# Consumer Beliefs, Knowledge, and Willingness-to-Pay for Sustainability-Related Poultry Production Practices
## *Egg Survey Report*

Prepared for the Food Marketing Institute Foundation, Animal Agriculture Alliance, and the Foundation for Food and Agriculture Research

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January 1, 2018

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# EXECUTIVE SUMMARY

The purpose of this project is to determine market potential and consumer willingness-to-pay for eggs with different labels, with primary focus on cage free. In November 2017, a national survey of over 2,000 U.S. egg consumers was conducted. A choice experiment, which simulates retail purchases, was included to compare cage free egg demand for consumers exposed to different types of information. The core findings of this study are as follows.

- There is a high degree of heterogeneity in willingness-to-pay for cage free eggs. When provided no additional information, choices imply half of consumers are willing to pay no more than a $0.30/dozen premium for cage free eggs; however, the mean premium is $1.16/dozen, suggesting a small fraction of consumers are willing to pay sizeable amounts for the cage free label. Almost 60% of consumers have a willingness-to-pay for cage free less than $0.40/dozen, but 33% have a value greater than $1.00/dozen.
- If presented with a pair-wise choice between cage free and unlabeled eggs that are identical in all other respects, cage free market shares are projected to be 64%, 45%, and 33% when the per-dozen premium for cage free is $0.00, $0.50, and $1.00, respectively. If cage free eggs are brown and conventional eggs are white and carry natural and omega 3 labels, the projected market share for cage free eggs is 41%, 31%, and 26% when the premium for cage free is $0.00, $0.50, and $1.00 per dozen, respectively.
    - A custom-made tool (downloadable here) enables exploration of market shares under other user-defined scenarios.
- The most important attributes are price and the presence/absence of non-GMO and organic labels. Of mid-level importance is the presence/absence of cage free and omega 3 labels. Of lower importance is the natural label, egg color, and packaging type.
- Effect of information about cage free eggs tended to increase mean willingness-to-pay, even for the information condition that was more critical of cage free eggs. Despite mean willingness to pay increasing, in the two information treatments that used graphics, median willingness-to-pay fell. In general, information tended to increase consumer disagreement about willingness-to-pay for cage free eggs; the variance of willingness-to-pay increased by a factor of 4 to 6 in the information treatments relative to the control.
- Results reveal multiple market segments consisting of consumers with distinct preferences for egg attributes. Willingness to pay for cage free eggs tends to increase with household income and fall with the age of the shopper. Willingness-to-pay for cage free eggs is highest among consumers relatively more concerned about animal welfare, naturalness, fairness, and environment, and lowest among consumers relatively more concerned about price, convenience, and safety. Willingness-to-pay is also correlated with consumer beliefs (and misbeliefs) about egg production. In general, however, demographics, food values, and beliefs only explain a small share of the variation in willingness-to-pay for cage free eggs across consumers.

Ultimately, the results suggest there is potential for the market-share for cage free eggs to rise above the current state even at premiums as high as $1.00/dozen. However, even at much more modest price premiums, the potential for cage free eggs to attain majority market share is unlikely, particularly if conventional eggs advertise other desirable attributes. Completely removing more affordable conventional eggs will significantly increase the share of consumers not buying eggs.

# CHAPTER 1: INTRODUCTION

As agricultural producers and agribusinesses seek to respond to consumer and advocacy organization demands for alternative production practices, there is a need to better understand what food consumers know and understand and whether their willingness-to-pay is sufficient to offset the added costs.

When consumers and advocacy organizations support government or industry policies that increase prices beyond a point that can be reflected in higher retail sales, producers and retailers in essence face an unfunded mandate. This study focuses on potential impacts of increasing transition to cage free production practices in the retail market for shell eggs. Several states have passed laws and several retailers have adopted policies pledging to prohibit sales of eggs from systems with high stocking densities. Nonetheless, it is unclear that consumers are willing to pay the higher prices for cage free systems or whether they have sufficient knowledge that would translate willingness-to-pay (WTP) into action in the grocery store. There has, for example, been anecdotal discussions of an "over supply" of cage free eggs as some producers have begun to transition to cage free system in response to retailer pledges. Knowledge of whether consumer demand will grow is needed to determine whether to reverse adoption toward cage free systems or to continue the trend.

The main objectives of this research are to determine consumers': 1) knowledge about cage free eggs, 2) beliefs about the adoption of cage free eggs on animal welfare, retail prices, environmental impacts, and the tradeoffs among these issues, 3) WTP for cage free eggs relative to other egg attributes that may be of importance, and 4) responsiveness to information.

A number of previous studies have estimated consumer WTP for cage free eggs (see reviews in Norwood and Lusk, 2011 or Lagerkvist and Hess, 2010). Moreover, a few studies have analyzed price premiums and consumer demand for cage free eggs using household or retail scanner data (e.g., Allender and Richards, 2010; Chang et al., 2010; Lusk 2010, 2011). In addition, a couple recent studies have investigated the impact of animal welfare laws enacted in California on egg prices, either using USDA data (Malone and Lusk, 2016) or grocery store scanner data (Mullally and Lusk, 2017).

Much of the previous survey research is now dated, and much of it was designed to study consumer preferences for federal or state policies surrounding animal housing rather than to project consumer purchases in the current environment with multiple competing labels. While the scanner data studies provide useful benchmarks and are valuable in that they represent consumers' actual purchases, they can be problematic in estimating consumer demand. Stated simply, with scanner data it is hard to separate correlation from causation; it is also difficult to disentangle effects of cage free labels from other effects including branding, packaging, promotional activity, etc. A carefully designed survey, such as that utilized here, can separate out the unique effects of price changes, packaging, and specific labels on egg demand.

A downside of surveys is that prior research shows consumers do not always shop in ways that are consistent with their survey answers. In general, people tend to over-state the amount they

say they are willing to pay on surveys relative to what they will do when real money and real products are on the line (see the review in Murphy et al., 2005). Nonetheless, research also shows that certain types of questioning techniques – in particular the so-called choice experiment (CE) method which forces a trade-off choice in a simulated retail choice environment – can produce WTP estimates that are not statistically different than from real-money purchases (Lusk and Schroeder, 2004). Moreover, other studies have found that carefully designed CEs can generate market share predictions and estimated preferences that are highly predictive of actual market shares revealed in scanner data (e.g., Brooks and Lusk, 2010; Chang, Norwood, and Lusk, 2009). Coupling the CE method with requests to consumers to answer honestly (i.e., using so-called "cheap talk"), can produce more reliable estimates (Tonsor and Shupp, 2011). This research brings to bear the state-of-the-art choice experiments and latent class modeling to estimate heterogeneity in consumer preferences for egg labels and characteristics, which are then used to estimate willingness-to-pay (WTP) and market shares for cage free eggs.

# CHAPTER 2: METHODS AND PROCEDURES

## - Survey Overview

A national survey of egg consumers was conducted. The survey was programmed by the project director, delivered to an online panel maintained by Survey Sampling, International, and fielded in November 2017. An initial screener question asked "Do you eat eggs?" Ninety-seven percent of respondents said "yes", and 3% who did not were immediately directed to the end of the survey and were excluded from analysis.

In total, 2,037 completed responses were obtained. At the conclusion of the survey, respondents answered demographic questions. Table 1 summarizes the characteristics of the sample. Overall, the sample demographic characteristics are similar to U.S. Census population data with a few exceptions. Our sample is slightly younger and contains fewer households in the highest income category of $160,000/year or more than is in the U.S population.

Of greater interest is whether the sample is representative of U.S. egg consumers. Unfortunately, there is no census-level data on the characteristics of egg consumers. However, we can weight our sample according to the stated volume of eggs purchased by each respondent. As shown in table 1, such weighting had relatively minor effects on sample characteristics. The most notable changes were pulling up the mean household size and percentage of households with children (implying households that consume more eggs have more members in the household and are more likely to have children).

The sensitivity of the main results to different weighting schemes was explored (see appendix table A2). Also explored was sensitivity to several tests for response reliability. In particular, toward the end of the survey, a "trap" question was included in a list asked people to check "somewhat disagree" if they were reading the question. About one fifth of the sample missed this trap question. However, as shown in the appendix, removing such individuals from the sample had minimal impacts on the results. As a result of these sensitivity checks, the choice was made to report the main results including all respondents who ate eggs without any special weighting. However, as will be described later in this section, an alternative method is used to control for individual who may have answered the choice questions randomly.

**Table 1. Characteristics of Egg Survey Sample**

| Characteristic | All Respondents Unweighted (N=2,037) | All Respondents Weighted by Egg Purchase Volume (N=2,037) | U.S. Census Data |
|---|---|---|---|
| Resides in Northeast Census Region | 17.5% | 16.7% | 17.5% |
| Resides in Midwest Census Region | 22.1% | 22.6% | 21.1% |
| Resides in South Census Region | 38.7% | 40.0% | 37.7% |
| Resides in West Census Region | 21.7% | 20.7% | 23.7% |
| Female | 51.5% | 52.4% | 51.4% |
| Age 18–24 years | 16.4% | 16.7% | 12.9% |
| Age 25–34 years | 18.0% | 20.2% | 17.6% |
| Age 35–44 years | 18.7% | 20.9% | 17.0% |
| Age 45–54 years | 17.6% | 17.9% | 18.4% |
| Age 55–64 years | 15.2% | 13.7% | 16.1% |
| Age 65–74 years | 11.3% | 8.4% | 10.0% |
| Age 75 or older | 2.7% | 2.1% | 8.0% |
| Married | 50.2% | 53.5% | n/a |
| % of Grocery Shopping for Household | 84.82 | 85.95 | n/a |
| Mean Household Size (# people) | 2.79 | 3.01 | 2.58 |
| Children under 12 in Household | 33.6% | 40.2% | 33.4% |
| SNAP (foodstamp) Participant | 18.4% | 18.9% | 16.4%[a] |
| Collee Degree | 35.0% | 32.6% | 29.3% |
| Income less than $20K | 16.0% | 13.1% | 15.8% |
| Income $20K–$39K | 23.9% | 26.9% | 18.9% |
| Income $40K–$59K | 18.9% | 18.5% | 15.8% |
| Income $60K–$79K | 14.2% | 14.9% | 12.4% |
| Income $80K–$99K | 9.7% | 9.6% | 9.3% |
| Income $100K–$119K | 5.9% | 5.6% | 7.1% |
| Income $120K–$139K | 3.9% | 3.8% | 5.1% |
| Income $140K–$159K | 3.5% | 3.5% | 3.8% |
| Income $160K or higher | 4.1% | 4.1% | 11.7% |
| Hispanic[b] | 13.7% | 15.4% | 16.9% |
| White | 77.7% | 76.1% | 73.8% |
| Black or African American | 13.0% | 13.8% | 12.6% |

[a]Figure reported is household participation as reported by the USDA divided by number of US households.
[b]Following the Census Bureau, Hispanic origin is asked separate from other race questions; as a result, the percent indicating Hispanic, White, and Black sum to more than 100%.

## - Choice Experiment Design

To estimate consumer demand for egg characteristics, a choice experiment (CE) was created where participants made repeated choices between two cartons of eggs and a "none of these" option. The CE method developed out of the conjoint analysis literature, with a focus to utilize questioning frameworks consistent with economic theory and were more similar to the sorts of decisions consumers make when actually shopping (see Louviere, Hensher, and Swait, 2000 for a dated but compressive treatment of the method).

The first step in the analysis is to identify the egg attributes of interest. Given the focus of this study, price and the presence/absence of a cage free label were prerequisites. However, it is important to place these attributes in the context of other egg labels and attributes that also influence consumer choice. After consulting several supermarkets, prior studies, and scanner data, the following list of eight attributes was selected for inclusion in the choice experiment: price, packaging type (carboard or styrofoam), egg color (brown or white), and the presence/absence of the following labels: cage free, omega 3, organic, natural, and non GMO.

