Consumer Demand for Redundant Food Labels

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Abstract: Previous studies, as well as market sales data, show some consumers are willing to pay a premium for redundant or superfluous food labels that carry no additional information for the informed consumer. Some advocacy groups have argued that the use of such redundant labels is misleading or unethical. To determine whether premiums for redundant labels stem from misunderstanding or other factors, this study seeks to determine whether greater knowledge of the claims - in the form of expertise in food production and scientific literacy - decreases willingness to pay for redundant labels. We also explore whether de-biasing information influences consumers' valuations of redundant labels. An online survey of 1,122 U.S. consumers elicited preferences for three redundantly labeled products: non-GMO sea salt, gluten-free orange juice, and no-hormone-added chicken breast. Respondents with farm experience report lower premiums for non-GMO salt and no-hormone-added chicken. Those with higher scientific literacy state lower premiums for gluten-free orange juice. However, after providing information about the redundancy of the claims, less than half of respondents who were initially willing to pay extra for the label are convinced otherwise. Over 30% of respondents counter-intuitively increase their premiums, behavior that is associated with less *a priori* scientific knowledge. The likelihood of "overpricing" redundant labels is associated with willingness-to-pay premiums for organic food, suggesting at least some of the premium for organic is a result of misinformation.

Keywords: de-bias, gluten-free, GMO, hormone, labelling, organic, scientific literacy

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The gap between the average American consumer and the farmer who produces her food has grown. According to the Bureau of Labor Statistics, less than 2 percent of the United States population works in production agriculture, a 50 percent decline since 1980 (Daly 1981; U.S. BLS 2017). As Americans become more removed from the farm, urban and suburban individuals tend to be less knowledgeable about agriculture (Dale, Robinson, and Edwards 2017; Frick et al. 1995; Harmon and Maretzki 2006). However, growing consumer interest in food production methods and their impact on animal welfare, health and food safety, environmental sustainability, and social equity is evident in the proliferation of consumer products touting these qualities. For example, the number of new products bearing genetically modified organism (GMO)-free and organic labels nearly tripled between 2009 and 2016 (USDA ERS 2019b).

However, some advocacy groups have criticized some of these labels, arguing they are misleading to consumers. For example, in 2018, the Information Technology and Innovation Foundation, a non-profit policy think tank, filed a petition with the FDA to prohibit "non-GMO" labeling products for which no GMO is available for sale because they argued such a label is "false and misleading" (Court 2018). The FDA issued new non-binding guidelines in March 2019, emphasizing that food labeling related to bioengineering should be "truthful and not misleading" (U.S. Food and Drug Administration 2019). Such concerns extend beyond the representation of bioengineered foods as less safe or healthful than comparable products. The document states that food may be misbranded in context, if not in letter, listing the following example:

> A statement in food labeling that may be false or misleading could be the statement "None of the ingredients in this food is genetically engineered" on a food where some of the ingredients are incapable of being produced through genetic engineering (e.g., salt). (U.S. Food and Drug Administration 2019)

In fact, a salt manufacturer made headlines in 2015 by placing exactly such a label upon its packages (Brat 2015). Salt, of course, is a mineral with no genetic content. A brand of tomato-based products faced similar criticism in 2016 after a commercial advertised its tomatoes as non-GMO when there were no genetically modified tomatoes on the market at that time (Senapathy 2016).

The USDA has also addressed food packaging claims that, while true in fact, may cause consumer misunderstanding. Though the Food Safety and Inspection Service (FSIS) prohibits the use of added hormones in swine and poultry production, it allows products derived from these animals to carry a "no hormones added" claim. However, a disclaimer clarifying that "Federal regulations prohibit the use of hormones" must also be printed on an item with such a label (USDA Food Safety and Inspection Service 2015). Despite this, many consumers incorrectly believe pork and poultry products to contain added hormones (Yang, Raper, and Lusk, 2020).

Prior studies have found that some consumers are indeed willing to pay more for labels that provide redundant information (Bernard, Duke, and Albrecht 2019; Heng, Peterson, and Li 2016). If such spending is truly caused by confusion or lack of knowledge, consumers may be over-paying and suffer from a cost of ignorance which might be avoided with better information (Foster and Just 1989).

Existing studies on redundant information labels tend to focus on a single product or issue, such as the natural label. Prior works have found the effectiveness of better information to lower spending on such marketing claims to be varied. This study contributes to the literature by investigating three distinct products with labels referencing attributes spanning nutrition, biotechnology, and meat production practices. To determine whether premiums for redundant labels stem from misunderstanding or other factors, we determine the extent to which premiums for such labels are affected by (i) expertise – i.e., farm experience, (ii) knowledge – i.e., score on a scientific literacy quiz, and (iii) de-biasing information. To the extent willingness-to-pay for redundant labels falls with any of these three factors, this provides evidence of such labels being misleading. We conduct a nationwide online survey of 1,122 U.S. consumers, eliciting willingness to pay premia (or discounts) for non-GMO sea salt, gluten-free orange juice, and no-hormone-added chicken. We also investigate willingness-to-pay premia for organic apples; although the organic label is not redundant, consumers often misunderstand its meaning (Campbell et al. 2014; Guilabert and Wood 2012; Hoefkins et al. 2009). By investigating the relationship between preferences for redundantly labeled products and organic products, we can indirectly identify the extent to which organic preferences result from inadequate knowledge about food and agricultural production.

As a preview of results, we find respondents with farm experience report lower premiums for non-GMO salt and no-hormone-added chicken. Those with higher scientific literacy state lower premiums for gluten-free orange juice. However, fewer than 50% of participants who initially stated positive premiums are convinced otherwise by the information in the study. Over 30% of respondents counter-intuitively increase their premiums post-information; this behavior is associated with lower scientific literacy scores.

The refusal of experts and those with greater scientific understanding to pay more for redundant labels suggests that consumers who do pay a premium do so in part because they are not fully informed of labels' true meaning. Respondents who lower their willingness to pay for the labels after learning more about them also demonstrate that some portion of their initial premium stemmed from misinformation.

Background

Existing literature demonstrates that food labels that provide no additional information can still draw higher price premia from consumers (e.g., Bernard et al. 2019; Heng et al. 2016; Lusk 2019). How do we determine whether premiums for redundant labels stem from misunderstanding or other factors? Handel and Schwartzstein (2018) investigated cases where consumers appear not to use all available information to make decisions. They present a theoretical framework that distinguishes between observed demand for a good from the demand that would exist, were consumers to fully utilize all information. They identify three common approaches to measuring the wedge between the two demand curves. Researchers may compare the demand of subject matter experts with that of non-experts, assuming experts make choices based upon the true value of the good. Similarly, researchers may measure participants' relevant knowledge in a survey and compare the demand of apparently informed and uninformed consumers. Finally, studies may attempt to de-bias study participants by providing information about the topic and comparing expressed demand with and without the information treatment. Prior work on consumer misunderstanding of food labels has utilized each of the former approaches; this paper will add to the literature by including all three methods.

