

Submitted Article

Is the Natural Label Misleading? Examining Consumer Preferences for Natural Beef

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Abstract *A petition to the USDA claims that natural labeling misleads consumers. We investigate this claim using an online choice experiment to determine consumer willingness to pay for steak labeled as natural. Half of the sample was provided with the definition of natural, while half was not. The absence of the definition resulted in consumers placing a premium on “natural” steak, while those provided with the definition were not willing to pay a premium. Similarly, participants who consider themselves familiar with the natural definition did not place a premium on “natural” steak. Results indicate that consumers may misinterpret the natural label.*

Key words: Beef, interaction design, natural labeling, random parameters logit.

JEL codes: Q13, Q18.

Several foods in the United States carry a label claiming that the product is “natural”. From 2003 through 2010, natural and “premium” were consistently the two most commonly used claims found on new foods (USDA 2016). In 2010, “natural” appeared on 8.4% of all new food products, making it the most frequently-used new product label (USDA 2016). Despite the recurrent use of the term “natural”, the U.S. Food and Drug Administration (FDA) does not have a formal definition for the term or its derivatives (FDA 2016a). The absence of such a definition has resulted in the FDA receiving

Citizen Petitions from the Sugar Association, the Sara Lee Corporation, and the Grocery Manufacturers Association to define the term “natural” (FDA 2015). Furthermore, in 2014, the FDA received a Citizen Petition from Consumer Reports to prohibit the term “natural” from appearing on food (FDA 2015). In response to litigation regarding food labeled as natural, federal courts have also pressured the FDA to provide recommendations concerning the meaning of natural labels (FDA 2016b). In May 2016, the FDA closed a comment period for the public to weigh in further on this debate; however, a formal FDA definition for “natural” still has not been rendered (FDA 2016b).

Unlike the FDA, the USDA Food Safety and Inspection Service (FSIS) provides a definition for natural meat products, which states that natural meat is minimally-processed and contains no artificial ingredients or added color (USDA FSIS 2015). In addition to its petition to the FDA, Consumer Reports submitted a 2014 petition to the USDA to ban the use of natural labeling on meat products, claiming that the USDA natural definition for meat is misleading (FDA 2015; Rock 2016). Consumer Reports based this assertion on results from their consumer surveys, which found that more than 60% of consumers wrongly believed meat labeled as “natural” was raised without antibiotics, growth hormones and genetically modified (GM) organisms in the production (Rock 2015, 2016). Furthermore, Consumer Reports maintains that the natural label should be reserved for organic foods (FDA 2015; Rock 2016).

Against this background, the goal of this research is to use a choice experiment to estimate consumer willingness to pay (WTP) for 12-ounce USDA Choice boneless ribeye steaks labeled as natural, grass fed or corn fed, fed without GM feed, and produced without growth hormones and antibiotics. These characteristics were chosen because Consumer Reports found that consumers associate many of them with being natural, despite its legal definition (Consumer Reports National Research Center 2015; Rock 2016). Another research goal was to determine whether consumer WTP for beef labeled as natural is different for consumers who are informed about the USDA definition of natural compared to those who are not. Additionally, WTP is calculated for the various attributes (e.g., no growth hormones) interacted with the natural label to determine if the natural label adds value to the attributes that consumers typically associate with the natural label. For example, it is hypothesized that natural beef without growth hormones will generate a greater premium than beef only labeled as not containing growth hormones. The Delta Method, following Daly, Hess, and de Jong (2012), is used to derive the significance of the interaction WTP estimates.

Ultimately, this research determines if consumer WTP for the natural label is impacted by consumer knowledge regarding the USDA definition of natural. If results show that consumers are not willing to pay more for natural labeled beef when they are informed about the definition of natural, this may suggest that the natural claim is misleading consumers. In other words, the natural label is misleading if the premium decreases or vanishes when consumers learn about the meaning of the label. If the natural definition is found to be misleading, this finding would support the position of companies and courts who have requested that the government regulate and define the term “natural” on food products better. Indeed, this result would indicate that the USDA and FDA should consider revising the policies overseeing natural labeling. In general, there has been a recent push by not only

consumer groups, but also companies to have more transparent food labeling laws; therefore, it is of interest to determine the extent to which natural labeling influences consumer WTP for beef while this debate is underway.