To determine the range of egg prices to utilize in the CE, price data from the US Bureau of Labor Statistics was collected, which indicated that the average US city retail price for grade A large eggs in the two years prior to the survey (from November 2015 to November 2016) ranged from $2.75/dozen to $1.32/dozen (and averaged $1.44/dozen from January to November 2017). Previous analyses of US-wide scanner data (Chang et al., 2010) have found that prices for cage free and organic eggs (unadjusted for differences in packaging, egg color, etc.) were, on average, about 1.8 and 2.4 times higher than unlabeled eggs. Inspection of prices by the investigator in several local supermarkets revealed egg prices as low as $0.98/dozen and some high as $5.74/dozen. Given this backdrop, the experiment design considered prices ranging from $0.99 to $4.99 in $0.50 increments.

Even if price were varied at only two levels, there are $2^8 = 256$ different cartons of eggs that could be constructed based on variations in the eight attributes. To reduce the possibilities, an experimental design was constructed to minimize the standard errors of a multinomial logit choice model (i.e., to extract as much information as possible about consumer preferences while only asking consumers a reasonable small number of choices). The resulting design consisted of 12 choice questions.[1] Thus, each person answered 12 discrete choice questions regarding which carton of eggs they would buy. Table 2 lists the egg characteristics of the two options used in all 12 choice questions (the order of questions was randomized across respondents).

[1]The experiment was designed with the software Ngene. The D-optimal experimental design that minimizes the standard errors of the conditional logit depends on the true parameter values, which were assumed to be as follows for the design stage: Price (-0.5), Packaging (0.2), Egg color (0.1), Cage free (0.5), Organic (0.7), Omega 3 (0.25), Natural (0.15), non-GMO (0.3). The resulting design shown in table 2 has a D-error of 0.40, A-error of 0.48, and S-estimate of 178.

**Table 2. Twelve Choice Experiment Questions Used in Study**

| | Option A | | | | | | | | Option B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Choice | Price | Packaging | Egg color | Cage free | Organic | Omega 3 | Natural | non-GMO | Price | Packaging | Egg color | Cage free | Organic | Omega 3 | Natural | non-GMO |
| 1 | $4.49 | cardboard | white | ✓ | ✓ | ✓ | ✓ | - | $0.99 | styrofoam | brown | - | - | - | - | ✓ |
| 2 | $1.49 | styrofoam | white | - | ✓ | - | - | ✓ | $1.99 | cardboard | brown | ✓ | - | ✓ | ✓ | - |
| 3 | $3.49 | styrofoam | brown | ✓ | - | ✓ | - | - | $3.99 | cardboard | white | - | ✓ | - | ✓ | ✓ |
| 4 | $1.99 | styrofoam | brown | - | - | ✓ | ✓ | ✓ | $3.49 | cardboard | white | ✓ | ✓ | - | - | - |
| 5 | $0.99 | cardboard | white | - | - | - | - | - | $4.49 | styrofoam | brown | ✓ | ✓ | ✓ | ✓ | ✓ |
| 6 | $4.99 | cardboard | brown | - | - | - | ✓ | - | $4.99 | styrofoam | white | ✓ | - | ✓ | - | ✓ |
| 7 | $0.99 | styrofoam | white | - | ✓ | ✓ | ✓ | - | $2.49 | cardboard | brown | ✓ | - | - | - | ✓ |
| 8 | $2.99 | styrofoam | white | ✓ | - | - | ✓ | ✓ | $1.49 | cardboard | brown | - | ✓ | ✓ | - | - |
| 9 | $1.49 | cardboard | white | ✓ | - | ✓ | - | ✓ | $1.99 | styrofoam | brown | - | ✓ | - | ✓ | - |
| 10 | $3.99 | cardboard | brown | - | ✓ | ✓ | - | ✓ | $0.99 | styrofoam | white | ✓ | - | - | ✓ | - |
| 11 | $2.49 | cardboard | brown | ✓ | ✓ | - | ✓ | ✓ | $2.99 | styrofoam | white | - | ✓ | ✓ | - | - |
| 12 | $1.99 | styrofoam | brown | ✓ | ✓ | - | - | - | $1.49 | cardboard | white | - | - | ✓ | ✓ | ✓ |

Rather than simply presenting consumers with text descriptions of the egg cartons, to increase realism and external validity, the choices were presented utilizing images of eggs, cartons, and labels. Figure 1 shows a screenshot of one of the choice experiment questions presented to respondents (note the question in figure 1 corresponds to the first choice shown in table 2).

**Figure 1. Example Choice Experiment Question**


To analyze the effect of information on consumer choice, respondents were randomly assigned to one of the four information treatments shown in table 3. Treatment 1 is the control and respondents were not provided any additional information. Treatments 2 and 3 used information collected from the Coalition for Sustainable Egg Supply (CSES) project, whereas the last treatment used information from a graphic created by the Humane Society for the United States of America (HSUS). The goal was to present respondents with alternative types of objective information while avoiding some of the more sensationalist advocacy information.

**Table 3. Information Treatments**

| Treatment | Information | N obs |
|---|---|---|
| 1 (control) | No added information control | 506 |
| 2 | CSES Video Information | 504 |
| 3 | CSES Graphic Information | 512 |
| 4 | HSUS Graphic Information | 514 |

*Treatment 1 – No Information Control*

Treatment 1 is the control in which there was no added information provided about cage free eggs. Consumers utilized whatever beliefs they brought into the survey just as they would when entering a grocery store. Just prior to answering the choice questions, the following text was displayed:

> "Now, imagine you are shopping at your local grocery store.
>
> In what follows, we will ask you 12 different choice questions that are all similar to each other except for the characteristics and prices charged for carton of one dozen large eggs. The options differ in terms of the price (ranging from $0.99 to $4.99/dozen), packaging (styrofoam or cardboard carton), color of eggs (white or brown), and the presence or absence of several labels (cage free, organic, omega-3 enriched, non-GMO, and/or natural).
>
> For each question, we want to know which carton of eggs would you be most likely to buy.
>
> Please answer as honestly as possible and in a manner that you think would truly reflect how you would actually shop. Don't choose a higher priced option unless you would really pay the higher price in the grocery store."

*Treatment 2 – CSES Video Information*

Consumers randomly assigned to the second treatment were shown the following:

> "In a moment, we are going to ask you which types of eggs you prefer to buy. Before proceeding, please watch the following two videos comparing hens housed in conventional cage systems and cage free systems. (note: the videos and other resources are available from the Coalition for Sustainable Egg Supply)"

Then, two videos were embedded into the survey. One showing a cage free housing system and another showing a conventional cage system (the two videos can be viewed at his link). The order of presentation of the two videos was randomized across respondents.

Following this, respondents were shown the same text as in the control just prior to answering the choice questions.

*Treatment 3 – CSES Chart Information*

Consumers randomly assigned to the third treatment were shown the information and graphic that follows. The graphic was created based by pairing down information presented in a much larger table by the CSES.

> "In a moment, we are going to ask you which types of eggs you prefer to buy. Before proceeding, consider the following information comparing hens housed in conventional cage systems and cage free systems. (note: this information and other resources are available from the Coalition for Sustainable Egg Supply)"

**WHICH IS BETTER? CAGE OR CAGE FREE?**

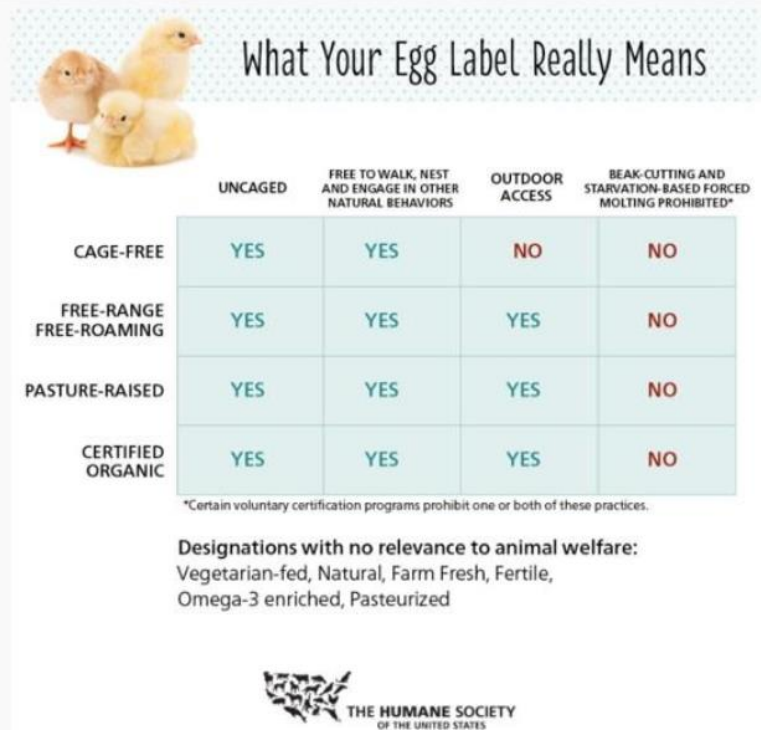
| CHARACTERSITIC | CAGE | CAGE FREE |
|---|---|---|
| Hen Deaths | ✓✓ | |
| Ability to Scratch and Dustbathe and Lay Eggs in Isolation | | ✓✓✓ |
| Cannibalism/Aggression | ✓✓✓ | |
| Breast Bone Damage | ✓✓✓ | |
| Leg Bone Strength | | ✓✓ |
| Feather Condition | | ✓ |
| Carbon Footprint | ✓ | |
| Indoor Air Quality | ✓✓✓ | |
| Cost of Production | ✓✓✓ | |

Following this, respondents were shown the same text as in the control just prior to answering the choice questions.

*Treatment 4 – HSUS Chart Information*

Finally, consumers randomly allocated to the fourth treatment were shown a graphic created by the HSUS. Respondents were shown the following:

> "In a moment, we are going to ask you which types of eggs you prefer to buy. Before proceeding, consider the following information comparing hens housed in conventional cage systems and cage free systems. (note: this information and other resources are available from the Humane Society of the United States)"




Following this, respondents were shown the same text as in the control just prior to answering the choice questions.

## - Analysis of Choice Experiment Data

To begin consider the analysis of the choice data via a relatively simple multinomial logit (MNL) model. Consumer *i* in treatment *t* is assumed to derive the following utility from choice option *j*: $U_{itj} = V_{tj} + \varepsilon_{itj}$. If the $\varepsilon_{itj}$ follow a Type I extreme value distribution and are independently and identically distributed across *i*, *t*, and *j*, then the conventional multinomial logit model (MNL) results:

(1) Prob(*i* chooses *j* in treatment *t*) = $\frac{e^{V_{tj}}}{\sum_{k=1}^{3} e^{V_{tk}}}$.

The systematic portion of the utility function is posited to be a linear function of egg attributes:

(2) $V_{tj} = \beta_{tj} + \alpha_t p_j + \sum_{k=1}^{7} \theta_t^k d_j^k$,

where $p_j$ is the price of alternative *j*, $\alpha_t$ is the marginal utility of a price change in treatment *t*, and $\beta_{tj}$ is an alternative specific constant indicating the utility of option *j* in treatment *t* relative to the utility of the "no purchase" option, $d_j^k$ are dummy variables indicating whether option *j* has one of the six labels (cage free, omega 3, organic, natural, and/or non-GMO), the carton type, and egg color, and $\theta_t^k$ reveal consumers' preferences for each of the $k^{\text{th}}$ attribute in treatment *t*. Estimating the parameters of the model is straightforward using maximum likelihood estimation.

Once estimates are obtained, calculating market shares is achieved by utilizing equation (1). Also of interest in this study is the calculation of willingness-to-pay (WTP). WTP refers to the dollar premium that would induce a consumer to be exactly indifferent to buying an egg option with one set of characteristics vs. another egg option (or "none") with a different set of characteristics. WTP for egg option *j* in treatment *t* compared to "none" is calculated as $WTP_{tj} = -(\beta_{tj} + \sum_{k=1}^{7} \theta_t^k d_j^k)/\alpha_t$. This is the price that would make the average or representative consumer indifferent to eggs with the assigned characteristics and choosing "none." Also of interest is WTP for different labels or characteristics. Consider two egg options that are identical in all respects except one attribute contains a label (i.e., $d_{j=1}^k = 1$) and the other option does not (i.e., $d_{j=2}^k = 0$). The maxim premium a consumer would be willing to pay to have option 1 with the $k^{\text{th}}$ label or characteristic vs. option 2 without the label or characteristic is simply $-\theta_t^k/\alpha_t$.

