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Alternative Production Practices and the Role of Consumer Choice: Willingness-to-Pay Analyses

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ALTERNATIVE PRODUCTION PRACTICES AND THE ROLE OF CONSUMER CHOICE: WILLINGNESS-TO-PAY ANALYSES

A Master Thesis

Presented to

The Graduate College of

Missouri State University

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science, Agriculture

By

Amanda P. Wecker

May 2020

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ALTERNATIVE PRODUCTION PRACTICES AND THE ROLE OF CONSUMER CHOICE: WILLINGNESS-TO-PAY ANALYSES

Agriculture

Missouri State University, May 2020

Master of Science

Amanda P. Wecker

ABSTRACT

Production choice is often viewed as driven by the resources and methods known to the producers. However, recent discussions focus on the other factors leading to production choice such as consumer preference, measured by factors such as willingness to pay (Tait, Saunders, Guenther, and Rutherford, 2016). This study evaluates the role of diet preference and age in driving a consumer's willingness to pay for food produced with specific method. The data analyzed are from the 2016 U.S. Lifestyles of Health and Sustainability (LOHAS) Consumer survey. A total of 1042 individuals were asked whether they were willing to pay 10% more for food/beverage products which have the following characteristics: GMO Free, USDA Certified Organic, and Antibiotic-Free Meat production methods. The study found consumers who do not eat red meat or have diet with less meat are more likely to be willing to pay 10% more for all three production methods. There are also indications that younger millennials are more likely to pay more for both GMO free and Antibiotic free products, while the Silent and Baby Boomer generations are less likely to pay more for these labels. Similarly, non-white consumers are willing to pay more for organic food products.

KEYWORDS: consumer choice, willingness-to-pay, gmo free, organic, antibiotic free, production choice

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In the interest of academic freedom and the principle of free speech, approval of this thesis indicates the format is acceptable and meets the academic criteria for the discipline as determined by the faculty that constitute the thesis committee. The content and views expressed in this thesis are those of the student-scholar and are not endorsed by Missouri State University, its Graduate College, or its employees.

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INTRODUCTION

Production choice is often viewed as driven by the resources and methods known to the producers. However, recent discussions focus on the other factors leading to production choice such as consumer preference, measured by factors such as willingness to pay (Tait, Saunders, Guenther, and Rutherford, 2016). Six out of ten people are now concerned about what they are eating (Court, 2009) and a big part of that is how it is being produced. Labels are an important way for consumers to get information fast about food. This can include information about origin, nutrition, attributes, and how the food was produced. What exactly the consumer is looking for in those labels can stem from a preference for different production processes, nutritional needs, or a desire for more information overall. According to Hartman (2014) consumers make up their mind about buying a product in approximately the first 90 seconds of looking at it and as such it becomes critical for labels to be clear and concise to be effective.

To better understand how consumer preference effects producer production decisions, first the consumers' perception of Genetically Modified Organism (GMO) Free, USDA Certified Organic, and Antibiotic Free production processes should be understood. Previous studies identify knowledge as the biggest issue in this area (Boccaletti and Moro, 2001). How much does the consumer actually know about GMO, Organic, and Antibiotic Free processes? For example, when it comes to GMOs, they can be used to allow the producer to increase yields by creating a crop resistant to herbicides, pesticides, and disease (United States Department of Agriculture, 2019). However, consumers who are unable to experience the process firsthand may be unsure of its safety and then purchase GMO free products. When considering organic

production, consumers may make the assumption that organic foods are healthier without really knowing how organic foods are produced (Kremen, Greene, and Hanson, 2002).

There have been several studies focusing on what consumers prefer when it comes to food attributes, but very few have been done on why they prefer those attributes. The objective of this study is to explain the relationship between socio-demographic variables and willingness to pay for specific food product characteristics (GMO Free, USDA Certified Organic, and Antibiotic-Free Meat), identify key variables associated with higher (lower) willingness to pay, and provide program and policy guidelines to producers or processors in selecting production systems. A series of probit regressions were used to analyze the relation between the consumer demographics and their willingness-to-pay more for foods produced under these production processes. The likelihood that a given customer will be willing to pay for these attributes can then be identified. Knowing what influences the consumer's choice will give the producer insights into what the consumer prefers, enabling them to choose the production practice that both meets the consumers' needs/wants and maximizes profitable opportunities in their market area.

LITERATURE

The Push for Labeling

Value of Labels. Studies show consumers make up their minds within the first 90 seconds of their initial interactions with both people and products (Hartman, 2014). Labels are one way for the consumer to get information about a product in that short time span. Consumers consult labels to get information about a food product. According to a consumer study on attitudes of food labeling by Court in 2009, the only case in which consumers don't generally consult labels is when purchasing what the consumer would consider 'junk food.' The junk food is already thought to be an unhealthy product by the consumer. This study also found the amount of information and messaging on the label plays a role in consumer attitudes to food labeling. Court identified that when food labels are crowded with messages and information it becomes even more critical for the labels to be detailed, accurate, and honest. The labels should inform the consumer of the nature and characteristics of the product (Court, 2009). Clear labeling allows consumers to be able to read and understand the labels. This then allows consumers to make informed choices.

Hawley, Roberto, Bragg, Liu, Schwartz, and Brownell (2012) reviewed previous studies on front of the package labeling. The review found the credibility of the labeling system to be critical to consumers when they are looking for health and nutrition attributes. This can be achieved through endorsements from both international and national agencies (Hawley et al., 2012). Grolleau and Casewells (2006) evaluated environmental labeling and consumer choice. They found that the market success of eco-friendly products required a mix of both environmental and other verifiable attributes to be considered credible (Grolleau and Casewell,

2006). For a label to be effective the consumers have to have some level of trust in the claim. Riley, Bowen, Krause, Jones, and Stonehouse (2016) evaluated consumer attitudes towards nutrition and health statements on food labels in South Australia. The research found that the less the consumers trust a label, the less likely the label is to influence the purchasing decision (Riley et al., 2016).

Need for more information. Consumers are becoming increasingly interested in the link between health and the food they are consuming as well as the credence of those health attributes of food (Zou and Hobbs, 2010). The survey on consumer's attitudes done by Court (2009) showed that six out of ten people are now concerned about healthy eating. Grolleau and Casewells (2006) found that buying foods produced under specific processes may lead to increased utility for some consumers. Labels are a means for consumers to be able to evaluate the product including the production practices used by looking at the packaging.

When it comes to policies on labeling, an empirical study done by Hemphill and Banerjee (2015) found that there are several arguments both for and against the issue. Proponents for required labeling argue right to choose, religious rights, ethical rights, and right to know. Those against required labeling bring up additional cost for consumers, existing regulation, and possible consumer choice restrictions. It is also argued that in some cases consumers may take it as an implied warning (Hemphill and Banerjee, 2015). The "warning" is a concern to many as it portrays that if that substance/technology is an attribute of the product that it would be unsafe. For example, in cases where a label might say "GMO-Free," the warning would be that GMOs are unsafe.