Using Expertise as a Proxy for Information

Bronnenberg et al. (2015) used Nielsen expenditure data to compare the spending of experts and non-experts on generic and branded goods that are physically homogenous, such as pain medication and pantry staples. Experts in medication, such as nurses and pharmacists, were far more likely than the general public to purchase generic headache remedies. As experts in food preparation, chefs were more likely to purchase store brand pantry staples than the general public. While these expert proxies strongly correlated with direct measures of knowledge about the products' attributes, this level of information was domain-specific; a consumer who was well-informed about the equivalency of generic and branded headache remedies was not significantly more likely to purchase generic pantry staples. The authors estimate that if average consumers were as informed as pharmacists, consumer surplus would increase by 4 percent in the $2.88 billion pain reliever industry. Though their estimate of consumer surplus increase in the food sector is economically smaller, the estimate includes only those information gains that would move consumers from branded products to physically identical generic products.

Björkegren (2018) studied experts' purchases of "nostalgic" foods, defined as products that reject modern technology but are not proven to be safer, more healthful, or better for the environment. In contrast to Bronnenberg et al. (2015), the author finds that health experts are no less likely than non-experts to demand non-GMO milk or eggs; however, his study did not demonstrate whether the "experts" were in fact more knowledgeable on these particular subjects.

Although the study did not analyze willingness-to-pay or purchase intentions, Funk et al. (2015) found that members of the American Association for the Advancement of Science (AAAS), individuals who are presumably more knowledgeable about science and genetics than the general public, were much more likely to perceive GMOs as safe than the general public. 88% of AAAS members indicated they thought GMOs were generally safe as compared to only 37% of the general public. The gap between beliefs of AAAS members and the general public on the topic of GMOs was larger than for any of the other issues, including climate change and nuclear energy, that Funk et al. (2015) studied.

Directly Measuring Knowledge

Researchers have found some evidence that consumers with higher levels of relevant knowledge are less susceptible to deceptive advertising and food labeling claims. Schmuck, Matthes, and Naderer (2018) showed experiment participants advertisements for water in plastic bottles that featured a false claim about environmental friendliness. Those participants who scored higher on an environmental knowledge quiz were more likely to identify the false claim as greenwashing. Andrews, Burton, and Netemeyer (2000) evaluated perceptions of a factually true but potentially misleading nutrition label: a claim of reduced sodium on a soup product that remained high in absolute levels of sodium. Respondents who scored higher on a nutrition quiz were less likely to believe the soup was healthy and ranked it higher in sodium content and blood pressure impacts. The same authors also measured consumer attitudes about a candy bar that advertised “half the fat” or “half the calories” of the leading bar but was still high in fat and calories. They report an increasingly negative relationship between objective knowledge and purchase intentions (Andrews, Netemeyer, and Burton 2009).

Surveys have shown that U.S. consumers are generally uninformed about genetics and genetically modified food (McFadden and Lusk 2016; Onyango, Govindasamy, and Hallman 2006). Several studies have investigated the relationship between survey respondents’ knowledge about and attitudes toward bioengineered foods, often distinguishing between participants’ self-reported level of knowledge and measured knowledge of scientific facts (e.g., House et al., 2004; Fernbach et al., 2019; McFadden, 2016; Rose et al., 2019). Overall, evidence on the effects of knowledge on attitudes toward food technology is conflicting. This is perhaps due in part to differing methods of measuring knowledge across studies. Furthermore, a survey by McFadden and Lusk (2016) found that merely calling attention to subject’s lack of factual knowledge through the act of measuring objective knowledge can shift opposition levels. Although many studies have documented U.S. consumers' lack of knowledge about bioengineered foods, we are not aware of any work that has studied consumer responses to a non-GMO label on a food incapable of being genetically modified, such as salt.

De-Biasing Subjects by Providing Information

Labels describing food as "natural" have been criticized as misleading, in part because consumers tend to overestimate the attributes associated with them (Butler and Vossler 2018). The Food and Drug Administration does not define the word natural on non-meat products; however, the USDA regulates the claim for meat, and the definition (contrary to most consumer's suppositions) merely implies the product is minimally processed. Several studies have investigated the impact of outlining the legal requirements for natural labels on willingness to pay for products carrying them. Gifford and Bernard (2011) collected bids for natural and organic chicken breasts before and after presenting the USDA regulations for each. Nearly 50% of participants increased their premium for organic over natural after learning the requirements; these individuals tended to have overestimated the definition of natural before receiving information. Syrengelas et al. (2018) randomly assigned participants either to a control group that received no information or to a treatment group that received the USDA definition of natural. Among respondents in the control group, those who indicated they were not familiar with the label's definition were more likely to state a positive premium for naturally labeled beef. The informed treatment group demonstrated no significant willingness to pay extra for the natural label. The findings in Syrengelas et al. (2018) thus suggest the natural claim, while federally regulated by the USDA, is in fact misleading for most consumers.

As indicated, while the USDA provides a broad definition of natural for labels on meat products, the FDA does not define the claim for foods under its regulation. Berry, Burton, and Howlett (2017) found that a natural label increased perceptions of healthfulness and purchase intentions, but exposure to a news article explaining that the claim is not defined by the FDA nullified this link. When similar information was instead presented in a brief disclosure on the product packaging, incorrect perceptions were only somewhat mitigated. McFadden and Huffman (2017) conducted an auction for conventional, organic, and natural apples, eggs, and broccoli. Respondents who received information from the perspective of the natural industry increased premiums for organic food, implying prior misunderstanding of the natural claim.

Previous work has also found evidence that the provision of information changes willingness to pay for organic and bioengineering labels that may be misleading. Streletskaya, Liaukonyte, and Kaiser (2019) studied consumer understanding of the distinction between wines labeled "organic" or "made with organic grapes." Because many wine drinkers are not familiar with the non-grape inputs of conventional wine production, organic restrictions on inputs such as egg whites may not be obvious to the average consumer. The study revealed that outlining the more stringent requirements of the organic label raised premiums for organic wine over wine made with organic grapes.

Consumer misunderstanding about GMO agricultural products seems evident in a group of studies that change willingness to pay for GM products by providing information about them. Many studies have shown that consumer willingness-to-pay for GMO foods is affected by information provision (e.g., Li, McCluskey, and Wahl, 2004; Lusk et al., 2004; Rousu et al., 2007). Despite evidence that the provision of information can "de-bias" study participants, another line of work indicates that the impact of objective information may be dependent upon recipients' prior perceptions. Costanigro et al. (2014) elicited willingness to pay for conventional, local, and organic apples before and after presenting limited scientific evidence of nutritional or environmental benefits to local and organic. Participants appeared to interpret the information subjectively. Those with higher initial premiums for the alternative apples seemed to view the information favorably, increasing WTP premiums for the alternative labels, while those with low initial valuations lowered their premiums in response to the information. McFadden and Lusk (2015) presented survey respondents with scientific information refuting the purported risks of genetically modified foods. While respondents who initially believed GM foods to be safe strengthened that belief, those who initially believed GM foods to be unsafe were more likely to report unchanged safety perceptions.

Methods

An online survey was administered to a sample of the United States population. A total of 1,168 individuals completed the survey. Data were collected via the firm Dynata, which maintains a panel of individuals who have volunteered to take surveys in exchange for payment. The sample is generally representative of the U.S. population in terms of gender, ethnicity, age, and census region (see Table 1). Data were collected in June 2019. Respondents were deemed inattentive and dropped from the sample if they met two or more of the following criteria: (i) spent less than 20% of the average time on the survey, (ii) spent less than 2.5 seconds on information pages, or (iii) failed a "trap question" that instructed the respondent to select a particular answer. Forty-six responses were dropped, with a final sample size of 1,122. This sample size provides a sampling error of less than +/-3% with 95% confidence for dichotomous questions.

