Some consumer studies have found that organic products taste better (Annett et al., 2008; Costanigro et al., 2014), while others found that consumers rated organic similarly (Napolitano et al., 2013; Tobin, Moane, and Larkin, 2013; Gross, Waldrop, and Roosen, 2021) or inferior (Hemmerling et al., 2013; Bi et al., 2015; Rousseau, 2015; Teuber, Dolgopolova, and Nordström, 2016) to conventional products in blind tasting scenarios. These findings suggest that organic production methods may indeed alter product taste for certain products. However, existing literature also provides ample evidence that organic labeling alone significantly affects taste evaluations during actual product tasting, even when consumers taste two identical samples, one labeled organic and one not (Lee et al., 2013; Apaolaza et al., 2017; Bernard and Liu, 2017; Schouteten, Gellynck, and Slabbinck, 2019).

For example, Bernard and Liu (2017) examined the impact of the organic labeling on taste ratings for apples, focusing on three groups of respondents in different locations—a natural food store, a local park, and a university campus. Interestingly, the organic label had a significant positive effect

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on taste ratings in the natural food store sample, a negative effect in the university campus sample, and no effect in the local park sample, which most closely resembled the general population.

Past studies have also examined the expected taste of organic products relative to conventional products without taste testing and found mixed results across product categories. For example, Loebnitz and Aschemann-Witzel (2016) found no difference in expected taste between selected organic and conventional produce items. Conversely, studies have found a positive expected taste for organic chicken breasts (Napolitano et al., 2013), organic beef (Napolitano et al., 2010a), and organic cheese (Napolitano et al., 2010b). Prada, Garrido, and Rodrigues (2017) examined whether the impact of the organic label on taste evaluation varied between whole (i.e., fruits and vegetables) and processed foods (i.e., sweets and meals), finding that, overall, respondents expected organic whole and processed foods to be tastier than conventional ones, but some organic processed foods were expected to taste the same as conventional.

Ellison et al. (2016) also examined the effect of the organic label on the expected taste of two distinct products representing a "virtue" and a "vice" product (strawberries and cookies, respectively) and their perceived impact on consumer health and pleasure during consumption (Cramer and Antonides, 2011). In their study, the organic label improved the expected taste for strawberries, but it did not impact the expected taste of cookies. Similarly, Nadricka, Millet, and Verlegh (2020) found that the organic label improved the perceived taste of healthy food but not unhealthy food. Also, Schuldt and Hannahan (2013) found that consumers tended to believe that organic products are healthier but less tasty than conventional foods, in line with the "unhealthy = tasty" intuition (Raghunathan, Naylor, and Hoyer, 2006). However, Werle, Trendel, and Ardito (2013) and Jo and Lusk (2018) presented some contrary evidence.

Several studies focus specifically on the impact of organic labels on consumer taste ratings for bakery and wheat-based products. Prada, Garrido, and Rodrigues (2017) found that the expected taste of organic-labeled muffins, cake mixes, and grain-based meals was better than that of the conventional counterparts. In a study by Kihlberg et al. (2005), participants sampled various breads, and organic-labeled products received higher liking scores overall, especially among individuals who regularly consumed organic products. Annett et al. (2008) found that liking scores for organic bread increased significantly after the organic label was revealed, contrasting with the blind tasting scenario. This suggests that organic labeling had a positive effect on ratings, with no discernable differences in liking scores for conventional bread. In contrast, Lee et al. (2013) found that organic cookies were perceived as less tasty than the same, unlabeled organic cookies. These findings suggest that consumers likely base their assessment of product taste on their expectations and beliefs, and these beliefs may play an even more important role on the overall taste perceptions/ratings than the actual taste itself. Overall, previous study findings highlight the pure effect of organic labeling on taste evaluations, showing variations among respondent groups with diverse lifestyles, beliefs, and shopping habits (Bernard and Liu, 2017).

Previous studies have also provided consumers information about organic production practices and labeling standards while investigating respondent expected liking (rating without tasting) and actual liking (rating after tasting) of various organic products, including chicken breasts (Napolitano et al., 2013), beef (Napolitano et al., 2010a), cheese (Napolitano et al., 2010b), yogurt (Laureati et al., 2013), and ham (Gross, Waldrop, and Roosen, 2021). These studies have shown that organic labeling, when paired with information about organic production, positively influenced both expected and actual liking scores for organic-labeled products. Further, Napolitano et al. (2010a,b) discovered significant correlations between the expected liking score and willingness to pay (WTP) for organic beef and cheese, respectively. Notably, no correlation was found between the liking score under blind tasting and WTP. This also suggests that consumers are more influenced by the product information than by the actual sensory properties. But it remains uncertain whether the factors driving their WTP were the organic label, the information provided about organic production, or a combination of both.

In this study, our objective is to examine the effect of *subjective* taste beliefs on consumer preferences and WTP for organic specialty bakery products and assess the impact of providing *objective* product taste information and information on organic labeling standards. Taste beliefs often stem from either past experience with the product or expectations formed in the absence of past experience, influencing consumer preferences and WTP. These taste beliefs are integrated into the estimated stated preference models, aligning with recent advancements in the literature related to stated food preferences (e.g., Lusk, Schroeder, and Tonsor, 2014; Malone and Lusk, 2017, 2018; Costanigro and Onozaka, 2020; Neuhofer and Lusk, 2021).[1]

To examine the potential to mitigate or dampen negative organic product taste beliefs, we provided product taste attributes to respondents using three taste descriptors: "poor taste," "fair taste," and "good taste." Additionally, we randomly provided half of respondents with information on organic labeling standards and the other half (i.e., the control group) with no information to improve their understanding or knowledge of organic production. Three specialty bakery/pastry products—including a loaf of bread, croissants, and large cookies—were used in the analysis. These products are typically consumed on special occasions or as treats and thus are hedonistic (i.e., consumed for pleasure) in nature. Also, taste is likely to be very important in consumption decisions and may supersede other factors, such as health, which often impact consumer preferences for organic goods (Schuldt and Hannahan, 2013; Nadricka, Millet, and Verlegh, 2020).