Producer. For a producer to remain competitive and maximize profit, price for both inputs and outputs must be taken into consideration when choosing a production plan (Levin and

Milgrom, 2004). Consumer demand drives price, therefore the producer also needs to take consumer preference into consideration. Knowing what influences consumers preference will allow farmers and producers to better prepare the production plans and strategies to fit the market in their area.

The findings by Carter and Gruere (2003) on the mandatory labeling of genetically modified foods and consumer choice found that the number one factor in the processors decision to label was consumer demand. This was followed closely by profitability of the processor. (Carter and Gruere, 2003). This importance of the consumer needs above profitability leads to an interesting context in decision-making for business owners as well as producers, but leads to questions of knowledge of products' importance or a warning of products as mentioned by Hemphill and Banerjee (2015).

Hartman (2014) used Akerlof's "Lemons" model and the behaviorist concept of the "nudge" to explain consumers desire to avoid GMOs when analyzing labeling of GMOs. Hartman found that if farmers know that products containing GMOs are going to sell at a lower price, then they adjusted what seed was purchased and planted accordingly (Hartman, 2014).For example, the farmer may choose to either attempt to lower the production cost associated with GMO seed or avoid GMO seeds all together.

Consumer Preferences:

Genetically Modified Organisms. The popularity of seed varieties produced through biotechnology has been increasing since their introduction into the market. These varieties of seeds now make up over 90 percent of U.S. production when it comes to cotton, corn, soybean, sugar beets, and canola (Dodson, 2019). However, along with this growing popularity on the

producer side of things came a growing concern about safety from the consumer side which has sparked a debate about the labeling of GMO products. The overall uncertainty of long-term impacts of the technology drives much of the discussions on all sides of the issue.

The advancements in biotechnology have allowed farmers to produce more efficiently. In many cases they are able to lower overall production costs or achieve higher yields. The development of herbicide tolerant corps and disease resistant crops through bioengineering has improved crop production and made weed control and pest management methods more efficient for the crop industry (United States Department of Agriculture,2019). The USDAs definition of a GMO according to the Agricultural Biotechnology Glossary (2019) is **"**an organism produced through genetic modification**".** The USDA also defines Genetic modification as "the production of heritable improvements in plants or animals for specific uses, via either genetic engineering or other more traditional methods".

Consumer knowledge is a common theme in the literature when it comes to labeling and GMOs are no exception. Boccaletti and Moro (2001) asked respondents questions to gauge overall awareness of the GMO issue in Italy. The study found that consumers had a low level of understanding when it came to GMOs, yet 94% of the consumers wanted it to be labeled (Boccaletti and Moro, 2001). These customers were willing to pay more for different attributes of those GMO products including: longer shelf life, lower pesticide use and improved nutrition. These findings, as well as similar findings in others studies on GMO labeling, have raised concerns that mandatory labeling may cause some consumers to view GMOs negatively and potentially deter them from purchasing them.

Zhang (2013) addressed consumer concerns by using benchmark scenarios. The study found that mandatory labeling does benefit the consumer by easing consumer concerns and

building consumer confidence in the food products. However, this study also found that making the labeling of GMOs mandatory may hurt the perceived safety of the foods for the customer. Zhang found that when it comes to making policies about labeling, while customers do not necessarily look at the details of the research, they still make assumption about the foods based on policy. Delmond, McCluskey, Yormirzoev, and Rogova (2018) did a study on willingness-to-pay for GMO foods in Russia, finding that consumers who were more focused on health are less likely to buy GMO foods, while consumers more focused on income are more likely to buy GMO foods.

Organic. Organic food products have gained a lot of following in recent years and now make up over 4 percent of all U.S. food sales (USDA,2020). According to the USDA market overview, the increasing demand for organic foods is keeping the price premium for them high. A 2002 USDA report by Kremen, Greene, and Hanson on Organic Produce, Price Premiums, and Eco-Labeling in U.S. Farmers' Markets, showed that consumers tend to assume that produce bought at a farmer's market is both fresh and organic, though this is not always the case. Organic farms have to use natural processes and materials for pest and weed management, nutrition for crops, soil, and livestock, and to contribute to conserving "biological diversity" (United States Department of Agriculture, 2015). Under USDA standards, produce can be called organic if it's "certified to have been grown on soil that had no prohibited substances applied for three years prior to harvest" (McEvoy, 2019). As for organic meat, regulations require that "animals are raised in living conditions accommodating their natural behaviors (like the ability to graze on pasture), fed 100% organic feed and forage, and not administered antibiotics or hormones" (McEvoy, 2019). Beyond the basics of what it is to define a farm as organic, there are different specifications of a product's organic ingredients or production methods. The product can be

classified as “100% Organic,” “Organic” “Made with Organic ____,” or have specific listing of organic ingredients (USDA, 2020). For example, a product that is completely organic can be certified as “100% Organic,” but produce or products that have 95% organic methods or ingredients can be certified as “Organic”. There are even classifications for certifications depending where most or a few of the ingredients were produced organically. This adds a level of complexity to the designations and flexibility for producers and processors as well as complicating the level of understanding that consumers have about labels (USDA, 2020).

In a study done by Loureiro and Hine (2002) on discovering niche markets for potatoes using willingness-to-pay, age and education were significant factors in the consumers’ willingness to pay. The older the consumer was, the less likely they were to be willing to pay for organics. On the other hand, the consumer was more willing to pay for organics the as his/her levels of education and income increased (Loureiro and Hine, 2002). A conjoint analysis done by Wanga and Sun (2003) on consumer preference for organic food showed that price of the product was one of the major attributes in the decision to buy for Vermont apple and milk consumers, followed closely by production method. Results from this study also suggested that there is a potential for a niche market for both organic milk and apples, as many consumers will pay more for certified organic products (Wanga and Sun, 2003). Collectively, these studies show that though demand for organics is becoming increasingly popular, there is question as to whether consumers know what the term ‘organic’ actually means. Consumers tend to make assumptions about the production process behind organic foods.

Antibiotic Free. The increasing demand for antibiotic free foods stem from consumer concerns about antibiotic resistance bacteria being transferred from the product to the consumer (Sneeringer, 2015). However, the use of antibiotics in livestock practices has many benefits for

producers. Producers use antibiotics in livestock to keep their animals healthy and to prevent loss due to disease. According to the USDA labeling terms guideline, the antibiotic free label can be used if "sufficient documentation is provided by the producer to the Agency demonstrating that the animals were raised without antibiotics." Some concerns in popular press and previous literature are antibiotic resistance and the overall safety of the antibiotics left in the meat when it is used for human consumption.