Label Valuation

The survey began by eliciting willingness to pay for four sets of paired products. Each set consisted of one generic, unlabeled item and an identical item with an attribute label. Each set was presented on its own page, and ordering of the two items on each page was randomized to control for ordering effects. We included three sets of products with redundant labels: sea salt with and without a Non-GMO Project label; 100% orange juice with and without a "gluten-free" label; and fresh chicken breast with and without a "no added hormones" label. Because sea salt contains no genes, it cannot be genetically modified; juice comprised completely of oranges is naturally free of a protein found in wheat; and USDA regulations prohibit the use of added hormones in poultry. As such, these labels are redundant and do not provide any additional information for the informed consumer.

We also elicited willingness to pay for apples with and without an organic label. While the organic stamp does convey additional information about the production process, it has been shown to be commonly misperceived by consumers (Campbell et al. 2014; Guilabert and Wood 2012; Hoefkens et al. 2009). Apples were presented first, on their own page, to prevent the redundant labels from producing a framing effect for the organic label.

Respondents completed an open-ended WTP question for each food item. Beneath each item, respondents indicated the maximum amount they would pay using a click-and-drag scale. Survey pretesting revealed that some participants struggled to achieve cent-level precision with the scale, so we also include a space to allow respondents to type a specific, precise answer. In the foregoing analysis, we also account for this lack of exact measurement by defining a "positive premium" as a price more than three cents above the price of the similar item.

Table 1. Explanatory Variables

Variable	Description	Mean	Std. Dev.	Census estimate
FarmWorker	1 = has been employed by a farm OR self or family has owned a farm	0.101	0.301	-
SciLit	number of science questions correct out of 9	4.620	2.019	-
Liberal	1 = "Somewhat" or "Extremely" liberal	0.299	0.458	-
Conservative	1 = "Somewhat" or "Extremely" conservative	0.286	0.452	-
College	1 = attained 4 year degree or higher	0.428	0.495	0.309
Income	Low Income = < $40,000	0.370	0.483	0.338
	Middle Income = $40,000-$140,000	0.508	0.500	0.492
	High Income = > $140,000	0.122	0.327	0.17
Age	18-34	0.299	0.458	0.304
	35-54	0.328	0.470	0.339
	Over 54	0.373	0.484	0.358
HHsize	number of people living in household	2.428	1.193	2.63
Female	1 = female	0.523	0.500	0.508
Region	Northeast	0.191	0.394	0.172
	Midwest	0.232	0.422	0.21
	South	0.363	0.481	0.38
	West	0.214	0.410	0.238
SubjectiveKnowledge_salt	1 = "Somewhat" or "Strongly" agree w/ statement "I am knowledgeable about GMOs"	0.450	0.498	-
SubjectiveKnowledge_OJ	1 = "Somewhat" or "Strongly" agree w/ statement "I am knowledgeable about gluten"	0.426	0.495	-
SubjectiveKnowledge_chicken	1 = "Somewhat" or "Strongly" agree w/ statement "I am knowledgeable about poultry production"	0.399	0.490	-
ObjectiveKnowledge_salt	1 = answered “< 25% of sea salt contains GM ingredients”	0.363	0.481	-
ObjectiveKnowledge_OJ	1 = answered “< 25% of 100% OJ contains gluten”	0.376	0.485	-
ObjectiveKnowledge_chicken	1 = answered “< 25% of chicken administered growth hormones”	0.174	0.379	-

While open-ended WTP questions are known to produce certain biases, including hypothetical bias (Arrow et al. 1993; Donaldson, Thomas, and Torgerson 1997; Kahneman, Ritov, and Schkade 1999), they are easy for respondents to answer. Moreover, we are not particularly interested in the "total" WTP for each item, but rather the *difference* in WTP between the labeled and unlabeled items. We thus calculate a continuous premium variable by subtracting willingness to pay for the unlabeled item from that of the labeled item. Whatever biases exist with open-ended questions thus might be netted out by focusing on the difference in stated willingness-to-pay for two items.

Occupational Expertise

We identify "farm workers" for the purpose of the study through a series of questions about involvement in agriculture. Participants who indicate they have worked in production agriculture then choose from a list of experiences. We classify respondents with farm experience as those who selected one or more of the following: 1) employed by a farm that produced crops, primarily for sale, 2) employed by a farm or ranch that raised livestock, primarily for sale, or 3) affirmatively responding to the statement that "I have (or my immediate family has) owned a farm or ranch." 10.07% of our final sample met these criteria.[1]

[1] We checked the robustness of our classification with two alternative definitions of farm experience. The first expands the scope of past and present agricultural experience to also include employed in buying or processing of grain, employed in buying or processing of livestock, or employed in agricultural science/research. 12.48% of the final sample fell into the expanded definition. The second alternative classification includes only those respondents who had worked in a management role on a farm or ranch, comprising 7.13% of the sample. For our preferred model specification, expanding the definition of "farm worker" changes coefficient estimates in equations for salt and chicken premiums by no more than one cent. Narrowing the definition increases the magnitude of the farm worker variable for salt and chicken equations. For each of the alternative definitions, *FarmWorker* remains statistically insignificant in the orange juice equation and becomes statistically insignificant in the apple equation. We also collected each respondent's current occupation from a drop-down list of the Current Population Survey's occupational classifications (U.S. Bureau of Labor Statistics 2016), but these data are not used here because of the small number of people in each category.

Scientific Literacy

A consumer's understanding of the issues behind food labels such as "non-GMO" may be influenced not only by agricultural or food-specific knowledge, but also general scientific literacy. To provide a measure of scientific understanding, participants answered a series of questions from Kahan's Ordinary Scientific Intelligence (OSI) scale (Kahan 2017). Six of these questions come from the NSF Indicators battery (National Science Board 2014). These six items are true or false and reference basic scientific facts. Examples include "All radioactivity is man-made" and "Antibiotics kill viruses as well as bacteria". The OSI also contains three cognitive reflection questions derived from Frederick (2005), which feature an answer option that intuitively seems correct but should be recognized as false after some consideration. Scientific literacy scores are calculated as the number of the nine OSI questions correctly answered.

Subjective and Objective Knowledge

Bayesian decision theory postulates that when an individual receives new information, an updated belief is formed by a weighted combination of prior beliefs and new information. We expect that respondents' prior beliefs and knowledge about labels will influence responses to the facts presented in the survey. Before participants were provided information, self-assessed and factual knowledge about each redundant label are elicited through a set of two questions. Subjective knowledge is measured on a 5-point Likert scale, with responses ranging from "strongly agree" to "strongly disagree" with the following statement: "I am knowledgeable about <<GMOs; gluten; the way poultry is produced in the United States>>". A *SubjectiveKnowledge* indicator equals one if the individual expressed agreement for the issue in question. For each product, we then asked respondents to select the percentage of items sold that possess the attribute negatively referenced on the label. For example, one such question asks the percentage of broiler chickens sold in the United States that are given artificial growth hormones. Respondents choose either 0-25%, 26-50%, 51-75%, or 76-100%. An *ObjectiveKnowledge* indicator equals one if the individual correctly answered 0-25%.

De-Biasing Information

Following the willingness to pay and knowledge measurement sections, we present information about the redundancy of the salt, orange juice, and chicken labels and collect new willingness to pay measures. Similar to the "natural" label experiment in Syrengelas et al. (2018), we expect that providing information about the label will decrease premiums because uninformed consumers overestimate the benefits associated with the label. The information took the form of images and brief text segments taken from the GMO Answers Initiative, the Celiac Foundation, and the USDA Food and Safety Inspection Service websites (see appendix figures). After viewing information for each product, participants were asked the same valuation questions as prior to the information. The individual's earlier response is shown below the product; they could choose to confirm or change their initial WTP.