More importantly, while consumer demand for organic wheat products continues to increase, organic wheat production has fallen: Pricing is often not high enough to cover the increased cost of organic wheat production (Organic Trade Association, 2021; Curtis and Quarnstrom, 2019). This is partly due to industry sentiments that consumers will not pay more for higher-end organic baked goods such as specialty bakery/pastry products. This study provides evidence that there are consumers who will pay more for these organic products and that providing taste information does increase their WTP and dampens the effect of prior taste beliefs. Providing consumers with information on organic practices or labeling standards, however, has little or no impact, at least in the study described here. Study results can be used by industry agents (e.g., growers, millers, bakers) to enhance product descriptions, promotional materials and messages, and final product and input-pricing mechanisms.

## Data Overview

In this study, we use data collected through an online survey, administered via Qualtrics in Fall 2021. Respondents were recruited via a Qualtrics panel, and quotas for sample demographics were used to ensure the final sample was representative of the US population. A total of 721 fully completed responses were collected. The survey included questions about consumer taste beliefs and the consumption frequency of organic and conventional specialty bakery and pastry products, attitudes toward organic bakery products, knowledge of organic labeling standards, the importance of the organic label and taste when making purchasing decisions, and demographics. Additionally, choice experiments for three specialty bakery products—a loaf of bread, a croissant, and a large cookie—were conducted.

Due to the importance of taste in consumer studies of bakery products, we varied the taste attribute for product alternatives in the choice experiments to measure the impact of providing *actual* taste information on consumer choice. Also, as organic labeling often impacts consumer taste perceptions and expectations, we varied the presence of this label to examine its impact. Hence, the product alternatives in the choice experiments varied in organic and local labels (present or absent), taste information provided (poor, fair, good, or unknown taste), and price. Price levels were derived by applying a 50% discount and a 100% premium (see Alam and Alfnes, 2020) to average observed market prices in Utah during Summer 2021 for each product category. We used four price levels

[1] See the appendix for details on the literature on incorporating taste beliefs into stated preference models.

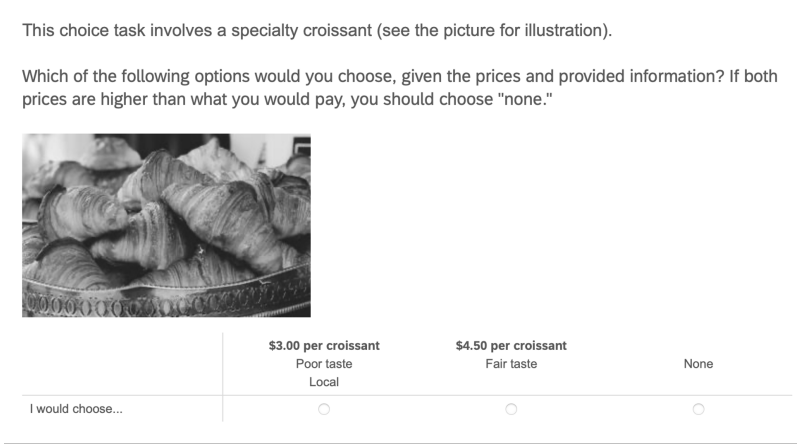


**Figure 1. Choice Task Example**

**Table 1. Sample Demographics**

| Characteristic | Pooled Sample | No Information Group (NI) | Information Group (I) | Difference (NI – I) |
|---|---|---|---|---|
| Age (2 = 18–24, 3 = 25–44, 4 = 45–64, 5 ≥ 64) | 3.646 | 3.608 | 3.685 | −0.078 |
| Woman (1 = woman, 0 = man) | 0.505 | 0.525 | 0.485 | 0.040 |
| Children under 18 in the household (1 = yes, 0 = no) | 0.337 | 0.351 | 0.323 | 0.028 |
| Education (1 = middle school, 2 = high school, 3 = some college, 4 = 2-year college, 5 = 4-year college, 6 = graduate school) | 3.713 | 3.688 | 3.738 | −0.050 |
| Employed (1 = yes, full- or part-time; 0 = no) | 0.653 | 0.660 | 0.646 | 0.014 |
| Income (1 ≤ $10,000, … 6 = $50,000–$59,999, … 12 ≥ $150,000) | 5.985 | 5.983 | 5.986 | −0.003 |
| Caucasian (1 = yes, 0 = no) | 0.777 | 0.812 | 0.741 | 0.071** |
| No. of respondents | 721 | 362 | 359 | – |

*Notes:* Double asterisks (**) denote significance of difference in means at the 5% level (*t*-test).

(see Van Loo et al., 2013) for a loaf of bread ($2.50, $5.00, $7.50, $10.00), a croissant ($1.50, $3.00, $4.50, $6.00), and a large cookie ($1.00, $2.00, $3.00, $4.00). We employed efficient design with Bayesian priors to build the choice experiments and identify product alternatives. The final design consisted of 12 choice tasks per product, which were divided into two blocks of six choice tasks; the blocks were randomly assigned to respondents. In each choice task, respondents were asked to choose from among two product alternatives and a no purchase option. In total, each respondent evaluated 18 choice tasks. Figure 1 provides an example of a choice task.