Cervantes (2015) conducted a review of articles on antibiotic free poultry production. The article found that although there is little evidence that antibiotic resistance is caused by antibiotics used in 'food-producing animals,' that consumers still believe this to be true. This level of concern about how animals are produced spans into other production methods as well.

In the 2009 study by Umberger, McFadden, and Smith, the consumer's willingness to pay for natural beef was assessed. The study asked consumers to assign a relative level of concern to different areas in regards to production methods. The respondents were asked to break down the comparison so that the combined concern level was equal to 100%. The study found that quality and safety had an average response of 48% for the consumers included in the survey. Potential antibiotic resistance had an average response of 23%. Credence attributes, including no antibiotics, where on average desired the most when taking a closer look at the willingness to pay for attributes (Umberger, McFadden, and Smithd, 2009).

In another study, Thilmany, Umberger, and Ziehl used a cluster analysis to evaluate natural beef consumers attributes. There was evidence to suggest consumers in the United States are most concerned about the safety of hormone and antibiotic use compared to other production practices (Thilmany, Umberger, and Ziehl, 2006). Lusk, Norwood, and Pruitt did a willingness-to-pay study on "antibiotic friendly" pork chops. The consumers were willing to pay on average

70% more for the “antibiotic friendly” chop than the regular pork chop (Lusk, Norwood, and Pruitt, 2006).

Willingness-to-pay

The survey used in this study asked consumers about their level of willingness to pay for food/beverage products with specific characteristics. Consumers were asked to identify their willingness to pay 10% more for those food products that are GMO Free, USDA Certified Organic, and Antibiotic-Free Meat. Willingness to pay refers to how willing a consumer is to pay more or less for a specific product or attribute. This can be completed through survey construction or through experimental auctions. Through a survey, the respondent is asked how willing they are to pay for the product based on a hypothetical scenario (Duflo and Banerjee, 2017). If all individuals in a given group cannot be easily questioned, then a contingent valuation can be done by surveying a population sample on their willingness to pay (Smelser and Baltes, 2001). The concern with this method is the lack of incentive for the consumer. This lack of incentive may cause the consumer to answer the question without putting much thought into it. Another concern is that the consumers may interpret the question differently than the surveyor intended if the question is not precise enough. In order to avoid these concerns, some researchers will use field experiments to get a more accurate demand level (Duflo and Banerjee, 2017).

One form of field experiment is an experimental auction or choice experiment. How an experimental auction is set up will vary depending on the product involved. A panel of consumers may be physically brought in to create a real life setting in which they will then bid on the different products. Conversely, an experimental auction may be completed through a survey. If done right, experimental auctions can provide feedback on both the potential market

prices and consumer demand for the products or product attributes being examined. The concern with physically bringing people in is that the participants may feed off each other's responses. To avoid this the experiment should instruct participants not to speak to each other during the process. This form of willingness-to-pay analysis also offers an incentive to the consumer in the form of cash and/or real-life scenarios (Umberger and Fuez, 2004).

Though there are several methods for evaluating willingness-to-pay. Contingent valuation and choice experiments were the most popular methods among similar studies (Boccaletti and Moro, 2001; Roosen, Lusk, and Fox, 2003; Brooks and Lusk, 2010). Boccaletti and Moro (2001) used contingent valuation to access willingness to pay for GMO foods in Italy. The explanatory variable in their study consisted of monthly income, age, level of education, the consumers self-appointed degree of knowledge, if they had heard of biotechnologies before, and if they knew of GMO foods on the market. Both income and knowledge had a positive effect on willingness to pay across all their models, while education and age showed up with a positive effect only in the model using GMOs providing for less pesticide use. In a study on beef labeling strategies, Roosen, Lusk, and Fox (2003) used stated willingness-to-pay through a mail survey. The variable they looked at in connection to willingness- to pay to-pay included sex, age, education, income, concern about biological hazards, and concern about production technology. Though the demographics were not significant in this study, both biological hazard and production technology concerns where significant factors (Roosen, Lusk, and Fox, 2003).

Brooks and Lusk (2010) used a combination of stated willingness to pay and choice experiments in a study on organic and cloned milk. Cloned milk referred to milk that has been producer from cloned cows. The study gave the consumers a series of choices using whole milk, skim milk, 1% milk, 2% milk, rBST free milk, non-cloned milk, cloned milk, and organic milk. Consumers

where willing to pay more for non-cloned and rBST free milk then the other options (Brooks and Lusk, 2010). The accuracy of the consumer's willingness-to-pay response will ultimately depend on his/her awareness of how willing they actually are to pay more for these attributes. In some cases what the consumer perceived their willingness to pay to be may change once faced with the decision in real life.

METHODS

Model

Willingness-to-pay studies tend to have a discrete structure, leading to the adoption of probit and logit type procedures (Greene, 1990). Harris and Zhao used an ordered probit model in their study to look at consumer consumption of tobacco (Harris and Zhao, 2007). These procedures are used for the analysis of ordered choices that are nonquantitative and categorized replies. Both the logit and probit models are estimation techniques for equations containing binary dependent variables that will avoid the unboundedness problem that occurs with the basic linear probability model. The unboundedness problem occurs when the mean of $\widehat{D_i}$is not bound by 0 and 1, where $\widehat{D_i}$ represents estimated binary responses for an ith individual. Any value outside this meaningful range is not an expressive result (Studenmund,2016). The only difference between probit and logit models is that probit models use a cumulative Gaussian Normal Distribution instead of a logistic function to calculate the probability of being in a particular category (McNelis, 2005). When using the probit model, it is important to test for the goodness of fit. The goodness of fit shows how well the regression model explains the variation in the data. Analyzing the model with R^2, also known as the coefficient of determination, will not tell as much about the fit of the model being analyzed when using binary variables because your models chosen $\widehat{D_i}$ is likely to be very different than actual $D_{i,}$ which is the actual binary response. This is due to the fact that D_i can only be 1 or 0, while $\widehat{D_i}$ is continuous (Studenmund, 2016).

When analyzing the models, some concerns can be raised as to the correlations of the variables being analyzed. To test for correlation, stepwise regressions can be used. Stepwise

regressions allow for the addition of explanatory variables one at a time to see how they impact the model. If a variable is added or removed, and the regression coefficients change drastically that would indicate a correlation issue.