Statistical Analysis

Our first target of analysis is characterizing consumers who are misled by redundant labels. The following OLS model regresses the characteristics of individual *i* on their calculated premiums for product $j \in \{apple, salt, orange\ juice, chicken\}$:

$$Premium_{ij} = \beta_0 + \beta_1 FarmWorker_{ij} + \beta_2 SciLit_{ij} + \beta X_{ij} + \varepsilon_{ij},$$

where *FarmWorker* equals one if a respondent is classified as having farm experience, *SciLit* denotes the number of OSI questions correctly answered, X_{ij} is a vector of other demographic variables including education, income, gender, political affiliation, age, region, and household size, and ε_{ij} is a random error term. This equation is first estimated by stacking data across the three product sets with redundant labels. Apple data are excluded from this initial analysis because this label, while potentially prompting misleading beliefs, is not redundant. We then estimate separate equations for each product, including apples, to investigate variation in effects across different attribute labels.[2]

Next, we estimate a similar equation to discover how individuals' characteristics, expertise, knowledge, and prior beliefs affect their responses to information. We study the change in premium for the labeled products after information as follows:

$$Premium2_{ij} - Premium1_{ij} = \beta_0 + \beta_1 farmWorker_{ij} + \beta_2 SciLit_{ij} + \beta_3 SubjectiveKnowledge_{ij} + \beta_4 ObjectiveKnowledge_{ij} + \beta X_{ij} + \varepsilon_{ij} ,$$

where *Premium2* represents the premium stated after viewing information and *Premium1* that stated at the beginning of the survey. *SubjectiveKnowledge* and *ObjectiveKnowledge* represent the self-assessed and actual knowledge for each product attribute measured before the presentation of information.

Organic Apple Premiums

Though we do not present information about the organic label to respondents, we investigate the relationship of respondents who are misled by redundant food labels with organic premiums.

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[2] To test the robustness of the results, we also estimate a logit model where the dependent variable denotes positive premiums for the redundant label (a WTP difference greater than three cents). Because median premiums are quite different from mean premium estimates, we also estimate quantile regressions on median premiums. The alternate specifications support our OLS findings in that our main variables of interest, farmWorker and SciLit, demonstrate significant effects in the hypothesized negative direction for multiple products.

Respondents who decrease premiums for redundant labels after viewing new information behave consistently with having been initially misled. We create a decrease index, which counts the number of products for which an individual decreased premiums after receiving information. Because prior works have found several common consumer misperceptions of organic, we suspect this measure of susceptibility to misleading food marketing claims may be positively correlated with premiums for organic. This index is thus added to the explanatory variables for a regression explaining organic apple premiums.

Results

113 respondents, or 10.07% of our sample, were classified as having farm experience. This percentage is much higher than the previously cited 2% of the US population working in production agriculture. However, note that our farm worker variable does not denote current employment in agriculture, but rather experience from having worked on a farm during one's lifetime. 1.52% of the sample indicated they are *currently* employed in the agricultural sector, a figure more closely aligned with the Bureau of Labor Statistics' estimate.

The mean scientific literacy score was 4.62 questions correct out of nine, with a median score of four. 44.92%, 42.51%, and 39.84% of respondents claimed to be knowledgeable about GMOs, gluten, and poultry production, respectively. However, only 36.27% of respondents correctly answered that 0-25% of sea salt sold in the United States contains genetically modified ingredients; 37.61% correctly answered that 0-25% of 100% orange juice contains gluten; and only 17.38% correctly identified the same statistic for broiler chickens given artificial hormones. After viewing information about the USDA's regulations of hormones in poultry, the percentage of respondents correctly answering the factual chicken question nearly tripled, to 49.29%. This large change provides support for the hypothesis of a knowledge deficit in public understanding of food production.

Mean and median WTP premiums are reported in Table 2. Prior to information, the mean premium is positive for all labeled products except gluten-free orange juice. The largest premium is for no-hormone-added chicken, at $0.31, or 20.13%. For all products, the median premium is closer to zero than is the mean. While a median near zero might be taken as a null result, it should be noted that the percent of consumers willing to pay a positive premium (or willing to pay at least $0.03 given our adjustment factor) ranges from 40.9% for orange juice to 58% for chicken; these are non-trivial shares of the population valuing a redundant label.

Table 2. Mean and Median Premiums for Labeled Products

	Before Information				After Information			
	mean	std. dev.	median	% positive	mean	std. dev.	median	% positive
Organic Apple	$0.19	$1.06	$0.12	57.9%	-	-	-	-
Non-GMO Salt	$0.08	$0.50	$0.02	46.9%	$0.07	$0.48	$0.00	38.7%
Gluten-free OJ	-$0.04	$0.95	$0.00	40.9%	$0.04	$0.85	$0.00	37.6%
No Hormone Chicken	$0.31	$1.29	$0.13	58.0%	$0.34	$1.27	$0.09	55.0%

Figure 2 shows the distribution of initial premiums for those with and without farm experience. Without controlling for any other factors, it is clear that the farm experienced are more likely to be willing to pay *less* for the label, i.e., have a “negative premium”.

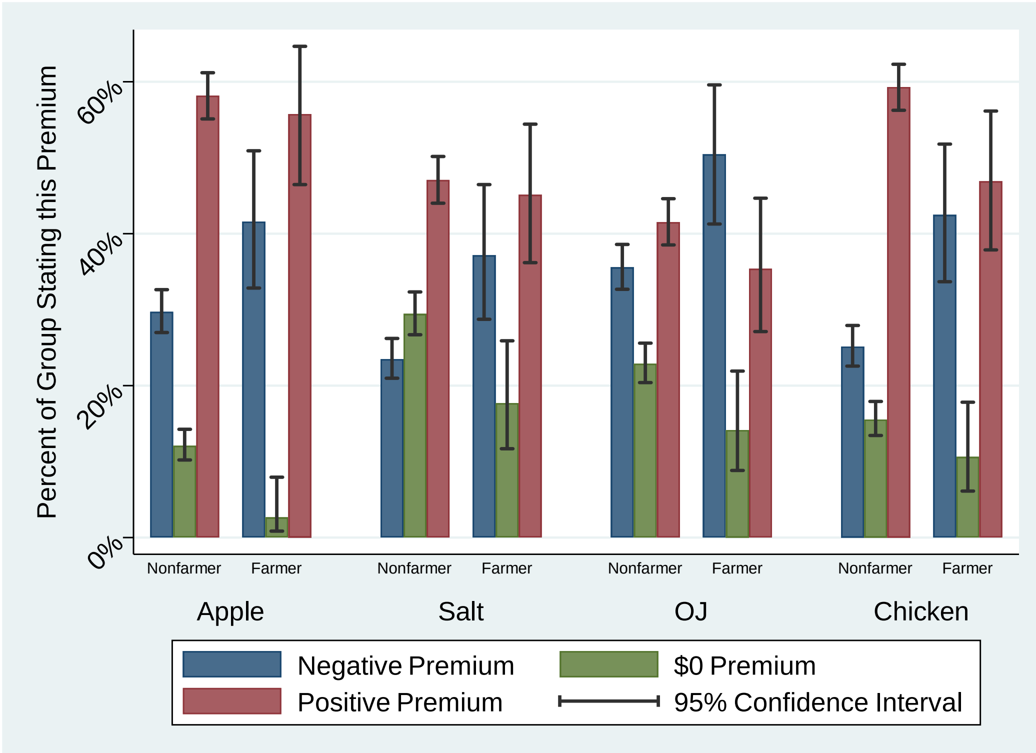

Figure 1. Distribution of Premiums for Respondents with and without Farm Experience

Figure 3 reports mean scientific literacy scores for respondents with a "negative," $0, or positive original premium. Science scores are nearly equivalent across the distribution of premiums for organic apples. For all other products, those who state they are willing to pay no more and no less for the labelled item score the highest on OSI questions.