A key downside to the MNL is that it assumes all consumers have the same preference. Moreover, the MNL imposes some potentially restrictive assumptions on the substitutability of alternative choice options. The present analysis considered several different models that relax these restrictive assumptions. In particular, mixed logit (or random parameter logit) models were considered (see Train, 2009) in which preferences were assumed normally distributed in the population (except for price, which was considered constant, lognormal, or Rayleigh distributed). However, none of these models fit the choice data (according to AIC model fit criteria) as well as a latent class model (LCM) which assumes that there are several distinct consumer segments, each with their own particular set of preferences. As will be shown, this is likely because we find that the underlying consumer heterogeneity is quite distinct in a way not easily captured assuming that preferences are normally distributed. Another advantage of the LCM is that it provides a convenient and straightforward way to identify and remove the effect of completely inattentive respondents (Malone and Lusk, 2017).

The LCM is given by:

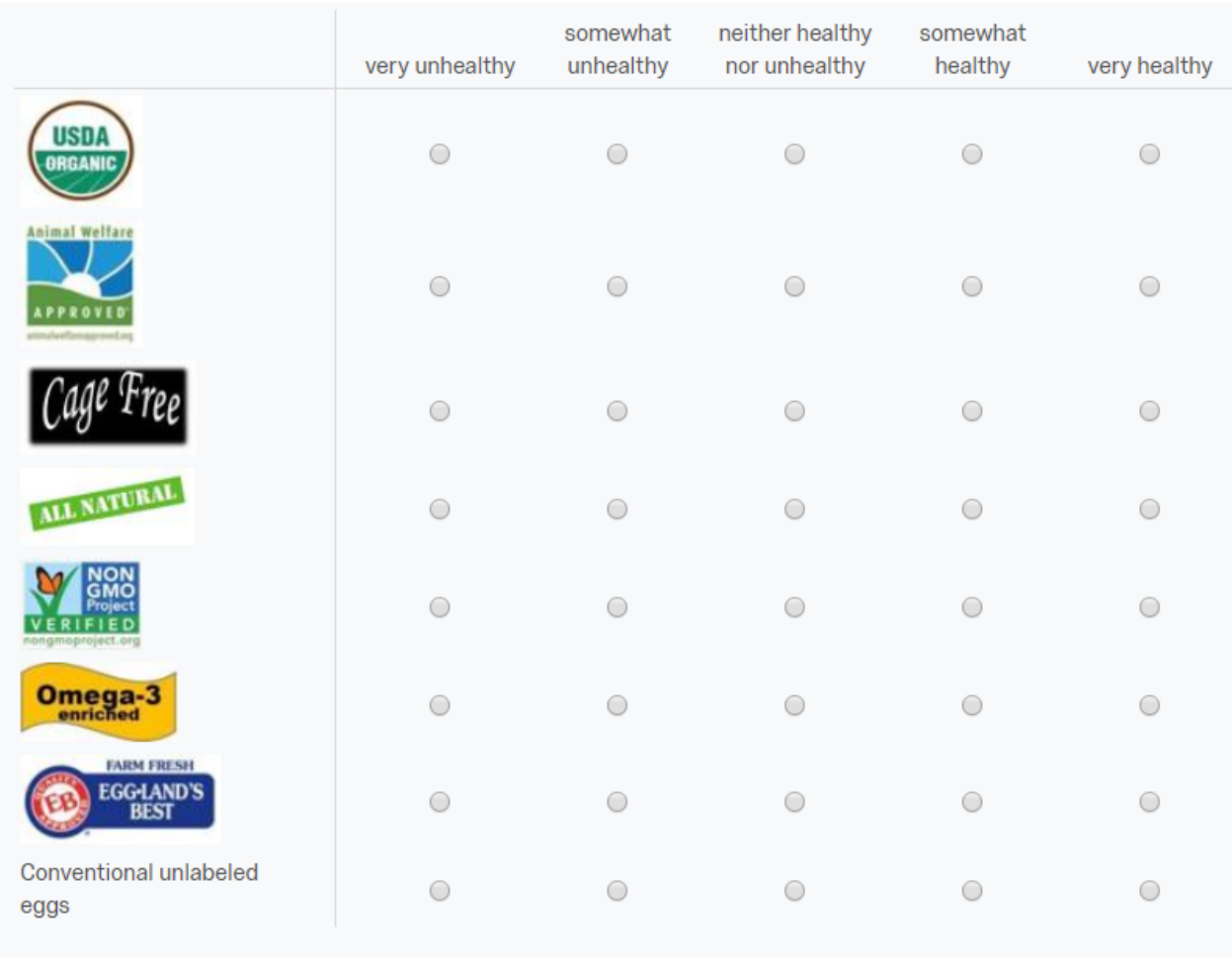
(3) Prob($i$ chooses $j$ in treatment $t$) = $\sum_{c=1}^{C} P_{ic} \frac{e^{V_{tjc}}}{\sum_{k=1}^{3} e^{V_{tkc}}}$.

where $P_{ic}$ is the estimated probability of individual $i$ being in latent class (or segment) $c$, and $V_{tjc}$ is the same as defined in equation (2) except now parameters are class/segment-specific as indicated by the $c$ suffix. In this application we estimate five-class LCMs where all the parameters of the fifth class are constrained to equal zero. A class with null parameter values implies responses that are completely random. Malone and Lusk (2017) denote the estimated probability of falling into this null class the "random response share" and suggest this approach as a means of removing the effect of inattentive, confused, or careless participants. In the analysis, we remove the impact of this null class (or any individual who is projected to fall into this class) when calculating WTP and making market share predictions. Estimates from (3) can be used to calculate WTP or market shares for each class, and then the class probabilities, $P_{ic}$ (after adjusting for the "null" class) can be used to arrive weight each class and arrive at an aggregate market prediction. To explore the distribution in WTP, we use the estimates derived by equation (3) and utilize them as priors, and update them with each individual's choices to form posterior estimates of each individual's preferences and WTP (see Train, 2009 for details). These produce expected WTP conditional on an individual's choices, something referred to as "individual" WTP estimates.

## - Belief Questions

A number of other questions were asked in the survey as will be revealed in the discussion of results. Some of these questions focused on consumers' beliefs about egg production and in particular cage free egg production. Questions were also asked to gather beliefs about the specific labels used in this study. Figure 2 shows one such set of question utilized to measure perceived healthiness of eggs with different labels.

**Figure 2. Screen Shot of Question Measuring Health Beliefs** (note: the question asked, "How healthy or unhealthy do you consider eggs sold with each of the labels shown below?")




Similar questions were used to measure other beliefs. In particular consumers were asked, "How expensive or inexpensive would you expect a carton of eggs to be with each of the labels shown below?", "How tasty or untasty do you consider eggs sold with each of the labels shown below?", "How safe or risky, in terms of food safety, do you consider eggs sold with each of the labels shown below?", and "How high or low a level of egg-laying hen welfare is associated with each of the labels shown below?"

# CHAPTER 3: RESULTS

## - General Consumption Questions

The survey began with general questions about egg consumption habits, beliefs about eggs, expected prices, and factors important when buying eggs. These questions were asked prior to the introduction of information, so the data are pooled across all four treatments and include all 2,036 respondents.

Respondents had overall favorable impressions about eggs (see table 4), with more than 85% agreeing that eggs taste good, are affordable, easy to cook, and are healthy. A slightly lower percentage, 74.5% thought eggs were sustainable. Respondents were divided on whether all eggs taste about the same, suggesting a belief that some types of eggs are better tasting than others. The least amount of agreement was found with the statement that "egg laying hens are well treated"; the most common response, chosen by 45.8% of respondents, to this statement was "neither agree nor disagree."

**Table 4. General Beliefs about Eggs**

| Statement | Mean[a] | Standard Deviation[b] | % Strongly or somewhat disagree[c] | % Strongly or somewhat agree[d] |
|---|---|---|---|---|
| Eggs taste good | 4.404 | 0.878 | 4.4% | 88.9% |
| Eggs are affordable | 4.296 | 0.913 | 5.6% | 86.4% |
| Eggs are easy to cook | 4.543 | 0.856 | 4.2% | 92.1% |
| All eggs taste about the same | 3.238 | 1.199 | 30.9% | 48.3% |
| Eggs are healthy | 4.247 | 0.864 | 4.1% | 85.7% |
| Eggs are sustainable | 4.015 | 0.931 | 5.2% | 74.5% |
| Egg laying hens are well treated | 3.043 | 1.020 | 26.1% | 28.1% |

[a]Mean score on a scale of 1=strongly disagree, 2=somewhat disagree, 3=neither agree nor disagree, 4=somewhat agree, and 5=strongly agree.
[b]Numbers are standard deviation of score on the five-point scale.
[c]Numbers are the percent of respondents who somewhat or strongly agree with the statement.
[d]Numbers are the percent of respondents who somewhat or strongly disagree with the statement.

Table 5 provides summary statistics associated with several consumption questions. Respondents most frequently reported buying eggs 2 to 3 times per week, and buying 12-17 eggs on each purchase. White eggs with no special labels or claims were most commonly reported as being purchased. On average, respondents reported paying about $2.00/dozen for eggs.

## Table 5. Responses to Specific Consumption Questions

**How often do you buy eggs?**

| Response Category | Percent of Respondents |
|---|---|
| Never | 0.9% |
| 2–3 Times a Year | 3.2% |
| Once a Month | 20.9% |
| 2–3 Times a Month | 35.0% |
| Once a Week | 29.2% |
| 2–3 Times a Week | 9.6% |
| Daily | 1.2% |

**When you buy eggs, how many do you normally buy?**

| | |
|---|---|
| less than 6 eggs | 1.3% |
| 6 to 11 eggs | 7% |
| 12 to 17 eggs | 55.5% |
| 18 to 23 eggs | 21% |
| 24 to 35 eggs | 8.8% |
| 36 eggs or more | 6.4% |

**Which type of eggs do you normally buy?** (*check all that apply*)

| | |
|---|---|
| white | 57.1% |
| eggs with no special labels or claims | 31.3% |
| brown | 20.4% |
| organic | 16.2% |
| cage free | 16.1% |
| free range | 12.2% |
| omega 3 | 6.4% |
| vegan fed | 2.5% |

**What price ($ per dozen) would you expect to pay for eggs at the grocery store you normally shop at?**

| | |
|---|---|
| less than $1.00 per dozen eggs | 9.4% |
| $1.00 per dozen eggs | 9.8% |
| $1.50 per dozen eggs | 22.7% |
| $2.00 per dozen eggs | 20.8% |
| $2.50 per dozen eggs | 15.7% |
| $3.00 per dozen eggs | 9.3% |
| $3.50 per dozen eggs | 4.9% |
| $4.00 per dozen eggs | 3.3% |
| $4.50 per dozen eggs | 1.7% |
| $5.00 per dozen eggs | 1.7% |
| more than $5.00 per dozen eggs | 0.7% |

One of the initial questions asked respondents, "Over the past five years, has your consumption of eggs increased or decreased?" 41.3% indicated consumption had increased, 53.0% responded "stayed the same," and the remaining 5.7% indicated consumption had decreased.

Respondents indicating an increase or decrease were given a conditional question asking why. Convenience, health, taste, and price were the most commonly stated reasons for increased consumption. Taste and health were the most commonly stated reasons for decreased consumption. Only about 7 out of 2036 respondents (0.3%) said they reduced egg consumption because of animal welfare concerns.

**Table 6. Why has consumption of eggs increased? (N=842)**

| Reason | % Indicating Reason |
|---|---|
| Eggs have become more convenient to cook | 40.8% |
| Eggs have become healthier | 28.6% |
| The price of eggs has fallen | 26.7% |
| Eggs have become tastier | 23.1% |
| My health status has changed | 18.6% |
| More egg options have become available | 17.6% |
| Other protein rich foods have become less attractive | 16.8% |
| My household income has changed | 15.7% |
| Eggs have become safer to eat | 14.7% |
| Other | 9.4% |
| Animal welfare has improved | 7.9% |

Note: total does not sum to 100% because respondents could pick more than one category.