Conceptual Framework

The purpose of this study is to identify and analyze the factors influencing consumers' willingness to pay for foods with GMO Free, USDA Certified Organic, and Antibiotic-Free Meat. In order to understand willingness-to-pay it is important to understand the theoretical concept of consumer utility. Utility is the satisfaction that the consumer gets from the purchase of a product or service. This utility can be modeled as:

$$U = U(z_1, z_2, \dots, z_m) \,, \tag{1}$$

where U represents the consumers utility and z is the attributes of the food products they are buying. The amount of utility a consumer experiences cannot be directly observed. However, the product attributes and consumer demographics are both observable variables. Using a random utility model, we can assume that the consumers utility can be shown as:

$$U_{ai} = V_{ai} + \varepsilon_{ai} \,, \tag{2}$$

where a is the attribute being chosen by the i^{th} consumer, U_{ai} is the utility the consumer gets from that choice, V_{ai} is the observable variables, and ε_{ai} is the unobservable or random variable. Because the unobservable variable (ε) is also unexplainable, we cannot predict the consumers exact choice. Instead, we measure the probability of the consumer to make a given choice. For this study, a ordered probit model is used to predict this probability.

For this study, basic demographic factors were included to evaluate the connection between the consumer characteristics and their level of willingness-to-pay for the attributes evaluated. These demographics were chosen based on the previous literature and findings described in the literature review. These basic socio-demographics included characteristics such as income (Delmond, McCluskey, Yormirzoev, and Rogova, 2018) (Loureiro and Hine, 2002), age (Loureiro and Hine, 2002) (Boccaletti and Moro, 2001), and education (Loureiro and Hine, 2002) (Boccaletti and Moro, 2001). Other demographic characteristics were identified through the process of model development and evaluation of factors available from the survey.

For the purposes of this study, age was converted into generational groups. The generational breakdown used in this study are based on data provided by Pew Research Center (2019) and are as follows: Silent Generation (73-90), Baby Boomers (54-72), Generation X (38-53), Older Millennials (30-37), Younger Millennials (22-29), and Generation Z (0-21). According to Pew Research Center (2019), grouping people together based on age can allow the researcher to understand how different influential experiences have formed peoples attitude toward the world. One way to break age down is through generation. Research has shown that there is a generational gap within the millennial generation caused by a number of factors including the great recession and life stage (The Center for Generational Kinetics, 2020). Using this reasoning, the decision was made to spilt the millennial generation for this study.

For the model, let Z_i denote consumer i's likelihood of willingness to pay 10% more for foods that are identified as GMO Free, USDA Certified Organic, or Antibiotic-Free Meat. To understand what drives a consumer's willingness to pay it is important to explore the characteristics that make up that consumer. Therefore, in this model Z_i is a function of the i^{th} consumers' basic demographic characteristics as follows:

$$Z_i = \boldsymbol{\beta}'\boldsymbol{X} + \nu_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik} + \nu_i, \quad \forall \text{ i} = 1, 2, \ldots, \text{n} \tag{3}$$

where, x represents the explanatory variables, x_{ij} denotes the j^{th} characteristic of the i^{th} respondent $\boldsymbol{\beta} = (\beta_0, \beta_1, \ldots, \beta_k)$ represents the parameter vector that is to be estimated and ν is the error term. Consumer i's willingness to pay for foods with GMO Free, USDA Certified Organic, and Antibiotic-Free Meat can be modeled in terms of the level of willingness-to-pay (Z_i) as follows with the threshold values denoted as Mu (μ). Consumer i will be *very willing* to pay more if Z_i is lower than some threshold negative value (i.e., $Z_i \leq -\mu_1$), *somewhat willing* to pay more if Z_i is negative but greater than $-\mu_1$, *neither willing nor unwilling* to pay more if Z_i is positive but lower than some threshold positive value (i.e., $0 \leq Z_i \leq \mu_2$), *not very willing* to pay more if Z_i is greater than μ_2 but less than μ_3 and *not at all willing* to pay more if Z_i is greater than μ_3. Formally, consumer i's attitude towards food biotechnology (denoted by Y_i where Y = 1 implies *very willing*, Y = 2 implies *somewhat willing*, Y = 3 implies *neither willing nor unwilling*, Y = 4 implies *not very willing,* and Y = 5 *implies not at all willing)* can be expressed in probability terms as follows:

$$\begin{aligned}
&P(Y_i = 1) = P[Z_i \leq -\mu_1)], \\
&P(Y_i = 2) = P[-\mu_1 < Z_i \leq 0)], \\
&P(Y_i = 2) = P[0 < Z_i \leq \mu_2)], \\
&P(Y_i = 4) = P[\mu_2 < Z_i \leq \mu_3], \text{ and} \\
&P(Y_i = 5) = P[Z_i > \mu_3],
\end{aligned} \tag{4}$$

Assuming that the error terms in equation (3) follows the standard normal distribution, the above model defers to the well-known ordered probit model. In this study, the probabilities that Y_i = 1, 2, 3, 4, and 5 are given by:

$$P(Y_i = 1) = \Phi(-\mu_1 - \boldsymbol{\beta}'\mathbf{X_i}),$$

$$P(Y_i = 2) = \Phi(-\boldsymbol{\beta}'\mathbf{X_i}) - \Phi(-\mu_1 - \boldsymbol{\beta}'\mathbf{X_i}),$$

$$P(Y_i = 3) = \Phi(\mu_2 - \boldsymbol{\beta}'\mathbf{X_i}) - \Phi(-\boldsymbol{\beta}'\mathbf{X_i}), \quad (5)$$

$$P(Y_i = 4) = \Phi(\mu_3 - \boldsymbol{\beta}'\mathbf{X_i}) - \Phi(\mu_2 - \boldsymbol{\beta}'\mathbf{X_i}), \text{ and}$$

$$P(Y_i = 5) = 1 - \Phi(\mu_3 - \boldsymbol{\beta}'\mathbf{X_i})$$

where Φ is the cumulative function of the standard normal distribution. This model is chosen because the dependent variable is discrete in nature and has a natural ordering. The $\boldsymbol{\beta}$-vector and the μ's can be jointly estimated using the maximum likelihood (ML) procedure which yields consistent and asymptotically efficient estimators. The marginal effects of the independent variables can be estimated using the estimated coefficients of the model (Greene, 2002). The interpretation of the coefficient then becomes the direction in which the latent variable moves under the influence of the regressor (Econometrics Academy, 2013). When using probit models, the sample size must be large for hypothesis testing to be meaningful (Studenmund, 2016).