Methodological Background

Consumer WTP for 12-ounce USDA Choice boneless ribeye steaks labeled with different attributes was elicited using an online choice experiment that included two treatments. In the control treatment, participants were provided with a cheap talk script following [Tonsor and Shupp \(2011\)](#) and then completed the choice experiment. In the information treatment, in addition to the cheap talk script, participants were provided with the USDA definitions of organic and natural, which can be found in the appendix. We included the definition of organic because Consumer Reports found that consumers tend to confuse foods labeled as natural for being organic. Hence, we provided both definitions to ensure that consumers in this treatment were aware of the differences between both definitions and related production methods.

Once they completed the choice experiment, participants in the control treatment were asked to indicate their familiarity with the USDA definition of natural prior to the study. Specifically, participants were shown the USDA definition of natural and were asked to, "Please indicate how familiar you were with the USDA definition of Natural prior to this survey on a scale from 1=not at all familiar to 5=extremely familiar". Participants answered the question after the choice experiment to ensure their choices were not biased by the question. In addition, socio-demographic information such as gender and education was elicited.

Choice Experiments

[Table 1](#) displays the attributes and attribute levels for the choice sets. The attributes are price per pound, type of production process, type of feed and natural labeling. The attribute levels for price were \$4.99/pound, \$6.99/pound, \$8.99/pound, and \$10.99/pound. The range of prices was chosen based on market observations and the USDA Agricultural Marketing Service ([AMS 2016](#)) National Retail Report of boneless ribeye steak prices ([Lusk and Schroeder 2004](#); [Greibitus, Jensen, and Roosen 2013](#); [Lewis et al. 2016](#)). We assumed the average market price was \$7.99 since this was the average price level we used for the choice experiments. This is consistent with the observed average retail market price of \$8.53/pound for boneless ribeye steaks that was recorded by [USDA AMS \(2016\)](#) at the time the survey was launched. The attribute levels for type of production process are no growth hormones, no antibiotics, no GM feed, and none. These attributes were chosen since studies have shown that U.S. consumers are willing to pay premiums for beef raised with no growth hormones and no GM feed (e.g., [Lusk, Roosen, and Fox 2003](#)). Furthermore, previous research has shown that consumers consider natural labeled beef to encompass these production practices ([Gifford and Bernard 2011](#); [Rock 2015](#); [Rock 2016](#)). The attribute levels for type of feed were grass fed, corn fed, and none. These attributes were selected because many consumers do not realize that the natural label can appear on packages of beef from cattle that were fed GM corn or were raised in a feedlot ([Rock 2015](#)) and previous research has found

varying premiums for grass-fed beef compared to corn-fed beef (Umberger et al. 2002; McCluskey et al. 2005; Xue et al. 2010; Evans et al. 2011). Lusk and Schroeder (2004) found that U.S. consumers were willing to pay more for beef products labeled as natural. Similarly, we include an attribute for natural labeling that is either present on the product or not. This design extends previous research by testing if consumers are willing to pay more for natural labeled beef compared to unlabeled beef when other—related—attributes are present. We hypothesize that consumers have a positive WTP for grass-fed beef, natural beef, and beef produced without antibiotics, growth hormones, and GM feed. Furthermore, we hypothesize that the natural label enhances positive premiums of other attributes. We test this using interaction effects that are included in the experimental design.

As discussed above, similar to Gifford and Bernard (2011), we included an information treatment in the experiment. Using an experimental auction, Gifford and Bernard (2011) found that consumers were willing to pay more for natural and organic chicken. Those researchers used a within-subjects design to examine how WTP was impacted if consumers received information regarding the organic and natural labels compared to not receiving information. In their information treatment, Gifford and Bernard (2011) provided participants with ten traits of organic production and informed participants that natural chicken used no artificial colors, no chemical preservatives, no artificial flavors, no hormones, and was minimally processed. These authors found that WTP for natural and organic chicken was not statistically different between the information and no information treatments. We extend this research by using a between-subjects experimental design to elicit consumer WTP through a choice experiment for natural beef. It is hypothesized that participants receiving information about the definitions of organic and natural beef will exhibit a smaller premium for natural labeled beef and the natural label interaction terms because it is likely that consumers who are unfamiliar with the definition of natural will overestimate the positive effect of natural production. Furthermore, we extend previous research by also examining how consumers' level of previous familiarity with the definition of natural impacts their WTP for natural labeled beef.