After respondents view information, median premiums for salt and chicken fell, while that of orange juice remained zero. Across the whole sample, 38.50%, 39.84%, and 42.69% decrease premiums for salt, orange juice, and chicken, respectively. More than 30% of respondents actually increase premiums for any given product. A smaller portion, 13-27%, of subjects maintain their initial premium within the 3 cent zone we use to account for the sensitivity of our sliding scale measurement tool.

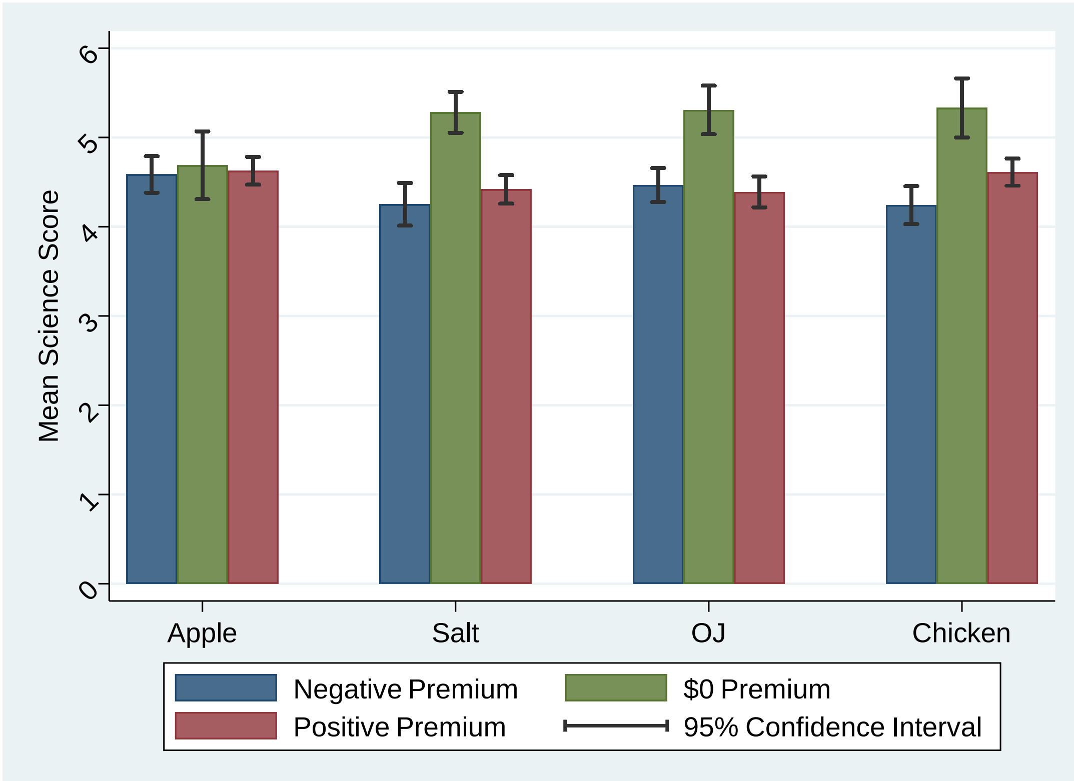

Figure 2. Scientific Literacy Scores by Type of Premium

Regression Analysis

We first stacked data across all three products, and included dummy variables for salt and chicken, and use orange juice as the reference product. OLS regression of individuals' premiums on respective characteristics reveals farm experience as the only statistically significant characteristic variable; having worked on a farm is associated with a 16 cent lower premium for a redundant label. On average, non-GMO salt and no-hormone-added chicken have 12 cent and 35 cent higher premiums, respectively, than does gluten-free orange juice. To account for the repeated nature of the data, we also report clustered standard errors and a random effects model. Results for each are reported in Table 3; the findings remain unchanged.

The effect of individual characteristics on premiums may differ between the labels in the survey, so we estimated separate regressions for each item. Results are presented in Table 4.

Farm experience is associated with lower premiums for all four products, but the effect is not statistically different from zero in the case of gluten-free orange juice. However, the effect of a higher scientific literacy score is consistently significant only for the gluten-free label; an additional correct OSI question is associated with a 3 cent lower premium. The significance of a similar effect for non-GMO salt weakens when controlling for other demographic variables.

Interestingly, the effect of a college degree is positive and significant for salt and orange juice, raising premiums by 6 to 14 cents. Midwesterners are willing to pay less, on average, for a non-GMO label on salt, while females are willing to pay less for a gluten-free orange juice label. The effect of income is generally insignificant.

Table 3. Determinants of Premiums on Redundantly Labeled Foods (Pooled Model)

Variable	OLS	Random Effects	Clustered SE's
FarmWorker	**-0.155*** **	**-0.155*** **	**-0.155** **
	(0.059)	(0.059)	(0.068)
SciLit	-0.011	-0.011	-0.011
	(0.009)	(0.009)	(0.009)
Liberal	0.018	0.018	0.018
	(0.041)	(0.041)	(0.042)
Conservative	-0.026	-0.026	-0.026
	(0.042)	(0.042)	(0.041)
College	0.047	0.047	0.047
	(0.039)	(0.039)	(0.040)
Income			
Middle Income	-0.047	-0.047	-0.047
	(0.039)	(0.040)	(0.041)
High Income	-0.084	-0.084	-0.084
	(0.062)	(0.062)	(0.066)
Age			
35-54	0.013	0.013	0.013
	(0.045)	(0.045)	(0.048)
Over 54	-0.023	-0.023	-0.023
	(0.046)	(0.047)	(0.052)
HHsize	0.004	0.004	0.004
	(0.015)	(0.015)	(0.015)
Female	-0.007	-0.007	-0.007
	(0.036)	(0.036)	(0.038)
Region			
Midwest	-0.049	-0.049	-0.049
	(0.052)	(0.052)	(0.055)
South	0.000	0.000	0.000
	(0.048)	(0.048)	(0.053)
West	-0.053	-0.053	-0.053
	(0.053)	(0.053)	(0.055)
Salt	**0.123*** **	**0.123*** **	**0.123*** **
	(0.041)	(0.041)	(0.031)
Chicken	**0.347*** **	**0.347*** **	**0.347*** **
	(0.041)	(0.041)	(0.050)
constant	0.062	0.062	0.062
	(0.085)	(0.086)	(0.087)
R squared	0.026		0.026
Adj. R squared	0.021		0.021