The following empirical model is used to estimate the relation between the consumers' willingness to pay for GMO free, Certified Organic, and Antibiotic-Free Meat, and demographic characteristics:

$$\begin{aligned} LEVEL\_WTP_i = {} & \beta_0 + \beta_1 CHILD + \beta_2 ADULTS + \beta_3 GENDER + \\ & \beta_4 SILENTGEN + \beta_5 BBOOM + \beta_6 GENX + \beta_7 MILLENO + \\ & \beta_8 MILLENY + \beta_9 WEST + \beta_{10} ETHNIC + \beta_{11} EDU1 + \beta_{12} EDU2 + \\ & \beta_{13} EDU3 + \beta_{14} INCOME1 + \beta_{15} INCOME2 + \beta_{16} INCOME3 + \\ & \beta_{17} DIET1 + \beta_{18} DIET2 + \beta_{19} DIET3 + \nu \end{aligned} \quad (6)$$

where:

LEVEL_WTP = 1 if the respondent is not at all willing to pay more for the given attribute, 2 if the respondent is not very willing to pay more, 3 if the respondent is neither willing nor

unwilling to pay more, 4 if the respondent is somewhat willing to pay more, and 5 if the respondent is very willing to pay for the attribute.

i = GMO Free (GMOF), USDA Certified Organic (ORG), or Antibiotic-Free Meat (ANTIF)

CHILD = number of children under the age of eighteen in the home

ADULTS = number of adults over eighteen in the home

GENDER = 0 if male and 1 if female

SILENTGEN = 0 for Silent Generation (73-90) and 1 if otherwise

BBOOM = 0 for Baby Boomer (54-72) and 1 if otherwise

GENX = 0 if Generation X (38-53) and 1 if otherwise

MILLENO = 0 if Older Millennial (30-37) and 1 if otherwise

MILLENY = 0 if Younger Millennial (22-29) and 1 if otherwise

WEST = 0 if identified as western region of the U.S. and 1 if otherwise

ETHNIC = 0 if white and 1 if otherwise

EDU1 = 0 if achieved Highschool diploma equivalent or less and 1 if otherwise

EDU2 = 0 if attended some college but no degree and 1 if otherwise

EDU3 = 0 if achieved undergraduate degree and 1 if otherwise

INCOME1 = 0 if 2016 household income was $34,999 or less and 1 if otherwise

INCOME2 = 0 if 2016 household income was between $35,000-$74,999 and 1 if otherwise

INCOME3 = 0 if 2016 household income was between $75,000-$149,999 and 1 if otherwise

DIET1 = 0 if respondent identified with a vegan or vegetarian diet and 1 if otherwise

DIET2 = 0 if the respondent did not eat red meat and 1 if otherwise

DIET3 = 0 if the respondent was consciously cutting back on red meat consumption and 1 if otherwise

Data. The data used for this analysis came from the 2016 U.S LOHAS (Lifestyles of Health and Sustainability) Consumer trends database survey. It was a nationwide survey sent out by NMI marketing research department to a panel of around 4,000 households. The data in this survey is cross-sectional, meaning it looked at one point in time. Consumers where first asked a

series of questions about their general demographics including, but not limited to, household income, number of children in the home, education level, and zip code. This was followed by a series of questions about their emotions and habits toward curtain food products, knowledge about food product issues, and willingness- to-pay for specific food products. This study focuses on the demographics, consumer diet preferences, and willingness to pay portions of this survey. For this study, a subset of 1,042 households was randomly selected from the original panel surveyed.

The dependent variable for the empirical models in this study is the consumers' willingness to pay 10% more for food products with specific production process. Respondents where asked to rate their willingness to pay more for: (1) products certified as GMO-free; (2) products which are USDA Certified Organic; and (3) Antibiotic-free Meat. The respondents rated their willingness to pay by choosing either "very willing," "somewhat willing," "neither willing nor unwilling," "not very willing," or "not at all willing". The dependent variable, LEVEL_WTP, was defined by assigning a value of 1 if they were "very willing," 2 if the respondent was "somewhat willing," 3 if the respondent was "neither willing nor unwilling," 4 if the respondent was "not very willing," and 5 if the respondent was "not at all willing,"
The explanatory variables used in these models to explain the consumers' willingness to pay 10% more for GMO free, Certified organic, and Antibiotic-free Meat attributes include their sociodemographic characteristics. The CHILD and ADULT variables are simply the number of each in the home. The generation, education, income, and diet variables where originally categorical, but where recoded into binary or dummy variables for the analysis. The GENDER variable was also a binary variable (male or female). The description of the variables and the descriptive statistics are in Table 1.

EMPIRICAL RESULTS AND DISCUSSION

The objective of this study is to explain the relationship between socio-demographic variables and willingness to pay for specific food product characteristics (GMO Free, USDA Certified Organic, and Antibiotic-Free Meat), identify key variables associated with higher (lower) willingness to pay, and provide program/policy guidelines to producers/processors in selecting production choices. Three ordered probit models were estimated to identify the factors driving the consumers' willingness to pay 10% more for GMO Free, USDA Certified Organic, and Antibiotic-Free Meat using SPSS software. The coefficients for these models where obtained and analyzed to assess the impact each explanatory variable has on a consumer's willingness to pay 10% more. The likelihood of each level of willingness to pay is shown in Table 2. The estimated coefficients, standard error, and marginal effects of the explanatory variables are shown in tables 3 through 8. These tables also report the McFadden R^2 and Chi-Squared values.

Table 2 shows the predicted probability of a given consumer to fall in each of the five willingness-to-pay levels based on the mean values of the explanatory variables. According to the model consumers are more likely to pay 10% more for Antibiotic-Free Meat than for organic or GMO-free food products. As shown in Table 2, consumers are nearly 48% likely to pay 10% more for Antibiotic-Free Meat, 43% likely to pay 10% more for certified organic food, and 39% likely to pay 10% more for GMO free food.

GMO Free Results and Discussion

When looking at willingness-to-pay for GMO free foods it is important to note that 171 (18%) of the respondents are very willing to pay more, 179 (19%) are somewhat willing, 303 (32%) are neither willing nor unwilling, 103 (11%) are not very willing, and 179 (19%) not at all willing to pay more. Table 3 presents the estimated coefficients and model statistics. The results show that MILLENY is significant at a 5% level with a positive effect. The diet characterizations of DIET2 and DIET3 also show a positive effect, but at a 1% level. The number of adults in the household expressed in the ADULTS variable is also significant and positive at the 1% level. This suggests that younger millennials (age 22-29), consumers who do not eat red meat or are cutting back on red meat, and respondents with a greater number of adults in the home are more likely to be willing to pay more for food products that are GMO free. Both generation variables SILENTGEN and BBOOM are also significant at a 5% level, but these variables express a negative effect. This suggests that both the Silent and Baby Boomer generations are less likely to pay more for GMO-Free foods. The McFadden statistic for this model is 0.048 and the Chi-Squared statistic is 140.115.

Table 4 shows the marginal effects of each significant characteristic on all five levels of willingness-to-pay. The tables indicate that the Silent Generation is 17% less likely to be willing to pay 10% more and Baby Boomers are 14% less likely to be willing to pay 10% more for GMO Free foods compared to other generations. When considering the variables with positive effects in the model estimation, Young Millennials are 15% more likely to be willing to pay 10% more for GMO Free foods compared to other generations. When it comes to diet, consumers with no red meat in their diet are 36% more likely to be willing to pay 10% more for GMO Free foods compared to the other diet preferences. Consumers with limited red meat in their diet are 16% more likely to be willing to pay 10% more for GMO Free foods compared to other diet

preferences. For each adult in the home, the likelihood that the respondent is willing to pay 10% more for GMO Free foods only goes up by 3%.