After respondents completed the choice experiments, they rated the taste of organic and conventional versions of each product on a scale from 1 (“very poor”) to 5 (“very good”). These taste ratings, reflecting individual taste beliefs or expectations, were incorporated into the utility function (Gross, Waldrop, and Roosen, 2021; Neuhofer and Lusk, 2021). Additionally, half the respondents received information regarding organic labeling standards and the other half did not. The respondents were randomly assigned to the Information and No Information groups. The Information group received the following text before completing the choice experiment:

> Organic food products must be produced without the use of genetically modified organisms (GMOs), ionizing radiation, sewage sludge, and most synthetic fertilizers and pesticides. Organic products may or may not be produced locally, but they must be certified by a USDA-accredited certifying agent.

By providing this information after evaluating respondents' knowledge of organic labeling standards and before the choice experiment, we were able to examine the influence that their improved understanding of organic labeling standards had on preferences. We evaluated respondents' knowledge of organic labeling standards by providing six statements related to organic production and asked respondents to indicate whether the statements were true or false. We created a score of organic knowledge, ranging from 0 to 6, based on how many of the true/false statements respondents correctly answered. This approach allowed us to examine whether respondent organic knowledge accounts for differences in taste ratings between organic and conventional bakery products.

Table 1 summarizes the sample demographics included in the analyses for both groups and the pooled sample. Respondents in the Information group are slightly older, less likely to be women, less likely to have children in the household, more educated, and less likely to be employed compared to the No Information group, but the differences are not statistically significant. The groups differ significantly only in the percentage share of Caucasians.

Table 2 reports respondent taste ratings for the organic and conventional specialty bakery products and the importance of taste when making a purchase decision. First, respondents in both groups rated the taste of organic specialty bakery products significantly lower than the taste of conventional specialty bakery products. This is in line with Lee et al. (2013) but in contrast to other studies (Kihlberg et al., 2005; Annett et al., 2008; Prada, Garrido, and Rodrigues, 2017). Given that the products examined in this study are specialty bakery/pastry products, primarily consumed for hedonistic rather than utilitarian purposes, the importance of taste is likely higher than that observed in past studies. This distinction may explain the lower taste ratings observed for organic versions of the examined products.

Taste ratings for organic specialty bakery products were similar, on average, across groups, but the No Information group rated the taste of conventional products higher than the Information group did. This indicates that the Information group might have lowered their ratings for conventional bakery products after receiving information about the organic labeling standards. Alternatively, it may indicate that this group tends to be more discerning than the No Information group when evaluating the taste of bakery products in general. It is worth noting that over 70% of the respondents considered taste to be an important characteristic when deciding to purchase each examined product, and there were no statistical differences between the two groups. Overall, taste is very important, but it appears to be the most important for cookies and least important for bread.

Table 3 summarizes respondents' organic and conventional specialty bakery product consumption frequency, the importance of organic in purchasing decisions, and the average number of correctly identified true/false statements (i.e., organic score). On average, respondents in both groups consume organic versions of each product approximately once a month or less. In contrast, conventional versions of these products, except for croissants, were typically consumed several times a month. We found no differences in consumption frequency between the two groups for any of the organic bakery products or conventional bread. However, respondents in the Information group consume conventional croissants and cookies less frequently, which might also be why they had their lower taste ratings for conventional products.

When making a purchasing decision, organic are most important for bread and least important for cookies, and there are no differences between the two groups. On average, respondents in each group answered three true/false statements correctly, with no significant differences between the groups. We assume the organic knowledge of the Information group increased after receiving the organic labeling standards information.

**Table 2. Taste Ratings and Taste Importance**

| Product | Pooled Sample | No Information Group (NI) | Information Group (I) | Difference (NI – I) |
|---|---|---|---|---|
| Bread loaf | | | | |
| Organic (O) | 3.595 | 3.638 | 3.552 | 0.087 |
| Conventional (C) | 3.914 | 3.986 | 3.841 | 0.145** |
| Difference (O–C) | −0.319*** | −0.348*** | −0.290*** | −0.058 |
| Taste importance | 0.705 | 0.707 | 0.702 | 0.005 |
| Croissant | | | | |
| Organic (O) | 3.613 | 3.663 | 3.563 | 0.100 |
| Conventional (C) | 4.026 | 4.124 | 3.928 | 0.197*** |
| Difference (O – C) | −0.413*** | −0.461*** | −0.365*** | −0.096 |
| Taste importance | 0.732 | 0.727 | 0.738 | −0.012 |
| Large cookie | | | | |
| Organic (O) | 3.571 | 3.610 | 3.532 | 0.078 |
| Conventional (C) | 4.117 | 4.204 | 4.028 | 0.177*** |
| Difference (O – C) | −0.545*** | −0.594*** | −0.496*** | −0.098 |
| Taste importance | 0.777 | 0.773 | 0.780 | −0.006 |

*Notes:* Double and triple asterisks (**, ***) denote significance at the 5% and 1% level, respectively. Taste rating for of each product is on a scale from 1 to 5, where 1 = "very poor" and 5 = "very good." Taste importance indicates the importance of taste when making a purchasing decision about the product (1 = important, 0 = not important).

**Table 3. Consumption Frequency, Organic Label Importance, and Organic Score**

| Characteristic | Pooled Sample | No Information Group (NI) | Information Group (I) | Difference (NI – I) |
|---|---|---|---|---|
| Organic bakery product consumption frequency[a] | | | | |
| Bread loaf | 1.232 | 1.287 | 1.175 | 0.112 |
| Croissant | 1.029 | 1.058 | 1.000 | 0.058 |
| Large cookie | 1.150 | 1.160 | 1.139 | 0.021 |
| Conventional bakery product consumption frequency[a] | | | | |
| Bread loaf | 2.184 | 2.188 | 2.181 | 0.007 |
| Croissant | 1.466 | 1.566 | 1.365 | 0.201** |
| Large cookie | 2.058 | 2.157 | 1.958 | 0.199** |
| Importance of organic when making a purchasing decision (1 = important, 0 = not important) | | | | |
| Bread loaf | 0.376 | 0.395 | 0.357 | 0.038 |
| Croissant | 0.276 | 0.285 | 0.267 | 0.017 |
| Large cookie | 0.214 | 0.224 | 0.203 | 0.020 |
| Organic score (0 = min.; 6 = max.) | 2.899 | 2.925 | 2.872 | 0.054 |

*Notes:* Double asterisks (**) denote significance of difference in means at the 5% level (*t*-test).
[a] 0 = never; 1 = once a month or less; 2 = several times a month; 3 = once a week; 4 = several times a week.