Table 1 Choice Experiment Attributes and Attribute Levels

Attributes	Attribute Levels
Type of Process	No Growth Hormones No Antibiotics No GM Feed None
Type of Feed	Grass Fed Corn Fed None
Natural	Natural (minimally processed; no artificial ingredients) None
Price	\$4.99/pound \$6.99/pound \$8.99/pound \$10.99/pound

The software Ngene was used to create an optimal orthogonal in the differences choice experimental design that allowed for interactions between the natural label and the other labeling attributes (ChoiceMetrics 2012). The design had two blocks with twelve choice sets each. A block design was used to avoid participants from becoming fatigued by answering all twenty-four choice sets (Savage and Waldman 2008), and the order of the choice sets was randomized among participants to prevent ordering effects (Loureiro and Umberger 2007). Each choice set had three alternatives, which included two steaks labeled with different attributes and a “none of these” option. Photos of the steaks used in the different choice sets were created by a professional photographer using shelf simulation (Lewis et al. 2016; Mueller Loose, Peschel, and Grebitus 2013). Figure 1 shows an example of a choice set provided to participants.

Random Parameters Logit Model

A random parameters logit (RPL) model was used to estimate consumer utility associated with steak labeled with different attributes. The RPL

Figure 1 Example of choice experiment question that appeared in the information and control treatments

<p>Assume you are in the grocery store and you wish to purchase a boneless ribeye beef steak that is USDA Choice. Which of the following products presented below do you prefer? Please choose one of the two alternatives or choose the neither option.</p>	
	—
	—
<p>Neither</p>	—

allows for random taste variation, does not restrict substitution patterns, and allows correlation in unobserved factors over time (Train 2009). The RPL is preferred over the simple logit model since unobserved heterogeneity is likely present in participants' preferences for steak labeled with different attributes. We follow a linear random utility framework to determine the utility of each participant n , from each steak alternative j , within the choice situation t .

The following represents the utility of individual n ($n=1, \dots, n$) from steak alternative j in choice set t ($t=1, \dots, 12$):

$$\begin{aligned}
 U_{njt} = & \beta_p p_{njt} + \beta_1 \text{NoHormones}_{njt} + \beta_2 \text{NoAntibiotics}_{njt} + \beta_3 \text{NoGMFeed}_{njt} \\
 & + \beta_4 \text{Grass}_{njt} + \beta_5 \text{Corn}_{njt} + \beta_6 \text{Nat}_{njt} + \beta_7 \text{neither}_{njt} \\
 & + \beta_8 \text{Nat*NoHormones}_{njt} + \beta_9 \text{Nat*NoAntibiotics}_{njt} \\
 & + \beta_{10} \text{Nat*NoGMFeed}_{njt} + \beta_{11} \text{Nat*Grass}_{njt} + \beta_{12} \text{Nat*Corn}_{njt} + \varepsilon_{njt}
 \end{aligned}
 \tag{1}$$

where the β s are the coefficients to be estimated, and ε_{njt} is a random error term that is independent and identically distributed extreme value (Train 2009). The utility function is interpreted as the maximum utility that the consumer can obtain from the specific alternative t given his/her available budget (McFadden 1980). The variable, p , represents the price of the given steak product; *NoHormones* is a dummy variable equal to one if the steak was labeled as "No growth hormones," and zero otherwise; *NoAntibiotics* is a dummy variable equal to one if the steak was labeled as "No antibiotics," and zero otherwise; *NoGMFeed* is a dummy variable equal to one if the steak was labeled as "No GM Feed," and zero otherwise; *Grass* is a dummy variable equal to one if the "Grass Fed" label is present, and zero otherwise; *Corn* is a dummy variable equal to one if the "Corn Fed" label is present, and zero otherwise; *Nat* is a dummy variable equal to one if the "Natural (minimally processed; no artificial ingredients)" label is present, and zero otherwise; *Neither* is a dummy equal to one if the individual selected "neither" of the product options. Regarding the interaction variables, *Nat*NoHormones* is equal to one if both the natural and no hormones labels are present on the product, and zero otherwise. The other interaction variables were created accordingly. The dummy variables are compared to the no label option since this variable is omitted from the model to avoid perfect collinearity.