These results highlight the value that the younger generation places on GMO Free products and the production practice. Further, it shows that as consumers make decisions to limit red meat or remove red meat from their diets, they see value in the production of their food without GMOs through recognition of the GMO-free attributes. This finding correlates with previous studies such as Delmond, McCluskey, Yormirzoev, and Rogova (2018). Their study found that consumers focused on health are less likely to buy GMO foods. One could view that if given the chance those individuals would be willing to pay more for those foods specified as non-GMO. It is interesting to note that income and education were not significant in this model as they were in previous studies such as Boccaletti and Moro (2001). In regards to education, it is important to note that this survey did not allow for analyzing the level of knowledge or understanding about the definition of GMO Free or any characteristics of the different types of GMO foods that can be found in the store or food markets. This could account for a differing of results from previous studies as the survey of this study kept the concept broad and did not address a consumer's knowledge about the product/process.

USDA Certified Organic Results and Discussion

When looking at willingness-to-pay for USDA Certified Organic food, 173 (19%) of the respondents are very willing to pay more, 213 (23%) are somewhat willing, 278 (30%) are neither willing nor unwilling, 102 (11%) are not very willing, and 169 (18%) are not at all willing to pay more. Estimated coefficients and other statistics for this model are shown in Table 5. The results show that variables DIET2, DIET3, and ADULTS are significant at the 1% level

and have a positive effect on willingness to pay. This suggests that consumers who do not eat red meat or are cutting back on red meat consumption, and respondents with more adults in the home are more likely to be willing to pay more for USDA Certified Organic foods. The generation variables of SILENTGEN and BBOOM were significant in this analysis at the 1% level but express a negative effect. When considering this model of willingness-to-pay for organic products, INCOME1 is significant at a 5% level with a negative effect. This suggests that consumers with a household income of $34,999 or less, the Silent Generation, and Baby Boomer Generation are less likely to pay more for food products that are USDA Certified Organic. The McFadden statistic for this model was 0.050 and the Chi-Squared statistic was 144.992.

Table 6 presents the marginal effects of each significant characteristic on all five levels of willingness-to-pay for USDA Certified Organic foods. In this analysis, the Silent Generation is 21% less likely to be willing to pay 10% more and Baby Boomers are 18% less likely to be willing to pay 10% more for USDA Certified Organic food compared to other generations. When looking at diet, consumers with no red meat in their diet are 33% more likely to be willing to pay 10% more for USDA Certified Organic food compared to the other diet preferences. Consumers with limited red meat in their diet are 18% more likely to be willing to pay 10% more for USDA Certified Organic food compared to other diet preferences. For each adult in the home, the likelihood that the respondent is willing to pay 10% more for USDA Certified Organic foods goes up by 5%. Also, consumers with a household income of less than $35,000 are 13% less likely to pay 10% more for USDA Certified Organic food than other income levels.

These results highlight the value of organic production through a consumer's willingness to pay more for that product attribute when that consumer is changing diet by limiting or removing red meat just as with GMO Free foods. These findings support previous research in

that consumers are increasingly interested in the link between health and the food they are consuming (Zou and Hobbs, 2010). When considering who is willing to pay more, Brooks and Lusk (2010) found when evaluating organic milk production, that while consumers preferred organic milk to a non-organic option that they disliked price increases. They found that consumers were willing to pay a $1.51 premium for organic milk (Brooks and Lusk, 2010, p.8). However, this contradicts our results as we found that the older generations are less likely to be willing to pay more for the food. It is likely that the specific attributes connected to a specific product may have a more significant impact in willingness-to-pay for USDA Certified Organic foods than just the general perception of all organic foods. This fact combined with the significance of the lower income bracket being less willing to pay more creates the impression that the perceived value for this attribute is considered but is not the overarching driver for purchasing USDA Certified Organic food. Individuals living on fixed incomes, such as those in older generations drawing on retirement accounts and/or social security might fit into this scenario and could account for their unwillingness to pay 10 more for USDA Certified Organic food as found by this study. It is again worth noting that consumers in this survey were not asked questions about their knowledge or understanding of the labeling requirements for organic certification or about the accepted practices for a food that is labeled as such.

Antibiotic-Free Meat Results and Discussion

When looking at willingness-to-pay for Antibiotic-Free Meat 212 (23%) of the respondents are very willing to pay more, 226 (24%) are somewhat willing, 253 (27%) are neither willing nor unwilling, 81 (9%) are not very willing, and 163 (17%) not all willing to pay more. Estimated coefficients and other statistics for this model are shown in Table 5. The results

show that variables estimating DIET2, DIET3, and ADULTS are significant at a 1% level and have a positive effect. This suggests that consumers who do not eat red meat or are cutting back on red meat, and respondents with more adults in the home are more likely to be willing to pay more for food products with Antibiotic-Free Meat. Younger Millennials represented by the MILLENY variable has a positive and significant effect at the 5% level. This highlights the younger generation's willingness to pay 10% more for Antibiotic-Free Meat. GENDER is significant at a 10% level with a negative effect, while EDU3 also expresses a negative effect but at a 5% level. This suggests that male consumers and consumers who have an undergraduate degree are less likely to pay more for Antibiotic-Free Meat. The McFadden statistic for this model was 0.035 and the Chi-Squared statistic was 102.553.

Table 8 presents the marginal effects of each significant characteristic on all five levels of willingness-to-pay. Young Millennials are 17% more likely to be willing to pay 10% more for Antibiotic-Free Meat compared to other generations. When looking at diet, consumers with no red meat in their diet are 25% more likely to be willing to pay 10% more for Antibiotic-Free Meat compared to the other diet preferences. Consumers with limited red meat in their diet are 16% more likely to be willing to pay 10% more for Antibiotic-Free Meat compared to other diet preferences. For each adult in the home, the likelihood that the respondent is willing to pay 10% more for Antibiotic-Free Meat only goes up by 4%. Education is unique to this attribute in that a consumer with a college degree (Associates or Bachelors) is 10% more likely to pay 10% more for Antibiotic-Free Meat when compared to other education levels.

These results highlight the value that consumers can place on Antibiotic-Free Meat. As found in the earlier analysis for other production methods, diet preferences play a significant role in a consumer's willingness to pay. When a consumer is actively changing his or her diet by

limiting or removing red meat, they take an active approach to selecting meats that are promoted as antibiotic free. The younger generation also sees value in this attribute and is willing to pay 10% more for it. This finding correlates with the findings in previous studies. Brooks and Lusk (2010) evaluated additives into the milk production process by analyzing a consumer's willingness to pay for rbST-free milk products. This hormone can be given to milk cows to increase milk production. The study found that consumers were willing to pay $1.46 more for milk that was rbST-free (Brooks and Lusk, 2010, p8). There is likely a correlation in consumers preference such that if they do not approve of hormone use they will not approve of antibiotic use.