Table 4. Determinants of Premiums on Redundantly Labeled Foods by Product

Dependent Variable: Premium for Non-GMO Sea Salt	1	2	3	4
FarmWorker	**-0.088***	**-0.098****	**-0.107****	**-0.118****
	(0.049)	(0.050)	(0.050)	(0.052)
SciLit		-0.011	**-0.015****	-0.010
		(0.007)	(0.008)	(0.008)
Liberal			0.028	0.027
			(0.036)	(0.036)
Conservative			0.003	0.016
			(0.036)	(0.037)
College			**0.056***	**0.064***
			(0.031)	(0.034)
Income				
Middle Income				-0.001
				(0.035)
High Income				-0.019
				(0.055)
Age				
35-54				-0.027
				(0.040)
Over 54				-0.066
				(0.041)
HHsize				-0.002
				(0.013)
Female				0.029
				(0.032)
Region				
Midwest				**-0.089***
				(0.046)
South				0.018
				(0.042)
West				-0.066
				(0.047)
constant	0.089***	0.141***	0.129***	0.153**
	(0.016)	(0.038)	(0.040)	(0.073)
R squared	0.003	0.005	0.008	0.02
Adj. R squared	0.002	0.003	0.004	0.008

Dependent Variable: Premium for Gluten-Free Orange Juice	1	2	3	4
FarmWorker	-0.069	-0.088	-0.090	-0.102
	(0.094)	(0.095)	(0.096)	(0.100)
SciLit		-0.022	**-0.030****	**-0.034****
		(0.014)	(0.015)	(0.015)
Liberal			-0.014	-0.006
			(0.069)	(0.070)
Conservative			-0.014	-0.017
			(0.070)	(0.072)
College			**0.117***	**0.141****
			(0.060)	(0.066)
Income				
Middle Income				**-0.135****
				(0.067)
High Income				-0.080
				(0.105)
Age				
35-54				0.014
				(0.076)
Over 54				0.022
				(0.079)
HHsize				0.003
				(0.025)
Female				**-0.112***
				(0.062)
Region				
Midwest				0.112
				(0.088)
South				0.051
				(0.081)
West				0.098
				(0.090)
constant	-0.035	0.069	0.064	0.122
	(0.030)	(0.073)	(0.077)	(0.140)
R squared	0	0.003	0.006	0.014
Adj. R squared	0	0.001	0.002	0.002

Table 4 continued

Dependent Variable: Premium for No-Added-Hormones Chicken

	1	2	3	4
FarmWorker	**-0.239***	**-0.243***	**-0.254***	**-0.244***
	(0.128)	(0.129)	(0.131)	(0.135)
SciLit		-0.004	0.004	0.010
		(0.019)	(0.020)	(0.021)
Liberal			0.032	0.035
			(0.094)	(0.094)
Conservative			-0.092	-0.076
			(0.094)	(0.097)
College			-0.093	-0.063
			(0.081)	(0.089)
Income				
Middle Income				-0.005
				(0.091)
High Income				-0.152
				(0.143)
Age				
35-54				0.051
				(0.103)
Over 54				-0.024
				(0.107)
HHsize				0.011
				(0.034)
Female				0.062
				(0.084)
Region				
Midwest				-0.171
				(0.120)
South				-0.069
				(0.110)
West				-0.191
				(0.122)
constant	0.329***	0.348***	0.370***	0.381**
	(0.041)	(0.099)	(0.105)	(0.189)
R squared	0.003	0.003	0.006	0.011
Adj. R squared	0.002	0.001	0.001	-0.001

Dependent Variable: Premium for Organic Apples

	1	2	3	4
FarmWorker	-0.155	-0.171	**-0.203***	-0.181
	(0.106)	(0.106)	(0.108)	(0.112)
SciLit		-0.019	-0.023	-0.027
		(0.016)	(0.017)	(0.017)
Liberal			0.113	0.111
			(0.078)	(0.078)
Conservative			-0.036	-0.056
			(0.078)	(0.080)
College			0.038	0.026
			(0.067)	(0.074)
Income				
Middle Income				-0.012
				(0.075)
High Income				0.024
				(0.118)
Age				
35-54				0.051
				(0.085)
Over 54				0.093
				(0.088)
HHsize				-0.016
				(0.029)
Female				-0.022
				(0.069)
Region				
Midwest				-0.017
				(0.099)
South				0.014
				(0.091)
West				0.040
				(0.101)
constant	0.209***	0.299***	0.280***	0.299**
	(0.033)	(0.082)	(0.086)	(0.157)
R squared	0.002	0.003	0.007	0.009
Adj. R squared	0.001	0.001	0.002	-0.004

Effect of Information

Determinants of the change in premiums after information are reported in Table 5. Respondents with higher science scores decrease their premiums more after learning about the labels' redundancy, though the effect is only statistically significant in the case of no-hormone-added chicken. Those with a college degree decrease their premiums for salt eight cents more than those without. Females also lower salt premiums by eight cents more than do males. Those with farm experience and those in the middle age category are more likely to increase premiums for salt, while those of middle income increase orange juice premiums more than lower income respondents.

Logistic Regression

Further insights to the drivers of premium changes are presented in Table 6. When we separately analyze the likelihood of increasing, decreasing, or maintaining the initial premium, we find scientific literary to be a consistent predictor of reactions to information. For all three products, those with higher science scores are significantly more likely to maintain their premiums and significantly less likely to increase premiums. In the case of orange juice, those with higher scientific literacy are more likely to decrease premiums. Similarly, factual knowledge is associated

Table 5. Reactions to Information, OLS Regression

Dependent Variable : Premium2 – Premium1

Variable	Salt	OJ	Chicken
FarmWorker	**0.119***	0.161	0.176
	(0.067)	(0.124)	(0.189)
SciLit	-0.017	-0.015	**-0.049***
	(0.010)	(0.019)	(0.029)
SubjectiveKnowledge	-0.034	0.038	0.126
	(0.040)	(0.075)	(0.118)
ObjectiveKnowledge	-0.003	-0.080	-0.014
	(0.041)	(0.075)	(0.141)
Liberal	0.024	0.027	-0.049
	(0.047)	(0.086)	(0.131)
Conservative	-0.017	0.037	-0.050
	(0.048)	(0.088)	(0.134)
College	**-0.080***	-0.068	0.137
	(0.044)	(0.081)	(0.123)
Income			
Middle Income	0.029	**0.143***	-0.096
	(0.045)	(0.082)	(0.125)
High Income	0.037	0.109	0.052
	(0.070)	(0.129)	(0.197)
Age			
35-54	**0.114****	0.101	0.019
	(0.051)	(0.094)	(0.144)
Over 54	0.076	-0.075	-0.004
	(0.054)	(0.099)	(0.149)
HHsize	0.006	0.005	-0.014
	(0.017)	(0.031)	(0.047)
Female	**-0.083****	0.041	-0.144
	(0.041)	(0.076)	(0.115)
Region			
Midwest	0.072	-0.109	0.262
	(0.059)	(0.108)	(0.164)
South	0.016	0.010	0.129
	(0.054)	(0.099)	(0.151)
West	0.012	-0.127	0.161
	(0.060)	(0.111)	(0.168)
constant	0.019	0.086	0.175
	(0.096)	(0.176)	(0.270)
R squared	0.019	0.016	0.012
Adj. R squared	0.005	0.002	-0.002

Table 6. Reactions to Information, Logistic Regressions

Dependent variable : 0/1 indicator for having decreased, maintained, or increased premium