Independent normal distributions were assumed for all parameter distributions. The price coefficient was fixed across individuals so that the associated WTP for each non-price attribute has the same distribution as the attribute's coefficient. A simulated maximum likelihood using 250 Halton draws in NLogit was used to estimate the RPL coefficients. A panel RPL was used given that each participant made 12 choices. The NLogit panel data code accounts for correlation over time in unobserved utility that arises when individuals make repeated choices.

Willingness to Pay

Consumer WTP was calculated by dividing the k^{th} attribute level parameter, β_k , by the negative of the price coefficient, β_p , such that $\text{WTP} = \beta_k / -\beta_p$.

Interaction WTP was computed by adding the coefficients of all terms involved in the interaction WTP and dividing it by the negative of the price coefficient. To illustrate this, the WTP for natural beef interacted with grass-fed beef is equal to $(\beta_4 + \beta_6 + \beta_{11}) / -\beta_p$. The variance of the WTP estimates was calculated following [Daly, Hess, and de Jong \(2012\)](#) with the following formula:

$$\left(\frac{\beta_k}{\beta_p}\right)^2 \left(\frac{\omega_{kk}}{\beta_k^2} + \frac{\omega_{pp}}{\beta_p^2} - 2\frac{\omega_{kp}}{\beta_k\beta_p}\right) \quad (2)$$

where β_k is the coefficient of the specific attribute of interest, β_p is the coefficient of price, and ω is the variance and covariance for the respective parameter estimates. Using [Daly, Hess, and de Jong \(2012\)](#) as a starting point, we derive the variance of the interaction WTP. First, assume interaction $\text{WTP} = (\beta_1 + \beta_2 + \beta_m) / -\beta_p$ where 1 and 2 are the subscripts of attributes 1 and 2, and m is the subscript of the interaction term among them. The denominator is the coefficient of the price. Following [Daly, Hess, and de Jong \(2012\)](#), the variance of the interaction term can be calculated by the matrix algebra process $\mathbf{L}'\mathbf{\Omega}\mathbf{L}$ (Delta Method) where \mathbf{L} is a 1x4 vector of the partial first derivatives of the interaction WTP with respect to the betas, and $\mathbf{\Omega}$ is the associated variance and covariance matrix of the coefficients involved in the interaction WTP calculation. Following this formula, we derive the variance of the interaction WTP using the following formula:

$$\begin{aligned} & \left(-\frac{1}{\beta_p}\right)^2 (\omega_{11} + \omega_{22} + \omega_{mm} + 2(\omega_{21} + \omega_{m1} + \omega_{m2})) \\ & + \left(-\frac{1}{\beta_p}\right) \left(\frac{\beta_1 + \beta_2 + \beta_m}{(-\beta_p)^2}\right) (2(\omega_{p1} + \omega_{p2} + \omega_{pm})) + \left(\frac{\beta_1 + \beta_2 + \beta_m}{(-\beta_p)^2}\right)^2 \omega_{pp}. \end{aligned} \quad (3)$$

The square root of [equation \(3\)](#) is the standard error, which is then used in the t-ratio test to determine the statistical significance of the interaction WTP.

Controlling for Consumer Familiarity with the USDA Definition of Natural

We controlled for consumers' previous level of familiarity with the USDA's definition of natural in the control treatment because we hypothesize that prior familiarity with the USDA definition of natural will have an impact on consumer WTP for natural labeled beef. Thus, we divided the participants of the control treatment into consumers who were familiar with the definition of natural (Familiar) and consumers who were not familiar with the definition of natural (Not Familiar). These classifications were designated by separating the data by the median (i.e., 3) of the control treatment responses to the natural familiarity question (see [table 2](#)). Thus, the Not Familiar group of the control treatment consisted of 208 respondents who answered 1, 2, or 3 to the natural definition familiarity question, while the Familiar group of the control treatment consisted of 124 consumers who responded 4 or 5 to the natural definition familiarity question. [Equation \(1\)](#)