It is interesting to note in this model that having an education actually decreases the likelihood of being willing to pay more for antibiotic free. Boccaletti and Moro (2001) found that education can increase contingent valuation of a product when a specific attribute is considered for that food or beverage product in comparison to generalized characterizations of food attributes. In that regards, it might be expected that specifically removing the antibiotics from the production of the food or beverage would increase the value of the product. Yet, that is not the case in this study. This is an interesting find and could lead to the discussion about the role of education in passing on knowledge about what technology or increased trust in the food system. As knowledge and understanding of these attributes were not part of the study, we cannot say this for a fact. It is important to note that all food products produced for human consumption are guaranteed to be antibiotic free by the USDA. Much of the debate in this production method rests on if the animal has ever been given antibiotics. It could be that the confusion of the production method is less when an individual has a college undergraduate degree.

CONCLUSION

As identified in the previous research, consumers demand to know what is in their food and how it is being produced continues to be important and that demand for more information is growing. As such food production methods that lead to specific food attributes are increasingly important. Therefore, it is important for producers to choose the production practices that meet food attribute demands, especially in their local markets. In the past, the producers used the resources and methods they have always known to make production choices. Now producers recognize the need to understand their consumer a little bit more.

This study evaluated the role that the consumers' demographics play in driving a consumer's willingness to pay for food produced under specific methods. Among the three attributes explored in this study, Antibiotic-Free meat had the highest likelihood (48%) of consumers being willing-to-pay more to some degree. This observation makes us take a closer look at the differences between the production methods. Upon closer evaluation there are a couple of facts that come to the forefront and could explain this. Antibiotic-free methods of production are directly connected to the health and safety of the animal while having a human connection in concerns with antibiotic resistance. This concern could create a value that consumers are willing to pay more for when making purchasing decisions. There is also the consideration of antibiotic free being a relatively new media trend of the three production methods. Customers could have a better understanding of GMO free and organic technologies and production methods, so the price they are willing to pay accounts is thereby adjusted.

This study found indications of several driving factors for consumer willingness to pay 10% more for GMO free, USDA Certified Organic, and Antibiotic-Free Meat. The main factors

this study found that drive a consumer's willingness to pay in all three attributes studied are the number of adults in the house, diet and generation. In all three analyses, the number of adults increased likelihood of a consumer's willingness to pay 10% more for that attribute. It is important to recognize that there could be a few factors driving this. As previous studies highlighted income is significant in a consumer's willingness to pay. It could be that there is a correlation between income and number of adults and that the number of adults drives the income consideration in this study. However, it is important to recognize that in some instances where there are more adults in the house, the buyers of the household also serve as caregivers for the others, making health and nutritional decisions where health and antibiotic resistance are a larger concern.

Individuals who are actively limiting or removing red meat from their diets were willing to pay more for all three attributes evaluated in this study. Consumers continue to be conscious of health attributes of their foods and take an active role in identifying practices that will lead to a more healthful meal. As this occurs, it will continue to be more critical for producers to take an active role in staying in touch with consumer trends and needs as well as conveying the healthy attributes of the food that they are providing. This study also highlights the importance of understanding consumers and their differing needs. This study showed that while younger millennial (age 22-29) consumers were willing to pay more for the attributes, in two cases the older generations were found to actually be less likely to be willing to pay more. As producers take a more direct approach in marketing, this gives them guidance as to what they can expect and use as marketing tools going forward. Targeted marketing as such could provide them the opportunity to meet the needs of the consumer and create promotional marketing situations in some cases. Yet producers should also consider, as found in previous studies such as Wanga and

Sun (2003), that price of food can be a driving factor in consumer choice even given potentially beneficial attributes. Therefore, producers will need to evaluate if the premiums paid will cover the increased costs of production.

One major limitation of this study was in the inability to evaluate the consumers understanding of what the food attribute means in connection to the production practice or even the role that labeling has on consumers' willingness to pay more. This limitation was brought to the forefront in the Antibiotic-Free Meat analysis. It showed that education, such as having a college degree, changed the consumers' willingness to pay. As the consumer is often generations removed from the farm, the accurate education of what goes into their foods becomes even more critical. Labeling can become even more important to a consumer understanding what he or she is eating. When a consumer is more aware, through education, they can make more informed decisions for their families. Further study into this education component and how to reach those generations willing to pay more could help producers to understand what value is placed on the production methods they have chosen.

These results hold true in the case of different methods of food production and trends in consumer consumption including plant-based meat alternatives. The drive for these different alternatives comes from millennials and people who have specific diet needs or prefer to make alternative diet choices. These diet needs can span from not being able to eat meat, or just a preference for less meat. Whatever the consumers reasoning behind their demand, it can be shown that both generation and diet are playing a role in their ultimate willingness to pay. All three of these production practices provide numerous benefits for producers, but how they are perceived by consumers is just as important. The insight from this study into what drives the consumers' willingness to pay for these attributes gives producers another tool to help them

choose the most profitable production practice by meeting the consumers' demands for that particular market area.

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Table 1: Descriptive Statistics

Variable Name	Description	Mean	Standard Error
Gender	0= Male, 1= Female	0.5444	0.0163
Silent Generation	0= Between the ages of 73-90, 1= Otherwise	0.9476	0.0073
Baby Boomers	0= Between the ages of 54-72, 1= Otherwise	0.6107	0.016
Generation X	0= Between the ages of 38-53, 1= Otherwise	0.7615	0.0139
Older Millennials	0= Between the ages of 30-37, 1= Otherwise	0.8738	0.0109
Younger Millennials	0= Between the ages of 22-29, 1= Otherwise	0.8481	0.0117
Generation Z*	0= 21 or younger, 1= Otherwise	0.9583	0.0065
Western Region	0= Lives in Western Region of the US, 1= Otherwise	0.6225	0.0159
Children	Number of children under 18 in the home	0.5572	0.034
Ethnicity	0= White, 1= Otherwise	0.2096	0.0133
Education 1	0= Highschool or less, 1= Otherwise	0.662	0.0155
Education 2	0= Some College, 1= Otherwise	0.7861	0.0134
Education 3	0= Undergraduate Degree, 1= Otherwise	0.6888	0.0151
Education 4*	0= Graduate School, 1= Otherwise	0.8631	0.0112
Income 1	0= Less than $34,999, 1= Otherwise	0.6663	0.0154
Income 2	0= Between $35,000 - $74,999, 1= Otherwise	0.6503	0.0156
Income 3	0= Between $75,000 - $149,999, 1= Otherwise	0.7455	0.0143
Income 4	0= $150,000 or more, 1= Otherwise	0.939	0.0078
Diet 1	0= Vegan or Vegetarian, 1= Otherwise	0.9786	0.0047
Diet 2	0= No Red Meat Diet, 1= Otherwise	0.9401	0.0078
Diet 3	0= Modified Red Meat Diet, 1= Otherwise	0.6364	0.0157
Diet 4*	0= Not Consciously Cutting Red Meat, 1= Otherwise	0.4449	0.0163
Adults	Number of adults in the home	2.1144	0.0352