**Table 4. Attitudes Toward Organic Bakery Products**

| Product | Pooled Sample | No Information Group (NI) | Information Group (I) | Difference (NI – I) |
|---|---|---|---|---|
| I am interested in organic bakery products | 3.472 | 3.536 | 3.407 | 0.129 |
| I am concerned about the taste of organic bakery products | 3.257 | 3.240 | 3.273 | −0.033 |
| Organic bakery products are healthier than conventional ones | 3.671 | 3.624 | 3.719 | −0.094 |
| Organic bakery products are safer than conventional ones | 3.422 | 3.401 | 3.443 | −0.042 |
| The selection of organic bakery products is not good | 2.988 | 3.000 | 2.975 | 0.025 |
| Organic bakery products are too expensive | 3.788 | 3.804 | 3.772 | 0.032 |
| Organic bakery products are not important to me | 2.985 | 2.956 | 3.014 | −0.058 |
| Variety/flavor is more important to me than the organic label | 3.680 | 3.674 | 3.685 | −0.011 |

*Notes:* Likert-type scale ratings from 1 (“strongly disagree”) to 5 (“strongly agree”).

**Table 5. Results of the Exploratory Factor Analysis**

| Statement | Factor 1 | Factor 2 | Uniqueness |
|---|---|---|---|
| I am interested in organic bakery products | 0.61 | | 0.44 |
| Organic bakery products are healthier than conventional ones | 0.84 | | 0.32 |
| Organic bakery products are safer than conventional ones | 0.78 | | 0.41 |
| The selection of organic bakery products is not good | | 0.51 | 0.78 |
| Organic bakery products are too expensive | | 0.59 | 0.69 |
| Organic bakery products are not important to me | | 0.64 | 0.41 |
| Variety/flavor is more important to me than the organic label | | 0.54 | 0.73 |
| Variance explained | 0.26 | 0.20 | - |

*Notes:* Tucker Lewis Index = 0.908, root mean squared error of approximation = 0.09, root mean square of the residuals = 0.03.

We also asked respondents about their attitudes toward organic bakery products. Table 4 reports the statements that respondents were asked to evaluate on a scale from 1 (“strongly disagree”) to 5 (“strongly agree”). Overall, respondents agreed that organic bakery products were too expensive and that the variety or flavor outweighed the importance of organics. Despite this, respondents still regarded organic bakery products as healthier than conventional products. On the other hand, respondents were less likely to agree that the selection of organic bakery products was not good and that organic bakery products were not important to them. There were no significant differences in the average ratings for each statement between the two groups.

Finally, we conducted an exploratory factor analysis using the organic bakery product attitude statements in Table 4, to condense the statements and identify latent factors that explain any variance in the original statements. These factors are included in the analysis to explain the differences in taste ratings between the organic and conventional bakery products, described later. After dropping the statement related to concerns about the taste of organic bakery products, while following guidelines for exploratory factor analysis in Yong and Pearce (2013), we obtained the satisfactory two-factor solution shown in Table 5. The first factor represents positive attitudes toward organic bakery products, while the second factor represents negative attitudes. We allowed for correlation between

the factors, which was estimated at −0.38 (relatively weak). After the exploratory factor analysis, we applied the Bartlett method to collect factor scores, which were needed for the analysis in the next step (DiStefano, Zhu, and Mîndrilã, 2009).

## Methods

### *Defining Utility*

The main goal of this study is to examine how consumers' (subjective) taste beliefs affect their preferences and WTP for organic specialty bakery products and whether providing objective taste information and improving their understanding organic labeling standards changes their preferences and WTP. The utility of respondent $n$ associated with alternative $i$ in choice scenario $t$ is specified as

$$
\begin{aligned}
U_{nit} = {} & ASC_{n,NoBuy} + \beta_{price}\, Price_{nit} + \beta_{n,organic} Organic_{nit} + \beta_{n,local}\, Local_{nit} \\
& + \beta_{n,poor} TastePoor_{nit} + \beta_{n,fair} TasteFair^{nit} \\
& + \beta_{n,good} TasteGood_{nit} + \beta_{n,belief} TasteBelief_{ni} + \varepsilon_{nit}, \qquad (1)
\end{aligned}
$$

where $ASC_{n,NoBuy}$ is an alternative-specific constant that captures respondent n's utility from the no purchase alternative; $Price_{nit}$ is price of the product alternative; $Organic_{nit}$ and $Local_{nit}$ are dummy variables equal to 1 when the organic and local attributes are present, and 0 otherwise; $TastePoor_{nit}$, $TasteFair_{nit}$, and $TasteGood_{nit}$ are dummy variables that communicate taste information; and $\varepsilon_{nit}$ is unobserved utility, assumed to be *i.i.d.* type I extreme value. Similar to Malone and Lusk (2017), Gross, Waldrop, and Roosen (2021), and Neuhofer and Lusk (2021), we also include $TasteBelief_{ni}$, which ranges from 1 ("very poor") to 5 ("very good") and represents respondent $n$'s perceived taste ratings for conventional and organic bakery products, dependent on the presence or absence of the organic attribute. The goal is to evaluate the impact of taste beliefs associated with conventional and organic specialty bakery products on overall utility. The baseline product is a conventional bakery product without the organic or local attributes, without taste information (i.e., taste is unknown), and a taste belief of 0.