Table 2 Demographics of the Information and Control Treatment, and the Control Not Familiar and Familiar Treatments

Demographic	Description	Information Treatment (n = 331)	Control Treatment (n = 332)	Control Not Familiar ⁴ (n = 208)	Control Familiar ⁵ (n = 124)	U.S. Population
Gender	% Female	45.3%	43.1%	40.4%	47.6%	50.8% ¹
Age	Median	40.0	41.0	44.0 ^a	36.5 ^b	37.8 ²
Education	% Bachelor's Degree or higher	32.8%	33.4%	32.7%	34.7%	29.3% ¹
Income	Median	\$40,000-\$49,999	\$40,000-\$49,999	\$40,000-\$49,999	\$40,000-\$49,999	\$53,482 ¹
Household Size	Mean	2.79	2.85	2.79	2.94	2.63 ¹
Natural Familiarity ³	Median	3	3	3	4	

Note: Superscript¹ indicates U.S. Census Bureau (2016); ²indicates U.S. Census Bureau (2015); ³indicates responses to the question, "Please indicate how familiar you were with the USDA definition of Natural prior to this survey on a scale from 1=not at all familiar to 5=extremely familiar"; ⁴indicates participants not familiar with the USDA definition of natural (1, 2, or 3 values on the natural familiarity scale); ⁵indicates participants who were familiar with the USDA definition of natural (4 or 5 values on the natural familiarity scale). Superscript ^aindicates that as evidenced by a t-test, the age of the control not familiar treatment is significantly different from the control and information treatments at the 5% level, and at the 1% level with the control familiar treatment; ^bindicates that as evidenced by a t-test, the age of the control familiar treatment is significantly different from the control and information treatments and the control not familiar treatment at the 1% level.

was then estimated separately for the Familiar and the Not Familiar groups of the control treatment.

Survey Characteristics

The survey received approval from the University of Tennessee Institutional Review Board. A survey pre-test was implemented in February 2016 among 30 undergraduate and graduate students at the University of Tennessee. The final version of the survey was administered online by Qualtrics in June 2016 to beef-eating consumers over the age of 18. Responses were collected from 663 individuals. The control treatment had 332 participants, and the information treatment had 331 participants. The demographics between the control and information treatment were not statistically different as revealed by t-tests (see [table 2](#)). Participants in the control and information treatment were, on average, 40 years of age, 33% had a Bachelor's degree or higher, 45% were female, and the median annual income was between \$40,000 and \$49,000.

The demographics of the "control not familiar treatment" and the "control familiar treatment" were not statistically different from each other or from the information treatment, with the exception of age. The control familiar treatment had a median age of 37 years, while the control not familiar treatment had a median age of 44 years. This, perhaps, indicates that younger people are more conscious food consumers; therefore, they are more cognizant about food labels than older individuals.

Results and Discussion

[Table 3](#) shows the RPL results for the control and information treatment, and the control not familiar treatment and the control familiar treatment.¹ As expected in all treatments, price had a significant and negative impact on consumers' utility, and many of the standard deviation estimates were significant, which implies that there is substantial heterogeneity in consumers' preferences. In the control treatment, consumer utility was positively affected by the grass-fed, no GM feed, no growth hormones, no antibiotics, and natural labels. Meanwhile, in the information treatment, consumer utility was only positively impacted by the grass-fed and no growth hormones labels. Thus, consumers informed about the definitions of natural and organic did not have increased utility associated with the natural label. This result was also apparent in the control familiar treatment. Consumers in the control familiar treatment, who indicated that they were familiar with the USDA definition of natural, only had slightly positive utility associated with the no growth hormones label ($p < 0.10$). In contrast to the control familiar treatment, the control not familiar treatment displayed increased utility for steak carrying labels for no growth hormones, no antibiotics, and natural. Thus, only consumers unfamiliar with the definition of natural had positive utility for natural labeled steak, while consumers familiar with the definition of natural did not have positive utility associated with the natural label.

¹We also estimated a baseline correlated RPL model to investigate how the natural label was correlated with the other attributes. However, our experimental design was specifically created for an interaction model. Thus, the correlated RPL model is not appropriate given our experimental design, and its results did not provide any additional insights to the interaction RPL model presented in this paper.