**Table 7. Why has consumption of eggs decreased? (N=116)**

| Reason | % Indicating Reason |
|---|---|
| Eggs have become less tasty | 24.6% |
| My health status has changed | 20.6% |
| Other | 17.5% |
| Eggs have become less convenient to cook | 13.5% |
| Eggs have become less healthy | 13.5% |
| Other protein rich have become more attractive | 13.5% |
| The price of eggs has increased | 10.3% |
| My household income has changed | 9.5% |
| Eggs have become less safe to eat | 7.1% |
| Animal welfare has fallen | 6.3% |
| Fewer egg options are available | 3.2% |

Note: total does not sum to 100% because respondents could pick more than one category.

Respondents were presented with a trade-off question related to "food values" (Lusk and Briggeman, 2009). In particular, respondents were asked, "How important are the following items to you when deciding whether to buy eggs?" Thirteen items were shown and respondents had to pick four items and click and drag them into a box labeled "most important" and pick for other items and click and drag them into a box labeled "least important."

As shown in table 8, the 13 items are placed on a relative importance scale ranging from -100% to +100%. Relative importance is calculated as the percent of times an item was placed in the most important category minus the percent of times the same item was placed in the least important category. If all respondents placed an issue in the most important category, the score for the issue would be +100%; by contrast if all respondents placed an issue in the least important category, the score for the issue would be -100%. A score of zero could imply that no one put an item in the most or least important categories or that equal frequencies of respondents put an item in the most important category as did the frequency of respondents putting an item in the least important category.

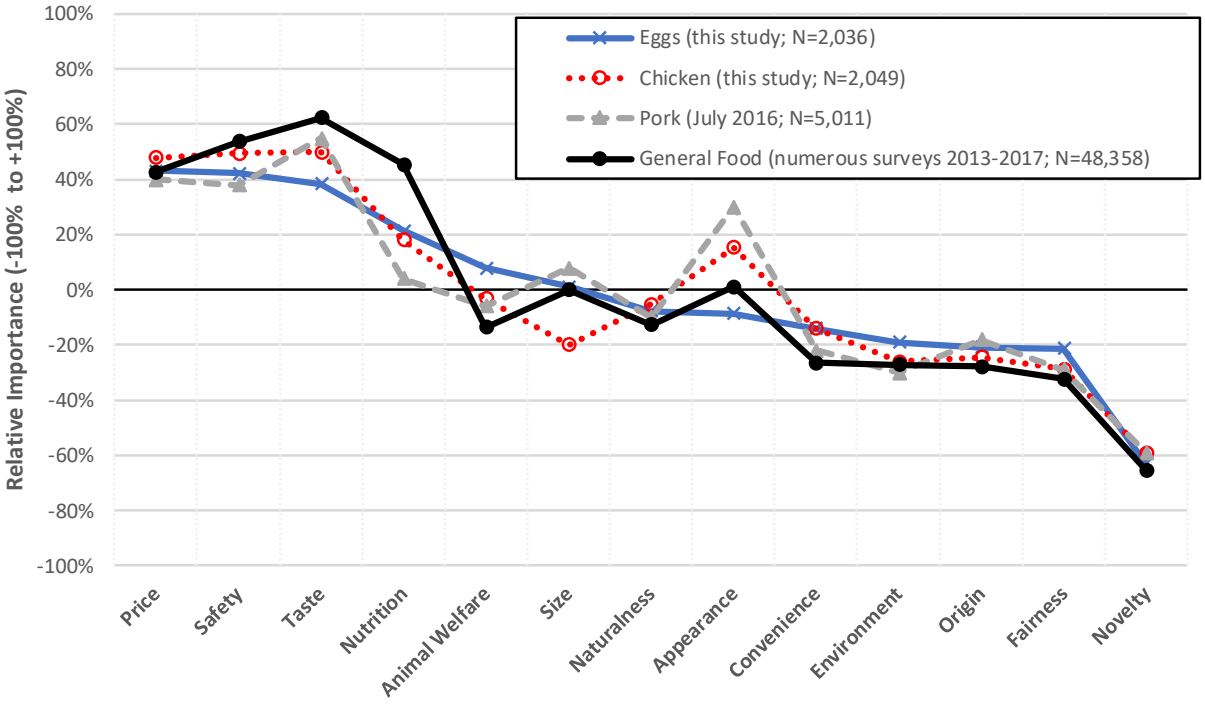
The most important overall attributes were price, safety, and taste. The least important attributes were origin, fairness, and novelty.

**Table 8. Relative Importance of 13 Different Factors When Buying Eggs**

| Factor | Relative Importance |
|---|---|
| Price (price you pay) | 43% |
| Safety (eating the food will not make you sick) | 42% |
| Taste (the flavor of the food in your mouth) | 38% |
| Nutrition (amount and type of fat, proteins, vitamins, etc.) | 21% |
| Animal Welfare (well-being of farm animals used in food production) | 8% |
| Size (small, medium, large, extra-large) | 1% |
| Naturalness (made without modern food technologies and ingredients) | -8% |
| Appearance (whether the food looks appealing and appetizing) | -9% |
| Convenience (how easy and fast the food is to cook and eat) | -14% |
| Environmental Impact (effects of food production the environment) | -19% |
| Origin (whether the food is grown locally, regionally, in the U.S. or overseas) | -21% |
| Fairness (farmers, processors, retails and consumers equally benefit) | -21% |
| Novelty (the food is something new you haven't tried before) | -63% |

The food-values questions has been used in a number of prior studies, and as such it is instructive to compare what consumers state as being most important when purchasing eggs as compared to purchasing other food items. Figure 3 shows food values for eggs, chicken, pork, and for food more generally (the latter was taken from the data compiled from a series of monthly surveys as a part of the Food Demand Survey (FooDS) project).

**Figure 3. Relative Importance of Product Attributes in Purchase Decisions for Eggs, Chicken, Pork, and General Food**




Overall, the patter of results is similar for all foods with a few exceptions. For general food (i.e., no specific food is mentioned), taste is most important followed closely by safety, nutrition, and price. Animal welfare is a more important driver of purchase for eggs than for chicken, pork, or general food.

## - Choice Experiment Results

To determine consumer WTP and market shares, data from the 12 choice questions described in table 2 were analyzed. For background information, appendix table A1 shows the percentage of respondents who selected each choice option for each of the 12 questions in each information treatment. Also shown in the appendix is the analysis of the choice data via the basic MNL model that assumes all respondents in an information treatment have the same preferences.

Model fit criteria indicate the latent class logit model (LCM) best fit the data. A likelihood ratio test rejects the hypothesis ($p<0.01$) that preferences are the same in each information treatment, suggesting that information significantly impacted consumer choice. As such, we report results separately for each information treatment (the results ignore the roughly 10% of respondents who were identified by the LCM as answering randomly).

Table 9 reports the aggregate mean and median WTP estimates for each egg characteristic (underlying estimates of the models are provided in the appendix). Focusing first on the results from the no information control, the estimates suggest extreme heterogeneity in consumer WTP for cage free eggs (i.e., the dollar premium that would induce a consumer to be exactly indifferent to buying and not buying cage free eggs). Under the control, no added information scenario, choices imply that half of consumers are willing-to-pay no more than a $0.30/dozen premium for cage free eggs; however, the mean WTP premium is $1.16/dozen, suggesting a small fraction of consumers are willing to pay sizeable amounts for the cage free attribute.

**Table 9. Willingness-to-Pay ($/dozen) Estimates from Latent Class Logit Models by Information Treatment**

| Attribute | Control No Information | CSES Video Information | CSES Graphic Information | HSUS Graphic Information |
|---|---|---|---|---|
|  vs. | $0.55[a] {-0.01}[b] [0.48, 0.63][c] | $0.34 {-0.04} [0.26, 0.42] | $0.67 {-0.06} [0.57, 0.77] | $0.82 {-0.12} [0.68, 0.96] |
|  vs. | $0.01 {0.12} [-0.06, 0.08] | $0.04 {0.08} [-0.03, 0.10] | $-0.23 {-0.30} [-0.27, -0.19] | $-0.77 {-0.25} [-0.95, -0.59] |
|  | $1.16 {0.30} [1.04, 1.27] | $1.30 {0.45} [1.06, 1.53] | $2.40 {0.25} [2.11, 2.68] | $1.86 {0.29} [1.58, 2.14] |
|  | $0.86 {0.32} [0.78, 0.93] | $0.47 {0.24} [0.40, 0.54] | $0.77 {0.25} [0.69, 0.84] | $1.38 {0.31} [1.22, 1.55] |
|  | $0.51 {0.32} [0.49, 0.54] | $0.30 {0.42} [0.26, 0.34] | $0.72 {0.43} [0.65, 0.78] | $0.65 {0.34} [0.58, 0.72] |
|  | $0.33 {0.16} [0.30, 0.37] | $0.20 {0.11} [0.15, 0.25] | $0.35 {0.09} [0.32, 0.38] | $1.13 {0.32} [1.00, 1.27] |
|  | $1.01 {0.47} [0.93, 1.08] | $0.85 {0.59} [0.78, 0.93] | $1.84 {0.59} [1.64, 2.04] | $1.95 {0.61} [1.74, 2.16] |

[a]Means
[b]Numbers in brackets{ }are medians
[c]Numbers in brackets[ ]are 95% confidence intervals for the mean

Figure 4 shows the mean and median WTP estimates for each attribute in the no information condition. Cage free had the highest mean WTP followed by non-GMO and organic. However, as previously indicated WTP is highly skewed, and median WTP values are much lower. Median WTP is highest for non-GMO, organic, and omega 3 followed by cage free.

A couple attributes – packaging and egg color – have median WTP values near zero. While it might be tempting to interpret this result to suggest that consumers do not care about these attributes, a more appropriate interpretation is that there are different segments of consumers who have divergent preferences for the attributes. Figure 5 shows a histogram of WTP values for packaging and egg color. As the figure shows, more than 30% of consumers are WTP at least a $0.35/dozen premium for cardboard vs. styrofoam packaging and for brown eggs vs. white eggs. However, there are many consumers with the opposite preferences. About 26% of consumers are WTP between $0.15 and $0.25/dozen for styrofoam over cardboard, and almost 30% of respondents are WTP between $0.05 and $0.15/dozen for white over brown eggs.