Coefficients $\beta$ measure marginal effects of the attributes and taste beliefs on overall utility. The coefficient $\beta_{n,belief}$ measures the marginal utility associated with a 1-unit improvement in expected taste associated with organic or conventional bakery products, and coefficient $\beta_{n,organic}$ represents the utility from the organic product relative to the conventional product that is not explained by expected taste. By including taste beliefs in the utility function, we separate the effect of taste expectations associated with organic on total utility from respondent preferences for the organic label (Costanigro and Onozaka, 2020; Neuhofer and Lusk, 2021). We allow for potential heterogeneity in consumer preferences and taste beliefs and assume that all coefficients except price vary across respondents, denoted by subscript $n$. To incorporate heterogeneous preferences and beliefs in the model, we estimate random parameter logit (RPL) models. We also assume that the random coefficients $\beta_n$ follow a normal distribution, $f(\beta_n|\Theta)$, where $\Theta$ represents parameters of the normal distribution (i.e., mean and standard deviation), which need to be estimated. During the estimation process, maximum likelihood was simulated with 2,000 Halton draws.

### *Willingness to Pay*

We used estimated RPL model coefficients and a variance–covariance matrix to simulate 10,000 observations for each parameter using the Krinsky–Robb (1986) procedure. The simulated observations were then used to calculate mean WTP values and determine confidence intervals. We calculated mean WTP for the organic (when not considering taste beliefs), local, and each taste

level as the ratio of the coefficient estimate for attributes or taste level and negative of the price coefficient estimate. Further, we calculated WTP for the organic label evaluated at the average taste rating for the organic bakery product as

$$WTP_{organic\ and\ organic\ taste\ belief} = \frac{\beta_{organic} + \beta_{belief} \times Avg\left(TasteBelief_{organic}\right)}{-\beta_{price}} \tag{2}$$

and the portion of the WTP for organic, associated with the taste rating, as

$$WTP_{organic\ taste\ belief} = \frac{\beta_{belief} \times Avg\left(TasteBelief_{organic}\right)}{-\beta_{price}}. \tag{3}$$

Similarly, respondent WTP for the conventional bakery product (i.e., the baseline product in the utility function) that is attributed to taste belief associated with the conventional product was calculated as

$$WTP_{conventional\ taste\ belief} = \frac{\beta_{belief} \times Avg\left(TasteBelief_{conventional}\right)}{-\beta_{price}}. \tag{4}$$

Finally, the difference in WTP between the organic and conventional bakery products, while accounting for differences in taste ratings, was calculated as

$$WTP_{organic\ -\ conventional} = WTP_{organic\ and\ organic\ taste\ belief} - WTP_{conventional\ taste\ belief}. \tag{5}$$

## Results

### *Tobit Regression Models*

We estimated Tobit regression models, also referred to as censored regression models, separately for each product—loaf of bread, croissant, and large cookie—to examine which factors explain the significant differences in respondent product taste ratings (see McDonald and Moffitt, 1980, for a full description of the Tobit model). The dependent variable was defined as the difference in respondent taste ratings between the organic and conventional product options. Since taste ratings ranged from 1 to 5, the differences in ratings ranged from −4 to 4. The Tobit model is appropriate for this analysis because the lower and upper bounds of the taste ratings and thus the differences in taste ratings are limited by the options provided to respondents. But the actual, unobserved difference in ratings may be lower than −4 or greater than 4. The dependent variable is censored by design on both the lowest and highest value.

The results in Table 6 show that neither the respondents' level of organic knowledge (organic score) nor the provision of information on organic labeling standards explains differences in respondent taste ratings between the organic and conventional specialty bakery products. This suggests that actual knowledge of organic labeling standards has little impact on consumer organic product taste perceptions. Consequently, informing consumers about organic production is unlikely to reduce any taste bias, either positive or negative, associated with the organic product.

However, greater organic product consumption frequency is associated with higher organic taste ratings in comparison the conventional product. In essence, consumers who have previous experience with organic products tend to rate their taste more favorably. Accordingly, it appears that consumers' beliefs or expectations regarding the taste of organic bakery products are positively related to their previous consumption experience. This aligns with the findings of Van Loo et al. (2013) and Asioli et al. (2018). Moreover, higher consumption frequency of conventional products is associated with lower taste ratings for organic products. Overall, consumer preferences for either conventional or organic bakery products are influenced by their consumption frequency.

**Table 6. Tobit Regression Results ($N$ = 721)**

| | Bread Loaf | | Croissant | | Large Cookie | |
|---|---|---|---|---|---|---|
| Organic score | 0.029 | (0.027) | 0.001 | (0.028) | −0.018 | (0.029) |
| Organic information | 0.089 | (0.075) | 0.068 | (0.079) | 0.072 | (0.082) |
| Organic consumption[a] | 0.312*** | (0.039) | 0.384*** | (0.043) | 0.359*** | (0.046) |
| Conventional consumption[a] | −0.159*** | (0.032) | −0.239*** | (0.039) | −0.219*** | (0.037) |
| Taste importance[a] | 0.136 | (0.084) | 0.045 | (0.089) | −0.188* | (0.100) |
| Organic importance[a] | −0.078 | (0.084) | 0.169* | (0.094) | 0.236** | (0.104) |
| Age | −0.084* | (0.047) | −0.082 | (0.050) | −0.067 | (0.052) |
| Women | −0.188** | (0.081) | −0.120 | (0.084) | −0.155* | (0.087) |
| Children present | −0.076 | (0.085) | −0.182** | (0.089) | −0.161* | (0.092) |
| Education | 0.000 | (0.031) | 0.005 | (0.033) | 0.007 | (0.034) |
| Employed | −0.003 | (0.084) | −0.087 | (0.088) | −0.146 | (0.092) |
| Income | 0.004 | (0.014) | 0.010 | (0.015) | 0.015 | (0.015) |
| Caucasian | −0.079 | (0.096) | −0.143 | (0.100) | 0.031 | (0.104) |
| Factor 1[b] | 0.141*** | (0.038) | 0.148*** | (0.040) | 0.128*** | (0.042) |
| Factor 2[c] | −0.163*** | (0.034) | −0.211*** | (0.035) | −0.246*** | (0.037) |
| Constant | −0.082 | (0.236) | −0.067 | (0.249) | −0.064 | (0.270) |
| | | | | | | |
| Log-Likelihood | −1,024.82 | | −1,054.55 | | −1,079.24 | |
| LR chi2(15) | 229.39 | | 267.52 | | 263.38 | |