Table 3 Random Parameters Logit Estimates for the Information and Control Treatments and the Control Not Familiar and Familiar Treatments

	Information Treatment	Control Treatment	Control Not Familiar Treatment ¹	Control Familiar Treatment ²
<i>Random Parameters</i>				
Grass fed	0.581***	0.257**	0.199	0.306
Corn fed	-0.016	-0.192	-0.231	-0.139
No genetically modified feed	0.234	0.295*	0.286	0.237
No growth hormones	0.306**	0.559***	0.661***	0.515*
No antibiotics	0.193	0.389***	0.517***	0.252
Natural	0.308	0.468**	0.583**	0.404
Neither	-4.181***	-4.325***	-4.677***	-4.324***
Natural and grass fed	-0.171	0.132	-0.025	0.364
Natural and corn fed	-0.322	-0.194	-0.265	-0.147
Natural and no GM feed	0.295	-0.059	-0.192	-0.172
Natural and no growth hormones	0.419	-0.070	-0.119	-0.090
Natural and no antibiotics	-0.127	-0.491***	-0.561**	-0.307
<i>Non-random parameter</i>				
Price	-0.336***	-0.384***	-0.464***	-0.283***
<i>Std. dev. of random parameters</i>				
Grass fed	0.752***	0.849***	0.769***	1.135***
Corn-fed	0.620***	0.524***	0.760***	0.812***
No genetically modified feed	1.249***	1.188***	1.554***	0.366
No growth hormones	0.392**	0.417**	0.177	0.705***
No antibiotics	1.177***	0.780***	0.985***	0.765***
Natural	0.432***	0.381***	0.008	0.666***
Neither	2.375***	2.291***	2.166***	2.487***
Natural and grass fed	0.453**	0.596*	0.989***	0.351
Natural and corn fed	1.041***	0.818***	0.721***	0.497
Natural and no GM feed	0.214	0.536**	0.507	0.888*
Natural and no growth hormones	0.267	0.386	0.245	0.543
Natural and no antibiotics	0.407	0.169	0.213	0.287
Participants	331	332	208	124
Observations	3,972	3,984	2,496	1,488
Log-likelihood	-3,205.11	-3,241.96	-1,986.09	-1,203.47
McFadden's Pseudo R-square	0.27	0.26	0.28	0.26

Notes: Asterisks ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively; ¹indicates responders who were not familiar with the USDA definition of natural, and ²indicates responders who were familiar with the USDA definition of natural, respectively, prior the survey.

Consumers in the information and control treatment were willing to pay, on average, \$1.73 ($p < 0.01$) and \$0.67 ($p < 0.05$) more, respectively, for beef labeled as grass fed compared to the unlabeled option, and \$0.91 ($p < 0.05$) and \$1.46 ($p < 0.01$) more, respectively, for beef carrying the no growth hormones label compared to the unlabeled option (see table 4). Consumers in the control treatment were willing to pay \$1.01 ($p < 0.01$) and \$1.22 ($p < 0.05$) more for beef carrying the no antibiotics and natural label, respectively.

Table 4 Willingness to Pay (\$) for the Information and Control Treatments and the Control Not Familiar and Familiar Treatments

	Information Treatment	Control Treatment	Control Not Familiar Treatment ¹	Control Familiar Treatment ²
Grass fed	\$1.73***	\$0.67**	\$0.43	\$1.08
Corn fed	−\$0.05	−\$0.50	−\$0.50	−\$0.49
No GM feed	\$0.70	\$0.77*	\$0.62	\$0.84
No growth hormones	\$0.91**	\$1.46***	\$1.43***	\$1.82*
No antibiotics	\$0.57	\$1.01***	\$1.12***	\$0.89
Natural	\$0.91	\$1.22**	\$1.26**	\$1.43
<i>Label combinations (Interaction terms)</i>				
Natural and grass fed	\$2.13***	\$2.23***	\$1.63***	\$3.80***
Natural and corn fed	−\$0.09	\$0.21	\$0.19	\$0.42
Natural and no GM feed	\$2.49***	\$1.84***	\$1.46***	\$1.66
Natural and no growth hormones	\$3.07***	\$2.49***	\$2.43***	\$2.93***
Natural and no antibiotics	\$1.11*	\$0.96*	\$1.16**	\$1.23