**Figure 4. Mean Willingness-to-Pay ($/dozen) for Seven Egg Attributes**

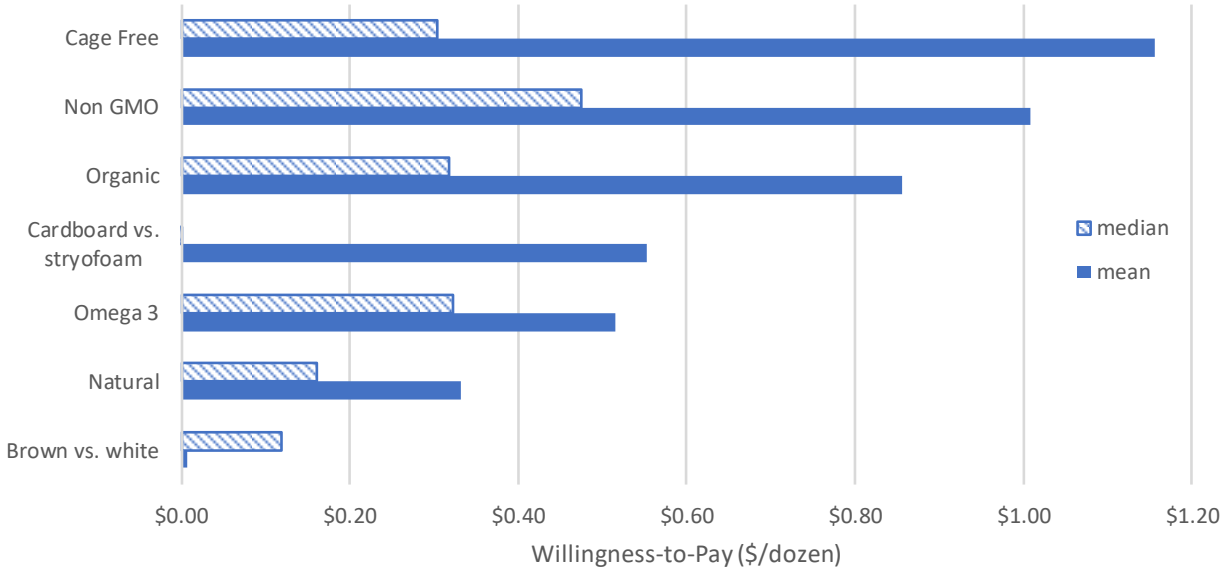



**Figure 5. Distribution of Willingness-to-Pay ($/dozen) for Packaging and Egg Color**

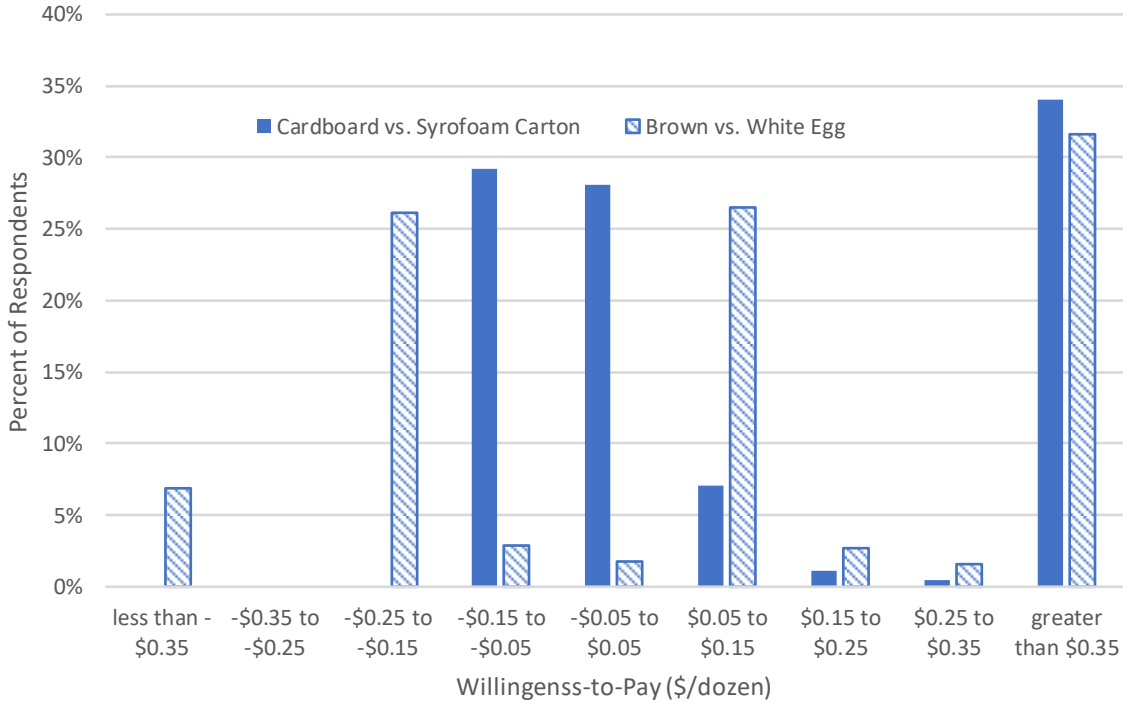


**Figure 6. Distribution of Willingness-to-Pay ($/dozen) for Cage Free and Organic Labels**

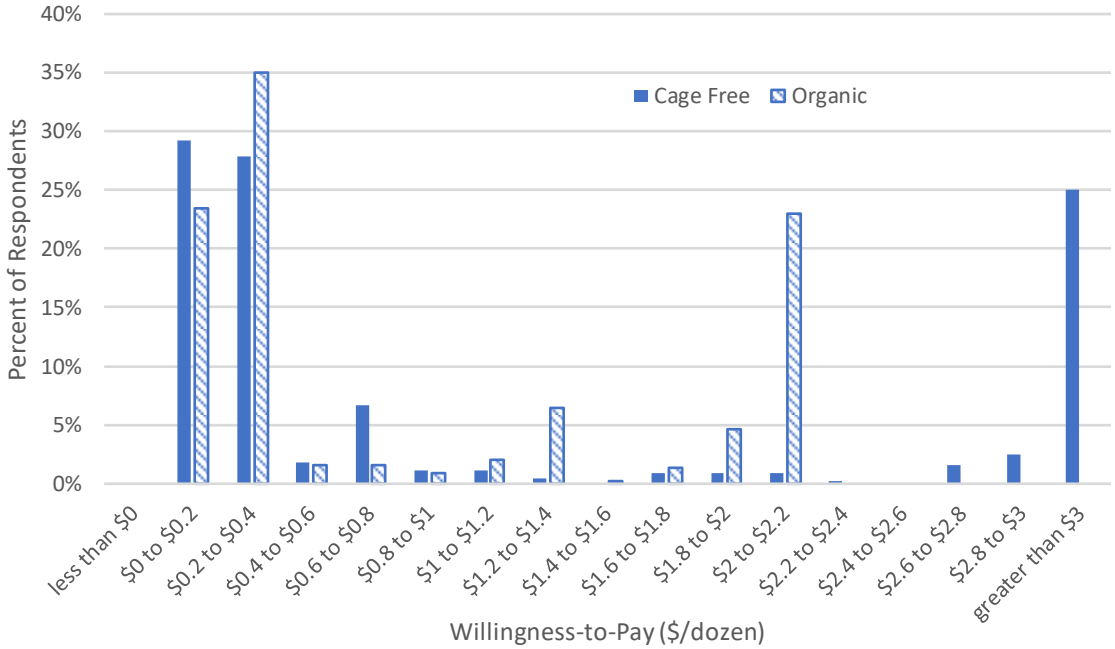



Figure 6 shows the high degree of heterogeneity in WTP for cage free eggs as compared to organic in the no added information condition. For cage free labels the most common category, representing almost 30% of respondents, was a WTP between $0 and $0.20/dozen; however, the next most common category, at about 25% of respondents, was a WTP greater than $3/dozen. The figure also shows ample heterogeneity in WTP for organic, although a lesser degree than exists with cage free.

Turning now to the impact of information on WTP, results in table 9 indicate all three information treatments tended to increase mean WTP for cage free eggs. Despite this, however, the median WTP for the two graphic information treatments reduced the median WTP. The most consistent effect of information (across the three information treatments) was to increase *disagreement* among consumers, as measured by the variance of WTP (a measure of dispersion around the mean). In the control, no information condition, the variance of WTP for cage free eggs was $1.64, but in the CSES video, CSES graphic, and HSUS graphic treatments, the variance was $6.35, $9.80, and $9.12 respectively; these figures are 3.9 to six times higher than in the control.

**Figure 7. Distribution of Willingness-to-Pay ($/dozen) for Cage Free Label by Information Treatment**

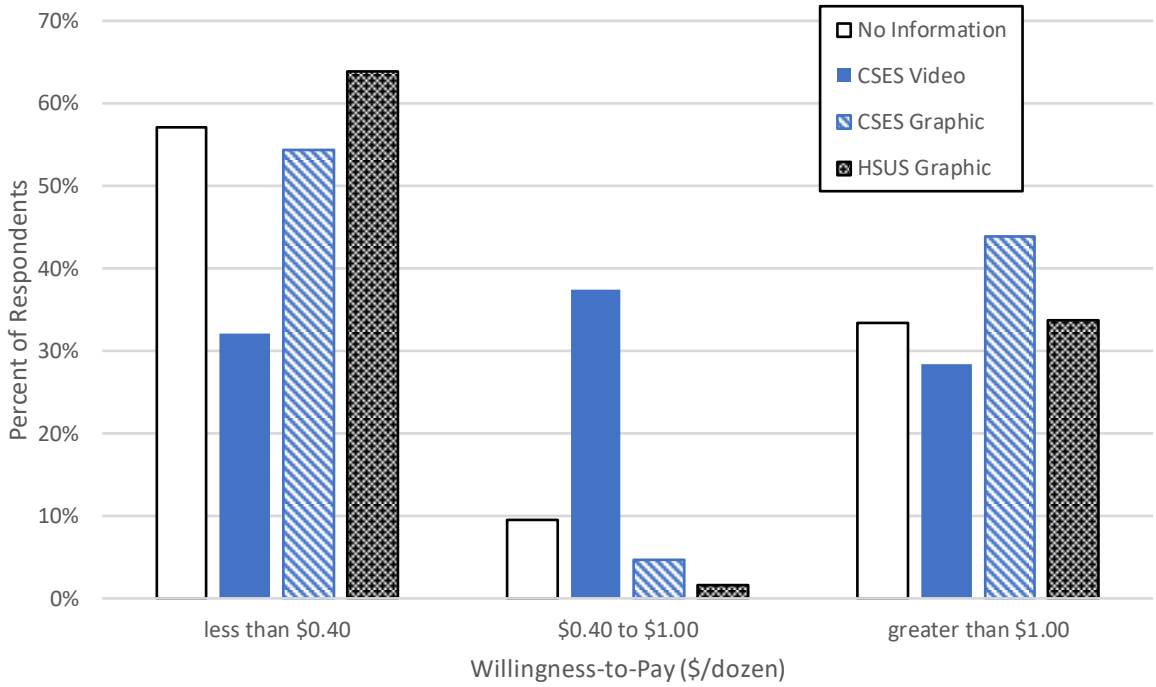



Figure 7 shows the distribution of WTP for cage free in the four information treatments. In the no information condition, almost 60% of consumers have a willingness-to-pay less than $0.40/dozen, but 33% have a value greater than $1.00/dozen. The CSES video information reduced the share of consumers at both the extreme low and extreme high levels and increased the share in the middle WTP category. Interestingly, the HSUS graphic resulted in the highest share of respondents with WTP less than $0.40/dozen.

The estimated models can be used to project market shares under assumptions about the options available to consumers. A custom-made tool was created to allow the user to explore market shares under alternative scenarios (the Excel tool can be downloaded here).

To demonstrate the results, it is useful to consider a simple choice scenario where there are only two egg options, A and B, that are identical in every respect. Under this simple baseline scenario, option A has a projected market share of 50% and option B has a projected market share of 50% (i.e., the chance of a consumer buying option A or B is as good as chance since the two options are identical). To determine the relative importance of the various attributes included in the study, one can investigate how projected market shares change from the baseline when, for example, option B adds a label or changes price. These changes are referred to as marginal effects.

Table 10 below shows the marginal effects resulting from changes in the eight attributes under inquiry. In the no information condition, a $1 reduction in price from the baseline increases the market share of option B from 50% to 77.1%, an increase of 27.1 percentage points. Starting again from the baseline 50%-50% scenario in the no information condition, the addition of a non-GMO label to option B raises the market share to 67.2%, an increase of 67.2%-50%=17.2%. In this sense, it can be said that price is more important than non-GMO labels. Table 10 carries out the same calculations for the other six attributes. According to the ability to move aggregate market shares, price and the presence/absence of non-GMO and the organic labels are the most important attributes. Of mid-level importance is the presence/absence of cage free and omega 3 labels. Of lower importance, changing market share 5.2% or less, is the natural label, egg color, and packaging type.