*Notes:* Single, double, and triple asterisks (*, **, ***) denote significance at the 10%, 5%, and 1% level, respectively. Standard errors are in parentheses.

[a] Organic consumption frequency, conventional consumption frequency, taste importance, and organic importance are related to bread in "Bread loaf" regression, croissant in "Croissant" regression, and cookies in "Large cookie" regression.

[b] Factor represents positive attitudes toward organic bakery products.

[c] Factor represents negative attitudes toward organic bakery products.

Further, the results show that positive attitudes toward organic bakery products (factor 1) are also associated with higher organic product taste ratings relative to conventional products, while negative attitudes (factor 2) are associated with lower taste ratings, regardless of product category. Among all three products, the importance of taste negatively impacts taste ratings for organic relative to conventional cookies. Considering that cookies may be the most hedonistic of the three products examined, taste may be more important in this case. Additionally, the importance of organic foods positively affects taste ratings for organic relative to conventional croissants and cookies. In other words, if organics are important to consumers, they tend to view taste more favorably, which indicates an organic halo effect in which one's positive experiences with one organic product leads them to positively view other organic products.

When examining the demographic variable results, we find women tended to rate the taste of organic products lower for bread and cookies. Also, households with children rated the taste of organic relative to conventional lower for croissants and cookies, while advanced age correlated with lower taste ratings for organic bread.

*Random Parameter Logit (RPL) Models*

Table 7 shows results of the estimated RPL models. First, price coefficients are negative and significant. Compared to a product with no taste information, poor taste has a negative and significant effect on utility, while, on average, fair taste and good taste have a positive and significant effect. These results are as expected and are consistent across product categories and groups. Similarly, the organic attribute is valued positively for each group and product. When taste ratings for organic and conventional products are the same, the coefficient for the organic represents the difference in utility

**Table 7. Random Parameter Logit (RPL) Model Results**

| | Bread Loaf | | Croissant | | Large Cookie | |
|---|---|---|---|---|---|---|
| | **No Information** | **Information** | **No Information** | **Information** | **No Information** | **Information** |
| Price | −0.414*** | −0.503*** | −0.915*** | −0.903*** | −1.048*** | −1.076*** |
| Poor taste | −3.277*** | −4.256*** | −5.367*** | −4.323*** | −3.437*** | −3.827*** |
| | (1.740***) | (2.599***) | (3.746***) | (2.670***) | (1.413***) | (1.896***) |
| Fair taste | 0.691*** | 0.733*** | 0.700*** | 0.416*** | 0.617*** | 0.563*** |
| | −0.412 | (0.877***) | (0.623*) | −0.346 | (1.171***) | (1.005***) |
| Good taste | 2.434*** | 2.910*** | 3.319*** | 2.977*** | 3.432*** | 3.725*** |
| | (1.395***) | (1.724***) | (2.282***) | (2.106***) | (1.858***) | (2.566***) |
| Organic | 0.263** | 0.452*** | 0.901*** | 0.593*** | 0.377*** | 0.285* |
| | (0.970***) | (0.963***) | (1.499***) | (1.482***) | (1.114***) | (1.248***) |
| Local | 0.251*** | 0.383*** | 0.341*** | 0.282*** | 0.268*** | 0.139 |
| | −0.055 | (0.518**) | −0.034 | −0.139 | (0.516***) | (0.544**) |
| None | −0.592 | −1.124** | −0.427 | −1.897*** | −0.048 | −0.443 |
| | (2.468***) | (2.967***) | (2.668***) | (3.085***) | (2.750***) | (2.941***) |
| Taste belief | 0.379*** | 0.293** | 0.506*** | 0.186* | 0.630*** | 0.495*** |
| | −0.125 | −0.06 | −0.064 | −0.057 | −0.186 | −0.032 |
| Log-likelihood | −1, 715.95 | −1, 607.78 | −1, 528.97 | −1, 561.11 | −1, 696.68 | −1, 648.30 |
| Akaike information criterion | 3, 461.91 | 3, 245.57 | 3, 087.94 | 3, 152.21 | 3, 423.37 | 3, 326.60 |
| Bayesian information criterion | 3, 563.64 | 3, 347.17 | 3, 189.67 | 3, 253.82 | 3, 525.10 | 3, 428.21 |
| No. of obs. | 6, 516 | 6, 462 | 6, 515 | 6, 462 | 6, 516 | 6, 462 |

*Notes:* Single, double, and triple asterisks (*, **, ***) denote significance at the 10%, 5%, and 1% level, respectively. Standard deviations for normally distributed coefficients in parentheses (except for price).

between the organic and conventional (baseline) product. If the taste rating is different, the utility from the organic product relative to the conventional product is adjusted by the utility associated with the difference in the taste rating.