Notes: Asterisks ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively; ¹indicates that participants were not familiar with the USDA definition of natural; ²indicates participants who were familiar with the USDA definition of natural

As previously mentioned, the average market price assumed in this research was \$7.99/pound. Therefore, the \$1.22/pound premium for the natural label equates to a 15.3% premium for “natural” steak. This is consistent with market premiums recorded by the [USDA AMS \(2016\)](#) National Retail Report for branded USDA Choice boneless ribeye steaks. Meanwhile, consumers in the information treatment were not willing to pay statistically more for beef carrying the no antibiotics and natural label. This suggests that consumers who were informed about the USDA definitions of natural and organic did not place a statistically significant premium on the natural label, which is in contrast to consumers who were not given this information. Similarly, while consumers in the control not familiar treatment were willing to pay \$1.26 ($p < 0.05$) more for natural labeled steak, which is a 15.8% premium, consumers in the control familiar treatment were not willing to pay statistically significantly more for natural labeled steak.

Examination of the interaction terms reveals that consumers in the information and control treatments and the control not familiar treatment were willing to pay significantly more for all label combinations except for natural and corn-fed steak. In the control and information treatment, and the control not familiar treatment, consumers most preferred steak that was labeled as natural and no growth hormones. Consumers in the information and control treatment were on average willing to pay \$3.07 ($p < 0.01$) and \$2.49 ($p < 0.01$) more, respectively, for steak labeled as natural and no growth hormones. This results in a market premium for steak carrying natural and no growth hormones labels of 38% in the information treatment and 31% in the control treatment. Consumers in the control familiar treatment were only willing to pay significantly more for the natural and no growth hormones label combination and for the natural and grass fed label combination. Since many of the natural interaction labels were significant in the information treatment and control familiar treatment, this may suggest that

while natural as a standalone label is not valued by these consumers, the natural label is utility-enhancing to these consumers if it is combined with a positively perceived label (e.g., no growth hormones).

The natural label did not enhance the corn-fed label in any treatments since the natural and corn-fed label combination was never found to be significant in any treatment. The natural label was utility-enhancing to the grass fed label in the control not familiar treatment considering that the grass fed label alone was not significant; however, once combined with the natural label it resulted in a \$1.63 ($p < 0.01$) premium compared to the no label option. Similarly, in the control familiar treatment, the grass-fed label and natural label alone were not significant; however, when combined they garnered a \$3.80 premium compared to the no label option ($p < 0.01$). Similarly, the no growth hormones label was only slightly significant ($p < 0.10$) as a standalone label in this treatment; however, when combined with the natural label it was highly significant ($p < 0.01$) with a premium of \$2.93. Again, this supports the hypothesis that consumers who are familiar with the natural definition do not value it as a standalone label, but have a higher WTP for a product that carries this label in combination with other positively-perceived labels.

Summary and Conclusions

Several companies and consumer groups have voiced concerns that the natural label on food products is misleading and should be banned, or at the very least, be redefined (FDA 2015). In light of this, we conducted a consumer choice experiment to examine if natural labeling is misleading to consumers. Specifically, a between-subjects experimental design with two treatments was used to elicit consumer WTP for 12-ounce USDA Choice boneless ribeye steaks labeled as being natural, grass fed or corn fed, fed without GM feed and produced without growth hormones and antibiotics. In the information treatment, consumers were provided with information regarding the USDA definitions of natural and organic. Meanwhile, in the control treatment, participants were not given this information. The control treatment was then split into subgroups that consisted of individuals who were either familiar or unfamiliar with the USDA definition of natural prior to the survey.

Consistent evidence was found that consumers place different values on the natural label when being informed or when familiar with the USDA definition of natural compared to being uninformed or unfamiliar with the definition. For example, consumers uninformed or unfamiliar with the USDA definition of natural were willing to pay \$1.22 and \$1.26 more per pound, respectively, for natural labeled steak. Meanwhile, consumers informed and familiar with the USDA definition of natural were not willing to pay more for natural steak.