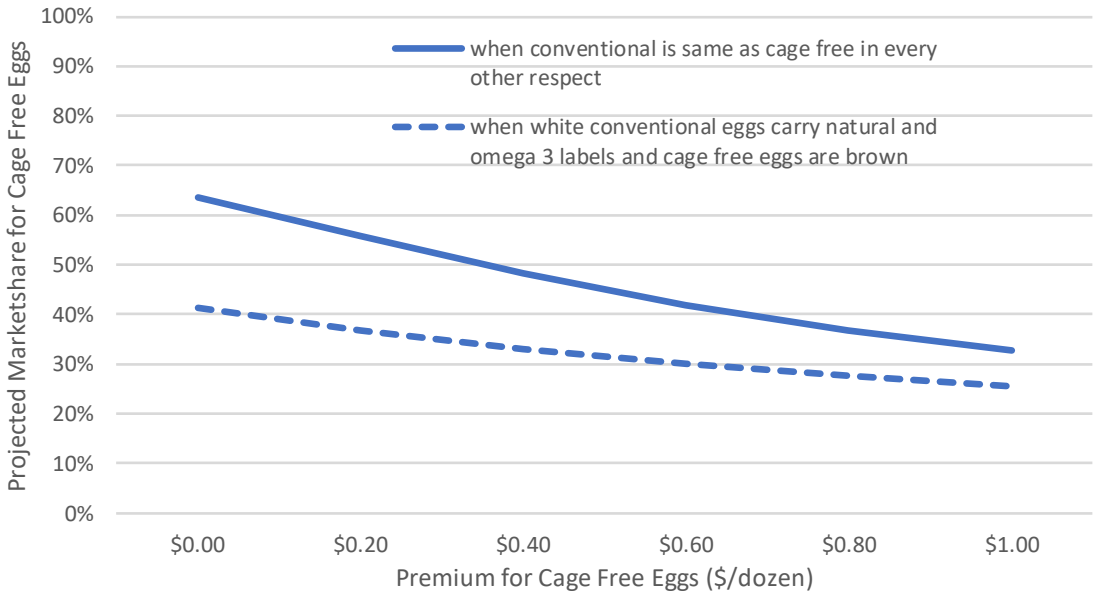
Also in table 10 are the relative importance calculations for the other information treatments. The effect of a $1.00/dozen price change had similar effects in all information treatments. The three information treatments tended to increase the importance of the cage free label and reduce the importance of the non-GMO label, most notably in the CSES Graphic and HSUS Graphic information conditions.

**Table 10. Relative Importance (or Marginal Effects) of Egg Attributes in Changing Market Shares**

| Change | Change in Market Share | | | |
|---|---|---|---|---|
| | Control No Info | CSES Video Info | CSES Graphic Info | HSUS Graphic Info |
| $1.00 reduction in price | 27.1% | 28.4% | 25.8% | 27.1% |
| addition of non-GMO label | 17.2% | 13.4% | 15.7% | 14.2% |
| addition of organic label | 15.2% | 6.3% | 8.5% | 12.8% |
| addition of omega 3 label | 14.0% | 10.4% | 8.5% | 13.5% |
| addition of cage free label | 13.7% | 10.6% | 14.5% | 15.4% |
| addition of natural label | 5.2% | 3.7% | 5.0% | 11.6% |
| white instead of brown eggs | 4.6% | 2.8% | 2.0% | 5.6% |
| cardboard instead of stryofoam carton | 1.2% | 0.7% | 0.7% | -5.1% |

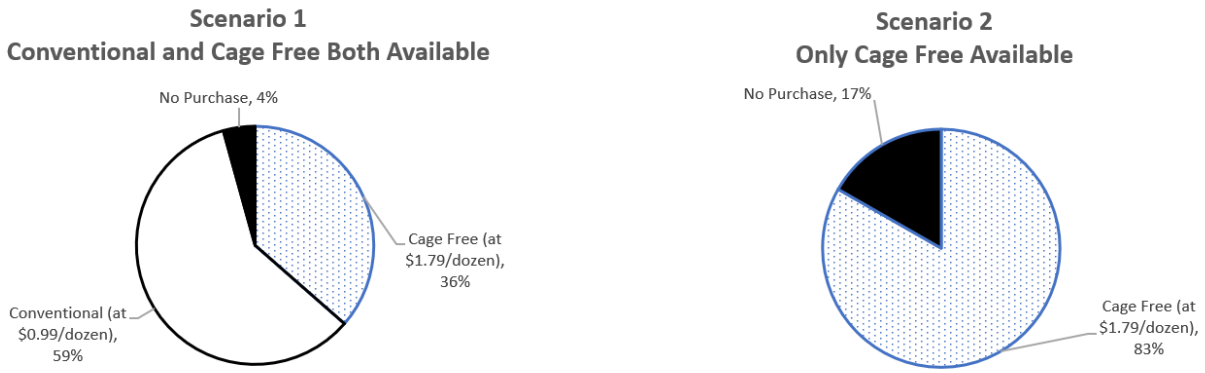
We utilize this same basic set-up to explore how the market share for cage free eggs would change with a change in the premium charged for cage free. Figure 8 shows the results. If presented with a pair-wise choice between cage free and unlabeled eggs that are identical in all other respects, cage free market shares are projected to be 64%, 45%, and 33% when the premium for cage free is $0.00, $0.50, and $1.00, respectively. If cage free eggs are brown and conventional eggs are white and carry natural and omega 3 labels, the projected market share for cage free eggs is 41%, 31%, and 26% when the premium for cage free is $0.00, $0.50, and $1.00, respectively. These results are similar to the findings of Allendar and Richards (2010) who studied household scanner data in California in 2007 and 2008 and estimated for cage free eggs to achieve a majority market share over conventional eggs, the price premium would have to be no more than $0.50/dozen.

**Figure 8. Predicted Market Share for Cage Free Eggs by Price Premium**



Another inquiry of interest is how the complete removal of conventional eggs might affect egg buying behavior. To explore this issue, it is now assumed consumers have a choice between a conventional egg option (priced at $0.99/dozen), cage free eggs (priced at $1.79/dozen), and they also have the option to choose "none" and refrain from buying eggs at all. As shown in the left panel of figure 9, under these assumptions, 59% are projected to choose conventional, 36% cage free, and 4% "none." The right-hand panel of figure 9 shows the projections of what would happen were the lower-priced conventional option removed from the market. If this were to occur, the models predict the share of consumers who would refrain from buying eggs would increase from 4% to 17%.

**Figure 9. How Removal of Conventional Eggs Alters the Share of Consumers Choosing to Refrain from Buying Eggs**



## -Market Segments and Determinants of Heterogeneity

So far, this analysis has tended to focus attention to aggregate-level results from the CE. However, as revealed by the preceding figures, there is ample underlying heterogeneity. In fact, underlying the WTP estimates are distinct consumer segments revealed by the LCM. Table 11 below shows the WTP estimates from four distinct segments from the no information control condition (the class probabilities are conditional on respondents providing meaningful answers, and ignores the 11% who have zero coefficients for all parameters).

The first two segments, representing 27.5% and 31.3% of respondents were sensitive to price changes, resulting in fairly low WTP values. Segments 3 and 4 were more label conscious; the 6.1% of consumers in segment three strongly preferred white eggs, completely discounted the natural label, and had a high WTP for non-GMO. The last segment, representing 35.1% of consumers had sizable WTP values for all labels, particularly the cage free label.

**Table 11. Willingness-to-Pay ($/dozen) for Four Consumer Segments when Provided No Additional Information**

| Attribute | Segment 1 Price Sensitive | Segment 2 Price Conscious | Segment 3 Label Conscious | Segment 4 Price Insensitive |
|---|---|---|---|---|
| Cardboard | -$0.08 [-0.19, 0.02] | -$0.02 [-0.13, 0.10] | $0.09 [-1.08, 1.25] | $1.85 [0.57, 3.13] |
| Brown | -$0.17 [-0.29, -0.04] | $0.12 [-0.04, 0.27] | -$2.78 [-4.61, -0.95] | $0.60 [-0.05, 1.25] |
| Cage free | $0.12 [-0.01, 0.24] | $0.29 [0.14, 0.43] | $0.79 [0.23, 1.36] | $3.13 [1.18, 5.07] |
| Organic | $0.32 [0.21, 0.43] | $0.17 [0.01, 0.32] | $1.23 [0.49, 1.97] | $2.03 [0.97, 3.08] |
| Omega 3 | $0.28 [0.17, 0.38] | $0.32 [0.17, 0.47] | $1.04 [0.14, 1.93] | $0.84 [0.13, 1.56] |
| Natural | $0.16 [0.05, 0.27] | $0.04 [-0.06, 0.15] | -$0.21 [-0.91, 0.49] | $0.91 [0.1, 1.72] |
| Non GMO | $0.23 [0.13, 0.33] | $0.46 [0.31, 0.62] | $1.80 [0.93, 2.67] | $2.16 [0.82, 3.5] |
| Probability | 0.275 | 0.313 | 0.061 | 0.351 |

As previously discussed, we can use Bayesian calculations to arrive at individual-level WTP estimates. Attention is now turned to the individual-level determinants of WTP for the cage free attribute. To carry out this analysis, several linear regression models were estimated. A word of caution is in order. As the previous tables showed, mean WTP for cage free is about twice the median WTP. As such, the WTP data are not normally distributed. A linear regression model estimates impacts on the mean, and in the presence of non-normal data, the statistical significance tests are likely suspect, though the underlying parameter estimates may still provide useful information about the mean.

First, note the factors that are NOT associated with large or significant changes in WTP premiums for cage free eggs:

- Gender
- Marital status
- Household size

- Presence of children in household
- Education
- Race
- Grocery shopping frequency
- Beliefs about share of US egg production that is cage free

There are conflicting effects of the quantity of eggs purchased on WTP for cage free eggs. Estimates suggest that for every 1 week increase in the frequency with which a consumer buys eggs, WTP increases $0.29/dozen. This would suggest preference for cage free eggs increases with the volume of egg consumption; however, we also find that within a given shopping trip, WTP for cage free falls in the number of eggs purchased. For each additional dozen purchased, on a given shopping trip WTP for cage free falls $0.17/dozen. These two effects compete against each other resulting in the combined effect on total number of eggs purchased per week having a small effect on mean WTP for cage free eggs (estimated about $0.09/dozen mean increase in WTP for each additional dozen purchased per week).

Figure 11 shows the effect of demographic variables on the mean WTP premium for cage free. Mean WTP or cage free eggs tends to increase with household income and fall with the age of the shopper. Gender had almost no effect on mean WTP. Consumers residing in the West and Eastern U.S. had higher WTP for cage free than consumers in the South and Midwest.