The local attribute also has a positive and significant effect on consumer utility in all categories except cookies in the Information group. Finally, the coefficient estimates for taste belief indicate that consumers' taste beliefs associated with organic and conventional versions of each examined bakery product indeed have a large and significant impact on utility, as hypothesized. The taste belief coefficients represent the marginal utility associated with a 1-unit improvement in consumer taste belief. Also, it appears that taste beliefs have a greater effect on utility for the No Information group than for the Information group. This indicates that the information on organic labeling standards may have reduced but not eliminated the importance of respondents' subjective taste beliefs on their overall preferences.

All coefficients (except price) were modeled as random under the assumption that the preferences related to the labels and taste levels, as well as taste beliefs, are not fixed but may vary among consumers. Varying preferences, evident through statistically significant standard deviations, are observed for the variables for poor taste, good taste, organics, and the "no product" or none choice. Conversely, differences in taste beliefs among respondents are relatively small and statistically insignificant for each product and group. This implies that the impact of taste beliefs on utility is similar across respondents, with minimal variability. A relatively low variability in taste preferences is also observed for fair taste and the local label, depending on the product category and group.

### *Willingness to Pay*

Table 8 reports calculated mean WTP values based on 10,000 simulated observations using the Krinsky–Robb (1986) procedure and estimated RPL model parameters. Initially, we find that WTP for the organic attributes has a positive and significant impact for every product and group. This holds true whether we disregard the contrast in taste ratings between organic and conventional bakery products or assume no difference in taste ratings. Specifically, the average WTP for organic product, considering the base utility, ranges between \$0.26 for cookies in the Information group to \$0.98 for croissants in the No Information group. Total WTP for the organic product, when evaluated at average taste beliefs associated with the organic product, ranges from \$1.39 for croissants for the Information group to \$3.96 for bread in the No Information group.

The results show that taste beliefs contribute significantly to the total WTP for the organic products. Respondent WTP for the organics explained by taste beliefs ranges from \$0.73 for croissants (Information group) to \$3.33 for bread (No Information group). Similarly, WTP associated with mean taste beliefs for the conventional version of each product ranges from \$0.81 for croissants (Information group) to \$3.65 for bread (No Information group). The conventional product is the baseline product in all models, with its utility normalized to 0 (when the taste rating equals 0) and thus the WTP for conventional products associated with average taste beliefs also represents total WTP associated with the conventional product.

In summary, the results in Table 8 illustrate the importance of taste beliefs when evaluating consumer WTP for organic and conventional products. As average taste ratings for conventional products are higher than those for organic products, the difference in total WTP between the organic and conventional product diminishes. When taste ratings are factored in, this difference becomes smaller than the WTP associated with the base utility from the organic label, particularly when taste beliefs and their differences are not considered. In fact, we find that when average taste ratings are considered, the differences in total WTP between the organic and conventional (baseline) versions of each examined product are positive but not statistically significant, as determined by the combinatorial test proposed by Poe, Giraud, and Loomis (2005).

**Table 8. Willingness to Pay (WTP) Values**

| | Bread Loaf | | Croissant | | Large Cookie | |
|---|---|---|---|---|---|---|
| | **No Information** | **Information** | **No Information** | **Information** | **No Information** | **Information** |
| Organic, base utility | 0.63** | 0.89*** | 0.98*** | 0.66*** | 0.36*** | 0.26* |
| Organic, taste belief | 3.33*** | 2.07*** | 2.03***,b | 0.73*, *b* | 2.17*** | 1.63*** |
| Organic, total | 3.96*** | 2.97*** | 3.01***,b | 1.39***,b | 2.53*** | 1.89*** |
| Conventional, base utility | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Conventional, taste belief | 3.65*** | 2.24*** | 2.29***,b | 0.81*, *b* | 2.53*** | 1.86*** |
| Organic, conventional | 0.31 | 0.72 | 0.73 | 0.58 | 0.00 | 0.03 |
| Local | 0.61*** | 0.77*** | 0.38*** | 0.32*** | 0.26*** | 0.13 |
| Poor taste | −7.91*** | −8.46*** | −5.87***,a | −4.79***,a | −3.28*** | −3.56*** |
| Fair taste | 1.68*** | 1.47*** | 0.77*** | 0.47*** | 0.59*** | 0.53*** |
| Good taste | 5.89*** | 5.79*** | 3.64*** | 3.30*** | 3.28*** | 3.47*** |

*Notes:* Single, double, and triple asterisks (*, **, ***) denote significance at the 10%, 5%, and 1% level, respectively, based on simulated 10,000 values (Krinsky and Robb, 1986). WTP associated with taste beliefs for organic and conventional products evaluated at the group mean taste beliefs. Superscripts a,b denote significant differences in estimated WTP between the No Information and the Information groups for a given bakery product at 10% and 5%, respectively, based on the combinatorial test (Poe, Giraud, and Loomis, 2005).

When assessing WTP values for the local product, we find positive and significant values for all products and groups, except cookies in the Information group. As expected, consumers require a large discount when taste is poor and would prefer a product with unknown taste, but they are willing to pay more to obtain a product with fair or good taste than one with unknown taste. Also, we use the combinatorial test (Poe, Giraud, and Loomis, 2005) to examine differences in WTP values between groups. When taste ratings are not considered, both groups value the organic label on each product similarly. Adjusting for the average taste rating, the WTP associated with the taste ratings and the overall WTP for the organic product is lower in the Information group compared to the No Information group for all products. However, this difference is significant only for croissants. In addition, taste beliefs related to conventional croissants lead to significantly reduced WTP for the Information group, which also discounted poor taste less than the No Information group.

In conclusion, our findings show that while subjective taste beliefs significantly contribute to WTP, disclosed positive taste information contributes more, while poor taste often results in overall negative WTP. This suggests that while subjective taste beliefs significantly influence WTP values, actual taste information can reduce their impact. Actual taste information becomes pivotal in adjusting overall respondent WTP, especially when the actual product taste is good, but taste beliefs are less favorable, or vice versa.