When testing for different combinations of the natural label with other labels (e.g., grass-fed), informed and familiar consumers were willing to pay more for the natural label when it was combined with other positively-perceived labels (e.g., grass fed, no growth hormones). This result suggests that while the natural label alone was not utility-enhancing for consumers familiar with the definition of natural, it was value-adding when appearing with other positively-perceived labels. For consumers uninformed and unfamiliar with the definition of natural, the natural label was also highly-valued when combined with the labels for no antibiotics, no GM feed, no growth hormones, and grass-fed.

Results of this research suggest that consumers' WTP for natural labeled beef varies depending on whether consumers are familiar or unfamiliar with the USDA definition of natural. The findings indicate that consumers familiar and informed regarding the USDA definition of natural do not place a premium on natural beef unless the natural label appears together with other positively-perceived labels (e.g., no growth hormones). Meanwhile, consumers uninformed and unfamiliar with the USDA definition of natural were willing to pay more for the natural label as a standalone label and when combined with other positively-perceived labels. Given these results, it seems plausible that the natural label is misleading to consumers who are uninformed and unfamiliar with its meaning given that it can produce inflated WTP for natural labeled products that would not exist if consumers were informed or familiar with the USDA definition of natural.

The implication of our findings and what they suggest seems to point towards the need for policies or initiatives that would educate consumers more about the meaning of the "natural" label. This is an important and urgent issue not just for meat but also for food products in general, given that there have been Citizen Petitions asking the U.S. government (i.e., the FDA) to define the term "natural" for use in food labeling and even to the extent of asking that its use be prohibited on food labels. Some federal courts, as a result of litigation between private parties, have also requested determinations from the FDA regarding which foods can be labeled as natural. A recent nationally-representative Consumer Reports Survey found that more than half of the consumers who seek out products with a "natural" food label search for it under the false belief that the food was produced without GM ingredients, antibiotics, and growth hormones (Rock 2015).

Our findings generally support the hypothesis that consumers are potentially misinformed about the meaning of "natural". Hence, policies or measures that can provide consumers with a readily accessible and easy way (e.g., QR code, website, phone number) to receive further information about the definition of "natural" should be considered. An example is the new federal mandatory GM labeling law (Charles 2016) that stipulates the provision of accurate and scientific information regarding foods to consumers at the point of purchase. While the USDA is considering the implementation of policy regarding the labeling of GM foods, they could also use this opportunity to resolve any confusion that consumers have about other labels such as natural labeling. While beyond the scope of this paper, there should also perhaps be an initiative to make the "natural" labeling policies of USDA and FDA not only transparent but also consistent with each other (i.e., harmonized) since this will likely produce less confusion on the part of consumers.

While we have examined a number of other attributes in relation to natural labels, there could be other factors that might also be interesting to test in relation to natural labeling, and future studies on these would be warranted. Moreover, future studies could also elicit consumers' subjective beliefs (see Lusk et al. 2014) to determine not only how consumers' choices about foods labeled "natural" are influenced by their beliefs but also how an introduction of a more transparent natural labeling policy could subsequently change beliefs not only about natural labeled products but also about unlabeled products. Results from such a study would be of further use for policy and welfare analysis.

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Appendix

Definitions Provided to Survey Participants

USDA Definition of the Label "Natural"

A product containing no artificial ingredient or added color and is only minimally processed. Minimal processing means that the product was processed in a manner that does not fundamentally alter the product. The label must include a statement explaining the meaning of the term natural (such as "no artificial ingredients; minimally processed").

USDA definition of the label "Organic"

Organic agriculture produces products using methods that preserve the environment and avoid most synthetic materials, such as pesticides and antibiotics. USDA organic standards describe how farmers grow crops and raise livestock, and which materials they may use.

Organic farmers, ranchers, and food processors follow a defined set of standards to produce organic food and fiber. Congress described general organic principles in the Organic Foods Production Act, and the USDA defines specific organic standards. These standards cover the product from farm to table, including soil and water quality, pest control, livestock practices, and rules for food additives.



Organic farms and processors:
Preserve natural resources and biodiversity
Support animal health and welfare
Provide access to the outdoors so that animals can exercise their natural behaviors
Only use approved materials
Do not use GM ingredients
Receive annual onsite inspections
Separate organic food from non-organic food