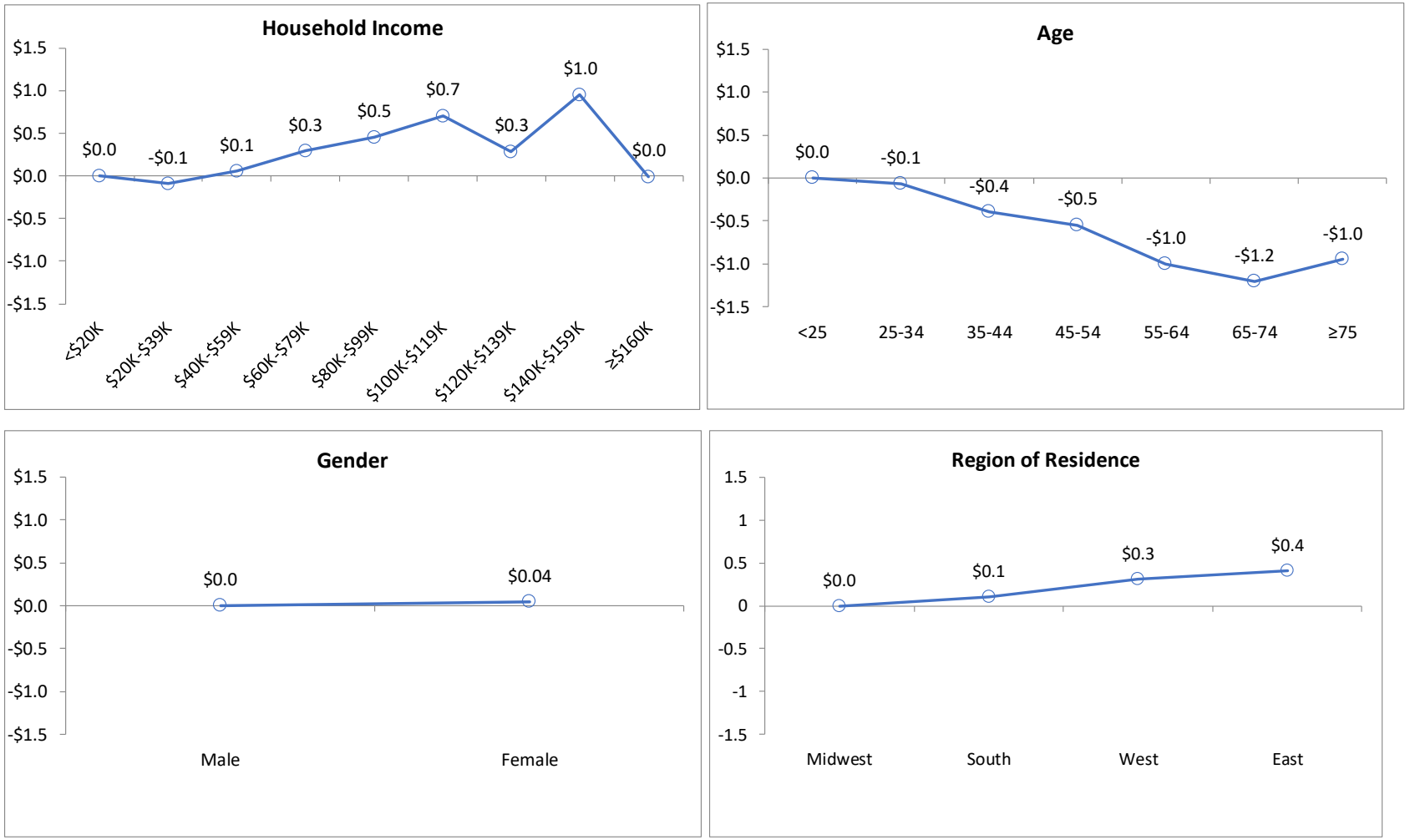



**Figure 11. Variation in Mean Willingness-to-Pay ($/dozen) by Selected Demographic Characteristics**

**Figure 12. Variation in Mean Willingness-to-Pay ($/dozen) by Food Values**

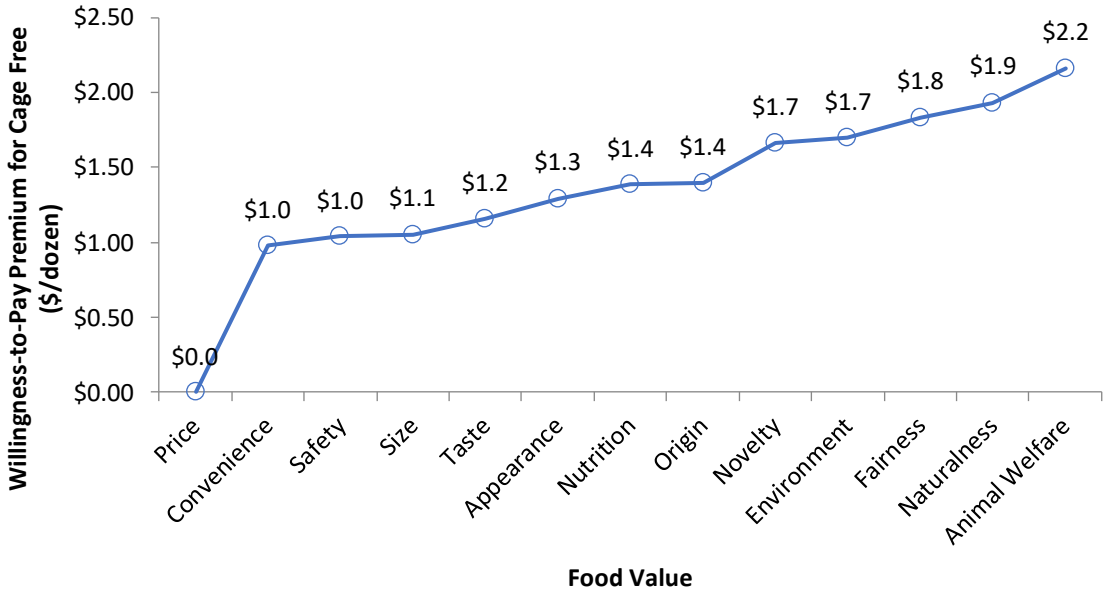



Figure 12 shows the relationship between "food values" and WTP for cage free. Willingness-to-pay for cage free eggs is highest among consumers relatively more concerned about animal welfare, naturalness, fairness, and environment, and lowest among consumers relatively more concerned about price, convenience, and safety.

Results indicate that if an individual who indicated animal welfare as the least important food value (a score of -100) instead indicated animal welfare as a most important food value (a score of +100), mean WTP for cage free would increase $2.20/dozen. Similarly for naturalness, results indicate that if an individual who indicated nutrition as the least important food value (a score of-100) instead indicated naturalness as a most important food value (a score of +100), WTP for cage free would increase $1.90/dozen. By contrast, greater importance placed on the food values of safety, convenience, and particularly price is associated with reductions in mean WTP for cage free.

While it may not be initially obvious, the results in figure 11 can be interpreted as providing evidence about people's beliefs about (or perceptions of) the cage free label. Suppose an individual highly values animal welfare. Figure 11 shows that such an individual will tend to have a higher WTP for cage free. As a result, it must be that cage free is perceived to provide high animal welfare. By this line of reasoning, figure 11 suggests that consumers, on average, perceive the cage free label to signal eggs that are high in animal welfare, naturalness, fairness, and environmentally friendly but they also perceive cage free eggs to be expensive, inconvenience, and less safe.

## -Beliefs and Knowledge

After the CE questions, respondents were queried about their knowledge and beliefs surrounding eggs, with focus on cage free production. Because these questions were asked after the provision of information, results are segmented by information treatment.

Only about a third of respondents correctly indicated that between 0 and 19% of egg laying hens in the US are housed in cage free systems. This figure increased to 43.5% in the CSES video information condition. Over 20% of respondents thought more than half of hens were in cage free stems in all information treatments.

**Table 12. Responses to Question, "What percent of egg laying hens in the United States are housed in cage free systems?"**

| Response Category | Control No Info | CSES Video Info | CSES Chart Info | HSUS Chart Info |
|---|---|---|---|---|
| 0 to 19% | 34.2% | 43.5% | 32.2% | 29.2% |
| 20 to 49% | 44.1% | 37.7% | 47.5% | 48.8% |
| 50 to 79% | 18.8% | 14.3% | 17.4% | 19.1% |
| 80 to 100% | 3% | 4.6% | 2.9% | 2.9% |

Table 13 shows the results associated with asking respondents the percent of eggs they purchase that they believe come from cage free systems. Relative to extant market shares, results suggest many consumers likely have over-optimistic beliefs or succumb to some level of social desirability bias. Another possibility is that some consumers may believe they are buying cage free eggs when, in fact, they are not.

**Table 13. Responses to Question, "What percent of eggs that you buy come from laying hens housed in cage free systems?"**

| Response Category | Control No Info | CSES Video Info | CSES Chart Info | HSUS Chart Info |
|---|---|---|---|---|
| 0 to 19% | 36.2% | 42.1% | 36.7% | 35.6% |
| 20 to 49% | 32.4% | 25.4% | 32.8% | 37.6% |
| 50 to 79% | 20.6% | 19.6% | 21.1% | 18.3% |
| 80 to 100% | 10.9% | 12.9% | 9.4% | 8.6% |

Table 14 reports the extent to which consumers agree or disagree with several statements. The first is a statement that was also asked at the beginning of the survey, and again results reveal about an even split between beliefs that egg laying hens are well treated and the opposite. There was more agreement than not that "all cage free eggs are brown" and "Brown eggs come from chickens with brown feathers." The opposite was the case with the phrase "cage free hens lay more eggs than caged hens." The CSES video information treatment tended to produce beliefs that were different than in the other information conditions. Figure 13 relates these beliefs to mean WTP for cage free eggs, as estimated by the CE and LCM.

**Table 14. Consumer Beliefs about Egg Production Practices by Information Treatment**

| Statement | Control No Info | CSES Video Info | CSES Chart Info | HSUS Chart Info |
|---|---|---|---|---|
| Egg laying hens are generally well treated | 3.026[a]<br>(1.128)[b]<br>[35.4%][c]<br>{31.8%}[d] | 3.095<br>(1.079)<br>[37.9%]<br>{28.0%} | 2.947<br>(1.058)<br>[30.7%]<br>{33.2%} | 2.971<br>(1.019)<br>[30.0%]<br>{30.6%} |
| All cage free eggs are brown | 2.484<br>(1.103)<br>[14.4%]<br>{46.4%} | 2.268<br>(1.107)<br>[11.7%]<br>{57.2%} | 2.428<br>(1.112)<br>[14.1%]<br>{50.0%} | 2.453<br>(1.065)<br>[12.8%]<br>{46.7%} |
| Brown eggs come from chickens with brown feathers | 2.249<br>(1.243)<br>[16.6%]<br>{57.1%} | 2.234<br>(1.172)<br>[13.1%]<br>{56.4%} | 2.178<br>(1.183)<br>[11.9%]<br>{58.2%} | 2.307<br>(1.154)<br>[12.6%]<br>{53.3%} |
| Brown eggs are more nutritious than white eggs | 3.081<br>(1.051)<br>[33.2%]<br>{23.1%} | 2.968<br>(1.110)<br>[28.8%]<br>{28.8%} | 3.016<br>(1.101)<br>[32.4%]<br>{25.4%} | 3.054<br>(1.096)<br>[33.1%]<br>{24.1%} |
| Cage free hens lay more eggs than caged hens | 3.298<br>(0.908)<br>[36.8%]<br>{13.4%} | 2.827<br>(1.151)<br>[27.6%]<br>{31.6%} | 3.270<br>(0.890)<br>[35.0%]<br>{13.9%} | 3.270<br>(0.842)<br>[33.7%]<br>{12.3%} |
| Number of Observations | 506 | 504 | 512 | 514 |

[a]Mean score on a scale of 1=strongly disagree, 2=somewhat disagree, 3=neither agree nor disagree, 4=somewhat agree, and 5=strongly agree.
[b]Numbers in parentheses ( ) are standard deviation of score on the five-point scale.
[c]Numbers in brackets [ ] are the percent of respondents who somewhat or strongly agree with the statement.
[d]Numbers in brackets { } are the percent of respondents who somewhat or strongly disagree with the statement.