*Variable dropped from model as required for method of regression

Table 2: Predicted Probabilities for the Levels of Willingness-to-pay

Level of Willingness-to-pay	**GMO Free**	**Certified Organic**	**Antibiotic- Free Meat**
Pr (y = 1 | x)	0.158	0.142	0.153
Pr (y = 2 | x)	0.11	0.106	0.086
Pr (y = 3 | x)	0.348	0.319	0.285
Pr (y = 4 | x)	0.209	0.25	0.256
Pr (y = 5 | x)	0.176	0.182	0.22

° 1=Not at all willing, 2=Not very willing, 3=Neutral, 4=Somewhat willing, 5= Very willling

Table 3: GMO free Regression Results

Variable Name	Coefficient Estimate	Standard Error
Gender	-0.002	0.074
Silent Generation	-0.511**	0.238
Baby Boomers	-0.369**	0.188
Generation X	-0.191	0.194
Older Millennials	0.088	0.205
Younger Millennials	0.383**	0.199
Western Region	-0.091	0.073
Ethnicity	-0.084	0.09
Education 1	0.051	0.128
Education 2	0.078	0.13
Education 3	-0.09	0.119
Income 1	-0.153	0.166
Income 2	0.014	0.16
Income 3	-0.081	0.159
Diet 1	0.349	0.245
Diet 2	0.939***	0.158
Diet 3	0.418***	0.076
Adults	0.092***	0.036
Children	0.026	0.037
McFadden	0.048	
Chi-Square	140.115	

Significance Level: *10%, **5%, ***1%

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Table 4: GMO free Marginal Effects

Level of WTP°	Silent Generation	Baby Boomers	Young Millennials	Diet 2: No red meat	Diet 3: Limited red meat	Number of Adults
Pr (y=1)	0.156*	0.09717*	-0.08487**	-0.15186***	-0.10026***	-0.02336**
Pr (y=2)	0.03438***	0.0304**	-0.0341*	-0.07867***	-0.03619***	-0.00789**
Pr (y=3)	-0.019	0.00857*	-0.030	-0.1299***	-0.02257***	-0.0034*
Pr (y=4)	-0.07329**	-0.04883*	0.0422**	0.04967***	0.05041***	0.01196**
Pr (y=5)	0.09835***	-0.0873**	0.1064*	0.31076***	0.10861***	0.02269**

° 1=Not at all willing, 2=Not very willing, 3=Neutral, 4=Somewhat willing, 5= Very willing

Significance Level: 10%*, 5%**, 1%*

Table 5: USDA Certified Organic Regression Results

Variable Name	**Coefficient Estimate**	**Standard Error**
Gender	-0.044	0.074
Silent Generation	-0.597***	0.238
Baby Boomers	-0.455***	0.188
Generation X	-0.26	0.194
Older Millennials	0.016	0.205
Younger Millennials	0.253	0.199
Western Region	0.002	0.073
Ethnicity	-0.138	0.09
Education 1	-0.046	0.128
Education 2	0.011	0.13
Education 3	-0.1	0.118
Income 1	-0.337**	0.166
Income 2	-0.241	0.16
Income 3	-0.213	0.159
Diet 1	0.339	0.244
Diet 2	0.86***	0.157
Diet 3	0.446***	0.076
Adults	0.115***	0.036
Children	0.007	0.037
McFadden	0.05	
Chi-Square	144.992	

Significance Level: *10%, **5%, ***1%

Table 6: USDA Certified Organic Marginal Effects

Level of WTP°	Silent Generation	Baby Boomers	Income 1: Less than $35,000	Diet 2: No red meat	Diet 3: Limited red meat	Number of Adults
Pr (y=1)	0.18055**	0.11533**	0.08609*	-0.13599***	-0.10147***	-0.02775***
Pr (y=2)	0.041***	0.0389***	0.02904**	-0.07437***	-0.04019***	-0.01029***
Pr (y=3)	-0.015	0.01822***	0.01308**	-0.11938***	-0.03218***	-0.00644***
Pr (y=4)	-0.09634**	-0.0655**	-0.04932*	0.04877***	0.05701***	0.01609***
Pr (y=5)	-0.11053***	-0.10695**	-0.07889**	0.28098***	0.11682***	0.02839***

° 1=Not at all willing, 2=Not very willing, 3=Neutral, 4=Somewhat willing, 5= Very willing

Significance Level: 10%*, 5%**, 1%*

Table 7: Antibiotic-Free Meat Regression Results

Variable Name	**Coefficient Estimate**	**Standard Error**
Gender	-0.135*	0.074
Silent Generation	-0.279	0.237
Baby Boomers	-0.182	0.188
Generation X	-0.101	0.194
Older Millennials	0.192	0.205
Younger Millennials	0.425**	0.199
Western Region	-0.051	0.073
Ethnicity	-0.047	0.09
Education 1	-0.162	0.129
Education 2	-0.17	0.131
Education 3	-0.261**	0.119
Income 1	-0.114	0.166
Income 2	-0.037	0.16
Income 3	-0.075	0.159
Diet 1	-0.07	0.243
Diet 2	0.674***	0.157
Diet 3	0.396***	0.076
Adults	0.096***	0.036
Children	0.019	0.038
McFadden	0.035	
Chi-Square	102.553	

Significance Level: *10%, **5%, ***1%

Table 8: Antibiotic-Free Meat Marginal Effects

Level of WTP°	Young Millennials	Education 3: College Degree	Diet 2: No red meat	Diet 3: Limited red meat	Number of Adults
Pr (y=1)	-0.08803**	-0.06619**	-0.11745***	-0.0907***	-0.02322***
Pr (y=2)	-0.03185**	-0.01876**	-0.04875***	-0.02931***	-0.00709***
Pr (y=3)	-0.04826*	-0.01785**	-0.09201***	-0.03682***	-0.00782**
Pr (y=4)	0.03136***	0.03023**	0.02455**	0.03747***	0.01031***
Pr (y=5)	0.13679**	0.07257**	0.23367***	0.11935***	0.02783***

° 1=Not at all willing, 2=Not very willing, 3=Neutral, 4=Somewhat willing, 5= Very willling

Significance Level: 10%*, 5%**, 1%*