Salt

	decrease	no change	increase
FarmWorker	0.157	-0.384	0.093
	(0.219)	(0.279)	(0.220)
SciLit	0.031	**0.168*** **	**-0.178*** **
	(0.034)	(0.039)	(0.036)
SubjectiveKnowledge	-0.097	0.095	-0.006
	(0.132)	(0.146)	(0.136)
ObjectiveKnowledge	0.007	**0.256***	**-0.253***
	(0.135)	(0.146)	(0.141)
College	**0.318****	**-0.363****	-0.031
	(0.144)	(0.162)	(0.149)
Conservative	0.224	-0.126	-0.114
	(0.157)	(0.174)	(0.163)
Liberal	-0.039	0.029	0.022
	(0.155)	(0.172)	(0.158)
Female	**0.687*** **	**-0.333****	**-0.432*** **
	(0.136)	(0.149)	(0.138)
Income			
Middle Income	0.001	0.088	-0.084
	(0.145)	(0.164)	(0.149)
High Income	-0.163	0.241	-0.069
	(0.231)	(0.251)	(0.236)
Age			
35-54	-0.186	0.257	0.028
	(0.166)	(0.199)	(0.168)
Over 54	**-0.430****	**0.712*** **	-0.160
	(0.169)	(0.194)	(0.174)
constant	-0.911***	-2.013***	0.608
	(0.238)	(0.275)	(0.242)

OJ

	decrease	no change	increase
FarmWorker	0.091	-0.189	0.004
	(0.218)	(0.303)	(0.217)
SciLit	**0.064***	**0.159*** **	**-0.172*** **
	(0.034)	(0.043)	(0.035)
SubjectiveKnowledge	-0.072	0.163	-0.052
	(0.132)	(0.165)	(0.133)
ObjectiveKnowledge	**-0.239***	**0.643*** **	-0.202
	(0.134)	(0.163)	(0.134)
College	-0.034	0.257	-0.139
	(0.142)	(0.177)	(0.144)
Conservative	-0.228	0.302	0.033
	(0.157)	(0.192)	(0.156)
Liberal	0.061	0.011	-0.056
	(0.150)	(0.195)	(0.153)
Female	**0.237***	-0.049	-0.219
	(0.132)	(0.168)	(0.134)
Income			
Middle Income	-0.097	-0.078	0.157
	(0.142)	(0.186)	(0.145)
High Income	**-0.381***	0.185	0.226
	(0.231)	(0.270)	(0.228)
Age			
35-54	-0.087	0.094	0.032
	(0.165)	(0.220)	(0.163)
Over 54	0.145	0.150	-0.248
	(0.166)	(0.217)	(0.168)
constant	-0.597**	-2.799***	0.657***
	(0.233)	(0.313)	(0.236)

Table 6 continued

Chicken

	decrease	no change	increase
FarmWorker	-0.153	-0.202	0.209
	(0.219)	(0.363)	(0.215)
SciLit	0.038	**0.146*** **	**-0.111*** **
	(0.033)	(0.048)	(0.034)
SubjectiveKnowledge	-0.133	-0.165	0.205
	(0.135)	(0.197)	(0.135)
ObjectiveKnowledge	-0.255	**0.393***	0.038
	(0.164)	(0.214)	(0.163)
College	0.049	0.040	-0.074
	(0.140)	(0.203)	(0.142)
Conservative	-0.190	-0.194	**0.289***
	(0.154)	(0.219)	(0.154)
Liberal	-0.030	-0.133	0.094
	(0.149)	(0.217)	(0.151)
Female	0.105	-0.034	-0.091
	(0.131)	(0.189)	(0.132)
Income			
Middle Income	0.201	0.005	-0.209
	(0.142)	(0.209)	(0.142)
High Income	-0.008	0.186	-0.105
	(0.225)	(0.309)	(0.225)
Age			
35-54	-0.092	0.096	0.062
	(0.163)	(0.254)	(0.163)
Over 54	-0.040	0.390	-0.149
	(0.164)	(0.243)	(0.165)
constant	-0.431*	-2.667***	0.257
	(0.237)	(0.356)	(0.237)

with unchanged premiums across all products. In no case did perceived knowledge have a significant impact on reactions to information. Possession of a college degree increased propensity to decrease salt premiums, and females were more likely to decrease salt and orange juice premiums. Older respondents tended not to change their premiums for salt.

Organic Premiums

When we add the index of premium decreases to the analysis of organic apple premiums, farm experience is no longer a significant predictor. Table 7 lists regression results. Under OLS analysis, the impact of the decrease index is not significantly different from zero. However, both logistic and quantile regression robustness checks point to a positive, significant relationship between the number of products about which a respondent was misinformed and organic premiums.

Table 7. Apple Premiums and Reactions to Information

	OLS	Logit	Quantile
Decrease	0.044	**0.140****	**0.058****
	(0.034)	(0.066)	(0.024)
FarmWorker	-0.181	-0.092	-0.013
	(0.112)	(0.213)	(0.079)
SciLit	-0.028	-0.032	-0.007
	(0.017)	(0.033)	(0.012)
Liberal	0.112	0.244	0.044
	(0.078)	(0.151)	(0.055)
Conservative	-0.055	-0.015	-0.021
	(0.080)	(0.153)	(0.057)
College	0.023	0.101	0.021
	(0.074)	(0.141)	(0.052)
Income			
Middle Income	-0.012	0.174	0.040
	(0.075)	(0.143)	(0.053)
High Income	0.030	0.291	0.062
	(0.118)	(0.228)	(0.083)
Age			
35-54	0.054	0.220	0.059
	(0.085)	(0.163)	(0.060)
Over 54	0.095	0.254	0.033
	(0.088)	(0.169)	(0.062)
HHsize	-0.017	0.005	-0.008
	(0.029)	(0.055)	(0.020)
Female	-0.032	0.021	0.003
	(0.070)	(0.133)	(0.049)
Region			
Midwest	-0.014	-0.204	-0.022
	(0.099)	(0.189)	(0.070)
South	0.017	-0.001	0.052
	(0.091)	(0.174)	(0.064)
West	0.043	0.142	0.015
	(0.101)	(0.196)	(0.071)
constant	0.256	-0.096	0.023
	(0.160)	(0.306)	(0.113)
R squared	0.010		
Pseudo R squared		0.013	0.007

Discussion and Conclusion

This study investigates three redundant labels, all of which are currently present in the marketplace. We conduct a nationwide, online survey of 1,122 United States adults, including an open-ended elicitation of willingness to pay for salt with and without a non-GMO label, orange juice with and without a gluten-free label, and chicken breast with and without a no-hormone-added label. We find that 40 - 58% of respondents are willing to pay premiums for products carrying the redundant labels. This is true even in the presence of a clarifying statement on the product package, indicating the ineffectiveness of a small print disclaimer to correct misperceptions in the presence of a misleading marketing claim. In fact, no-hormone-added chicken breast carrying a federally mandated disclaimer had the highest average premium, as a percentage of willingness to pay, among all the products studied.

We find some support for the hypothesis that these premiums stem from misunderstanding. Respondents with farm experience are willing to pay less than those without farm experience for redundant labels that directly reference farm production practices, i.e., "non-GMO" on salt and "no-hormone-added" on chicken. Like in Bronnenberg et al. (2015), expertise is domain-specific; there is no significant effect of farm experience on premiums for the nutrition-referencing label on orange juice. However, those with higher scores on a quiz of general scientific literacy tend to report lower premiums for gluten-free orange juice. Because two of our measures of informed consumers, expertise and scientific comprehension, are associated with a reluctance to pay more for redundant labels, we conclude that, in general, misinformation contributes to the willingness to pay a premium. It is surprising that scientific literacy is not a significant predictor of premiums for no-hormone-added chicken, given the statement on the package declaring the label's superfluity. Disclaimers seem to be ineffective at preventing misperceptions even among consumers well versed in understanding scientific facts.