## Conclusions and Implications

Recent studies evaluating consumer preferences for food attributes now acknowledge the importance of beliefs in consumer food choice and incorporate them in stated preference models to better understand what drives or inhibits food choice. For example, consumers might be interested in healthy foods, but they may not prefer organic food over conventional if they do not believe that organic food is healthier. Omitting these beliefs from the analysis may lead to incorrect conclusions. In this study, we examined the impact of subjective taste beliefs or expectations, and objective taste indicators associated with organic and conventional specialty bakery products on consumer choice and WTP for these products. We compared taste ratings related to organic and conventional versions of selected specialty bakery products (e.g., bread, croissants, and large cookies), products typically enjoyed for their indulgent qualities. Our study aimed to understand the factors contributing to the variations in respondent taste ratings between organic and conventional products. Additionally, we also examined whether taste beliefs and their impact on WTP differ among consumers who received information about organic labeling standards and those who did not. Overall, this study investigated whether providing actual taste information or improving organic label knowledge potentially mitigates the impact of taste beliefs and biases associated with organic specialty bakery products.

Primarily, we found that the examined organic specialty bakery/pastry products were perceived as less tasty than their conventional counterparts. This contrasts with past studies, which often found that consumers expect organic foods, including bakery products, to be tastier than conventional foods. Our observation that the taste of organic foods is viewed as inferior to conventional, especially in the context of specialty bakery products, suggests that the "healthy = less tasty" bias is applicable to more hedonistic food items, such as those items examined in our study. We focused on specialty bakery/pastry products, known for being more expensive and consumed on special occasions as indulgent treats. Consequently, the significance of great taste is likely more important than it is for mass-produced bakery products, making consumers more critical. Also, we found that the significance of taste partly explains the negative view respondents have of the taste of organic-labeled cookies—the most hedonistic product in the study.

Further, we found that higher consumption of organic specialty bakery products frequency improved respondents' taste ratings for these products relative to conventional, while higher consumption frequency of conventional specialty bakery products has the opposite effect. Thus, it appears that as consumers consume more organic products, they rated their taste more favorably,

suggesting that past consumption experience played a role in mitigating negative taste bias. However, consumers might have also chosen to consume these products based on a preexisting belief that they were inherently tastier than conventional products. We also found that positive attitudes toward organic bakery products increased taste ratings for organics relative to conventional, while the opposite was true for negative attitudes. Positive attitudes toward organic bakery products are likely to generate positive taste expectations, aligning with the organic halo effect.

Study findings indicate that taste beliefs play a substantial role in determining the utility associated with consuming specialty bakery products and influence consumer WTP for these products. Consumers are willing to pay extra for the organics when there is no expected taste difference between the organic and conventional versions. However, this positive WTP for organic may diminish if consumers believe that conventional products taste better. Overall, our study confirmed the significance of taste beliefs in shaping consumer choice for organic specialty bakery products, particularly when the actual taste is unknown. If respondents are given actual favorable taste information (i.e., at least fair, or better), their preferences and WTP for the organic products increases.

While providing organic labeling information may not have eliminated the negative taste bias associated with organic specialty bakery products—as we found no significant differences in taste ratings between the Information and No Information groups groups—in fact, the average organic taste ratings were slightly lower for the Information group. Additionally, we found that the provided information, along with respondents' actual organic scores, did not explain differences in taste ratings between organic and conventional products. This suggests that educating consumers about organic labeling standards is not effective at mitigating potential taste biases. It appears that consumer taste beliefs are more influenced by what they imagine or want to believe organic means rather than their knowledge or information available.

As previously mentioned, despite strong consumer demand, organic wheat market pricing is often too low to compensate growers for the higher production costs. In our work with industry agents, we have noted strong industry sentiment that consumers will not pay more for higher-end organic baked goods (e.g., pastries, cookies, croissants), especially among bakeries and retail providers. While this may be true for common bakery items, consumers tend to be less price sensitive when it comes to hedonistic goods. The higher pricing for these goods could lead to enhanced pricing for organic wheat inputs. Hence, the study results discussed here can be used by industry agents (e.g., growers, millers, bakers) to enhance product descriptions, promotional materials and messages, and final product and input-pricing mechanisms. These could be through both managerial decisions and broader food supply chain modifications. For example, it is often assumed that providing consumers with more information about organic production or labeling standards will increase their preference for or reduce their price sensitivity to organic products, but this type of intervention is costly and will not be effective, given study results. Taste assurances and taste-related information would be much more effective, as shown here, as taste is of utmost importance for these products.

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## Appendix: Literature Incorporating Beliefs in Stated Preference Models

Considering the acknowledged significance of consumer beliefs in influencing preferences for various aspects of food products, not limited to taste, recent studies on consumer food choice now integrate these beliefs into stated preference models, finding that these beliefs play a role in explaining a significant portion of utility, and thus influence WTP considerable. Table A1 provides an overview of select studies.

**Table A1. Literature Incorporating Consumer Taste Beliefs**

| Study | Product | Beliefs Considered |
|---|---|---|
| Malone and Lusk (2017) | Meat | Taste<br>Healthiness<br>Safety |
| Malone and Lusk (2018) | Beer | Taste<br>Brand familiarity |
| Neuhofer and Lusk (2021) | Chicken | Taste<br>Health<br>Safety |
| Gross, Waldrop, and Roosen (2021) | Ham | Taste |
| Costanigro, Deselnicu, and Kroll (2015) | Milk | Taste<br>Other product attributes |
| Costanigro and Onozaka (2020) | Chicken<br>Salmon | Taste<br>Other product attributes |