The survey reveals heterogeneous responses to text excerpts explaining the labels' redundancy. We find that 39- 43% of respondents lower their premiums after viewing information, which is behavior consistent with having been initially misled. A smaller percentage, 14- 27%, did not change their premiums beyond our measurement tool's sensitivity buffer of 3 cents. These respondents may have discredited the information for a variety of reasons: distrust in the sources used in the survey, failure to read the information in the interest of time, or misinterpretation of its message. Furthermore, the findings of Bernard, Duke, and Albrecht (2019) and Kim, Lusk, and Brorsen (2018) suggest that consumers view food attribute labels as signals of benefits beyond the scope of the claim made. These benefits may include characteristics of the product itself, such as safety, or outcomes of purchase, such as social status. Such perceptions would limit the effectiveness of information about the claim itself to decrease premiums. On the other hand, participants who maintain their initial premiums may have simply already been aware of the facts presented. Indeed, greater objective knowledge about the label increased the likelihood that a respondent did not change her premium.

It is less clear why over 30% of respondents increase premiums after viewing information. These results align with those of Gifford and Bernard (2011), who found that 30% of respondents altered premiums for organic over natural chicken in the opposite of the expected direction when presented with information. In a similar vein, McFadden and Lusk (2015) found that 12% of participants formed a posterior belief contrary to the scientific information provided about the safety of GM foods. That study reported that information-processing problems, selective scrutiny, and several other cognitive biases influenced this failure to align beliefs with new information. Our study has limited explanatory power for why participants may have increased premiums; future work on redundant labels may benefit from measuring respondents' prior beliefs about the labels and perceptions of the presented information in more detail. Respondents who lowered their premiums are likely to have held inflated beliefs about the benefits of the labeled products and corrected them in light of new information. We constructed an index of respondents' subjective tendency to be misled by labels, adding the number of products for which an individual decreased her premium after accurate information. Higher susceptibility to misleading claims increased the likelihood that a consumer was willing to pay a premium for organic food. This suggests that organic premiums are, at least partially, inflated by misinformation.

Policy Implications

Retailers continue to expand their selection of organic, non-GMO, natural, and other alternative foods (Bhattacharyya 2019; Thomasson and Naidu 2019). As marketers target consumers seeking these attributes, it is likely that such claims will continue to appear in contexts in which they do not provide any new information for knowledgeable consumers. It is thus important to understand how consumers value these labels; if grocery shoppers are misled by them, they may spend extra money without receiving extra value. Although the FDA has addressed the relevance of labels that are misleading in context, its new guidelines are non-binding. Some organizations have argued that redundant labels, at least in the case of GMOs, should be prohibited by law (Court, 2018). It is unclear whether such laws might run afoul of free speech protections. Nonetheless, redundant labels may encourage overspending by uninformed consumers. It is tempting to conclude that more consumer education is needed, but as our results show, provision of corrective information is often not enough to eliminate the willingness to pay more for products with redundant claims. Finding ways to provide consumers with food attributes they desire while avoiding misperceptions is a key challenge for regulators and the food sector.

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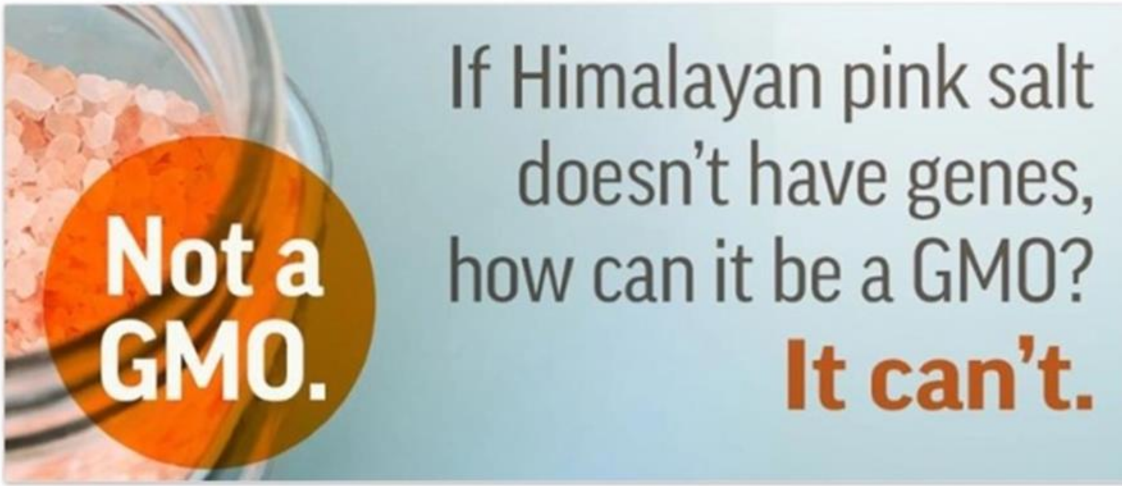
Appendix – DeBiasing Information Presented to Participants



Myth There are dozens of GMO crops, including strawberries, bananas and wheat. There is even GMO water and GMO salt.

Fact There are 10 genetically modified crops commercially available today: alfalfa, apples, canola, corn (field and sweet), cotton, papaya, potatoes, soybeans, squash and sugar beets.

This chart explains why each of the 10 GMO crops are genetically modified.

The majority of these crops, like alfalfa, field corn and soy are actually used for livestock feed. Other uses for these crops include common food ingredients, such as sugar, canola oil, corn starch and soy lecithin. You may find only a few of these in your produce section: rainbow papaya, summer squash, sweet corn, potatoes and apples.

You may also see *non-GMO water and salt*, but here's the catch: **it's not possible for either to be a GMO in the first place!** Although many products aren't among the 10 commercially available GMO crops sold in the U.S., you may still see certified GMO-free label even though there's no GMO counterpart.

Celiac Disease FOUNDATION. ABOUT CELIAC DISEASE GLUTEN-FREE LIVING

Gluten-Free Foods

SHARE | PRINT FRIENDLY

Cutting out gluten from your diet may seem like a difficult and limiting task. Fortunately, there are many healthy and delicious foods that are naturally gluten-free.

The most cost-effective and healthy way to follow the gluten-free diet is to seek out these naturally gluten-free food groups, which include:

- **Fruits**
- **Vegetables**
- **Meat and poultry**
- **Fish and seafood**
- **Dairy**
- **Beans, legumes, and nuts**

Beverages

Most beverages are gluten-free, including juices, sodas, and sports drinks.

Wine is generally considered gluten-free to the FDA standard of under 20ppm of gluten. According to the University of Chicago Celiac Disease Center, wines fermented in barrels lined with wheat paste (historically wines such as port, Madeira and muscatel) are unlikely to contain enough gluten to cause a reaction.

United States Department of Agriculture
Food Safety and Inspection Service

Food Safety Information

Meat and Poultry Labeling Terms

No Hormones (pork or poultry)

Hormones are not allowed in raising hogs or poultry. Therefore, the claim "no hormones added" **cannot be used** on the labels of pork or poultry unless it is followed by a statement that says "Federal regulations prohibit the use of hormones."