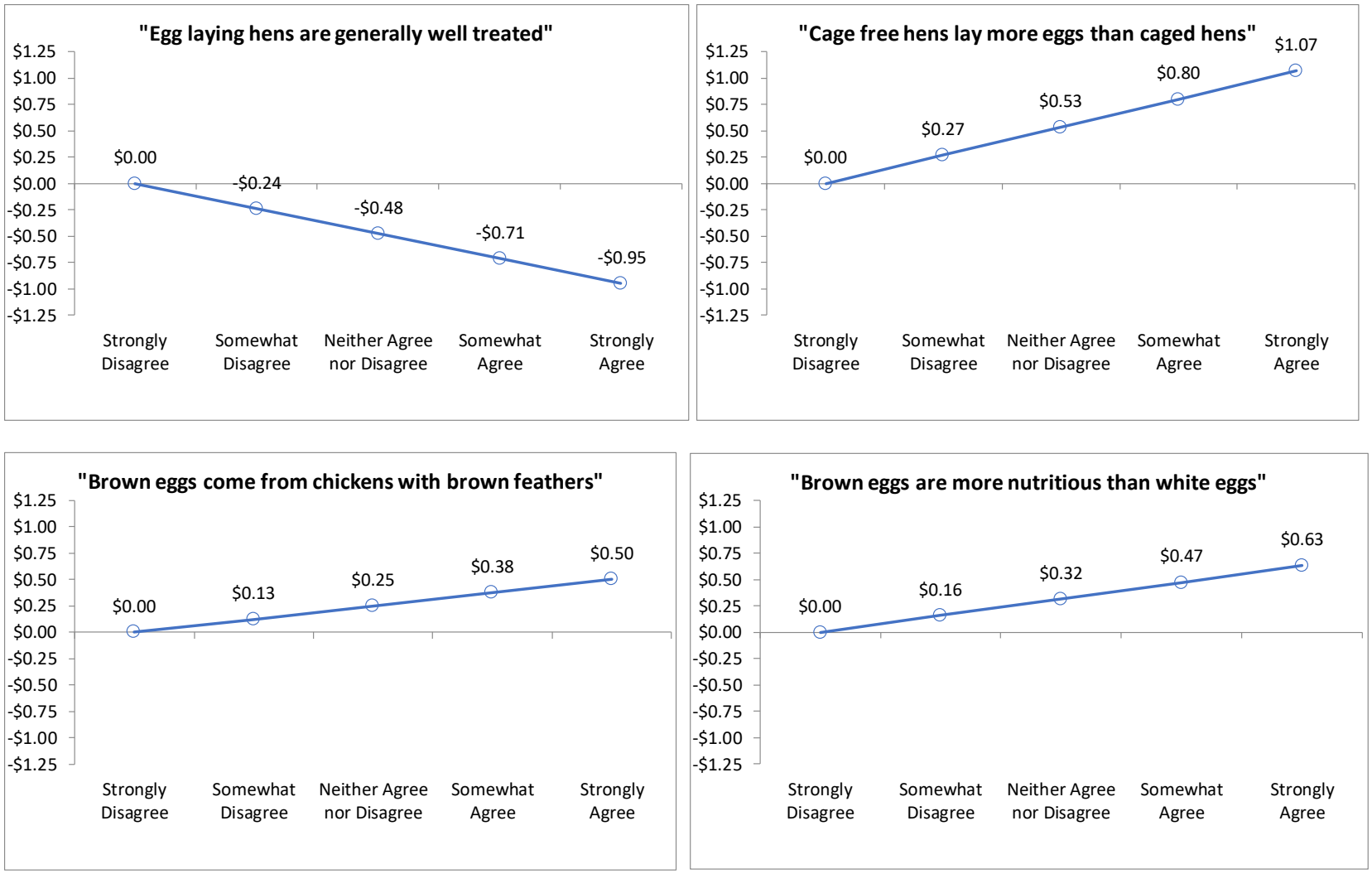



**Figure 13. Variation in Mean Willingness-to-Pay ($/dozen) by Beliefs about Egg Production**

Table 15 shows the average beliefs about animal welfare, expense, healthfulness, safety, and taste of eight different labels in each information treatment. In all treatments, unlabeled eggs were deemed lowest in animal welfare, cost, health, safety, and taste. In the no added information condition, the cage free label had the highest score on animal welfare and organic was highest in perceived expense, health, and safety. The brand Eggland's Best was perceived as being highest in taste (and second lowest in cost).

In the three conditions that provided extra information about cage free, the Animal Welfare Approved label was deemed as highest in animal welfare on average, with cage free being second highest. The cage free label had a similar rating in terms of animal welfare in all information conditions except the CSES video condition where it was a bit lower. Organic was consistently viewed as healthiest and safest.

Figure 14 relates these beliefs to mean WTP for cage free eggs. Because these WTP values represent premiums for cage free over unlabeled eggs, it is appropriate to explore how WTP varies with the *difference* in beliefs about cage free and conventional. Because each of the belief variables is on a 1 to 5 scale, the difference spans from -4 (when cage free takes the value of 1 and unlabeled takes the value of 5) to +4 (when cage free takes the value of 5 and unlabeled takes the value of 1).

Results show that the beliefs relate to WTP values in intuitive and expected directions. For example, an individual who believes cage free labels are highest in health (a score of 5) and unlabeled eggs are lowest in health (a score of 1) for a difference of 4, is projected to have an average WTP premium for cage free over conventional of $3.06/dozen relative to an individual who believes cage free labels are lowest in health (a score of 1) and unlabeled eggs are highest in health (a score of 5) for a difference of -4. The relative label beliefs that had the smallest impact on the WTP premium was animal welfare (not shown in figure 14).

**Table 15. Consumer Beliefs about Eight Labels by Information Treatment**

| Label | Animal Welfare[a] | Cost[b] | Healthiness[c] | Safety[d] | Taste[e] |
|---|---|---|---|---|---|
| *Control – No Information* | | | | | |
|  | 3.646 | 3.808 | 4.047 | 4.063 | 3.885 |
|  | 3.970 | 3.551 | 3.830 | 3.960 | 3.791 |
|  | 3.978 | 3.682 | 3.921 | 3.994 | 3.966 |
|  | 3.551 | 3.435 | 3.953 | 4.020 | 3.911 |
|  | 3.567 | 3.563 | 4.016 | 4.061 | 3.858 |
|  | 3.328 | 3.609 | 3.947 | 3.870 | 3.814 |
|  | 3.555 | 3.429 | 3.889 | 4.040 | 4.002 |
| unlabeled eggs | 2.834 | 2.358 | 3.281 | 3.360 | 3.595 |
| *CSES Video Information* | | | | | |
|  | 3.500 | 3.782 | 3.986 | 3.990 | 3.808 |
|  | 3.871 | 3.579 | 3.720 | 3.857 | 3.756 |
|  | 3.847 | 3.784 | 3.812 | 3.851 | 3.881 |
|  | 3.482 | 3.550 | 3.913 | 3.927 | 3.903 |
|  | 3.482 | 3.583 | 3.917 | 3.938 | 3.740 |
|  | 3.349 | 3.563 | 3.829 | 3.750 | 3.758 |
|  | 3.452 | 3.504 | 3.837 | 3.921 | 3.879 |
| unlabeled eggs | 2.887 | 2.302 | 3.266 | 3.321 | 3.546 |

Table 16 continued

| | Animal Welfare[a] | Cost[b] | Healthiness[c] | Safety[d] | Taste[e] |
|---|---|---|---|---|---|
| *CSES Chart Information* | | | | | |
|  | 3.582 | 3.799 | 4.029 | 4.008 | 3.869 |
|  | 3.963 | 3.531 | 3.777 | 3.902 | 3.754 |
|  | 3.906 | 3.625 | 3.920 | 3.887 | 3.938 |
|  | 3.494 | 3.516 | 3.949 | 3.914 | 3.879 |
|  | 3.502 | 3.623 | 3.967 | 3.982 | 3.865 |
|  | 3.295 | 3.547 | 3.867 | 3.803 | 3.752 |
|  | 3.451 | 3.500 | 3.852 | 3.896 | 3.961 |
| unlabeled eggs | 2.748 | 2.330 | 3.229 | 3.311 | 3.543 |
| *HSUS Chart Information* | | | | | |
|  | 3.591 | 3.716 | 4.060 | 4.070 | 3.918 |
|  | 3.949 | 3.626 | 3.842 | 3.897 | 3.819 |
|  | 3.774 | 3.556 | 3.842 | 3.905 | 3.893 |
|  | 3.432 | 3.547 | 3.934 | 3.916 | 3.911 |
|  | 3.457 | 3.634 | 3.969 | 3.986 | 3.833 |
|  | 3.323 | 3.605 | 3.879 | 3.813 | 3.794 |
|  | 3.455 | 3.506 | 3.895 | 3.959 | 4.014 |
| unlabeled eggs | 2.798 | 2.405 | 3.243 | 3.358 | 3.576 |

[a]Mean score on scale from 1 = very low hen welfare to 5=very high hen welfare
[b]Mean score on scale from 1 = very inexpensive to 5=very expensive
[c]Mean score on scale from 1 = very unhealthy to 5=very healthy
[d]Mean score on scale from 1 = very risky to 5=very safe
[e]Mean score on scale from 1 = very untasty to 5=very tasty
Note: green highlight indicates highest value in a column/treatment, red highlight indicates lowest value in a column/treatment, and yellow highlight indicates second lowest value in a column treatment.
Note: Sampling error for each mean is roughly +/- 0.08 on the 1 to 5 scale

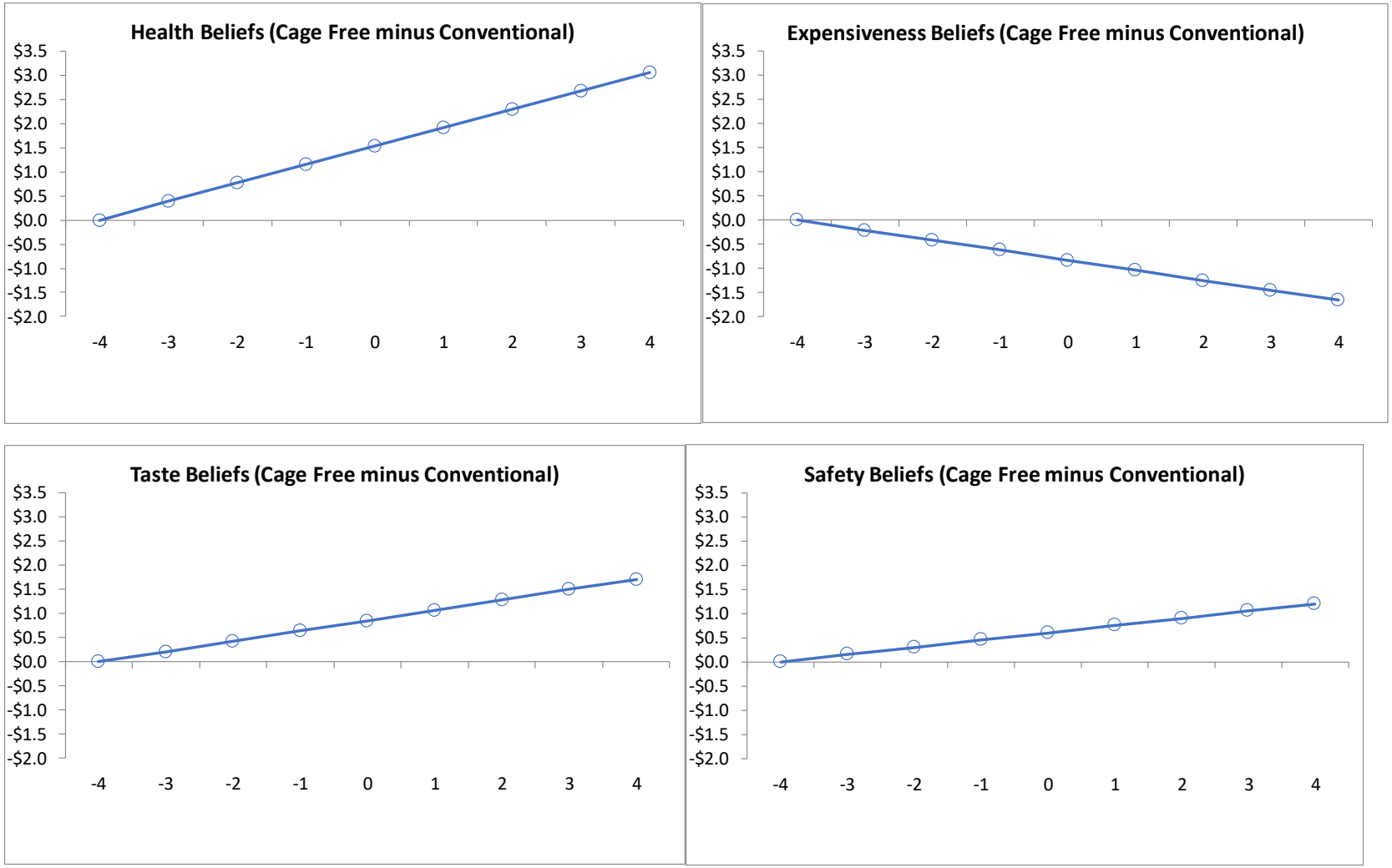



**Figure 14. Variation in Mean Willingness-to-Pay ($/dozen) by Relative Beliefs about Egg Labels**

# CHAPTER 4: IMPLICATIONS

Overall, consumers report price, safety, and taste as the most important factors they consider when buying eggs. Consumers perceive cage free labels as signaling more safety and better taste, but more expensive. These preferences and beliefs combine to explain consumer choice between eggs.

Results from a choice experiment, which simulates retail shopping choices, shows divergent preferences for different consumer segments. About 28% of consumers have a willingness-to-pay value for cage free that is only $0.12/dozen, and another 31% have a willingness-to-pay value that is only about $0.29/dozen. However, about a third of consumers made choices that indicate a willingness-to-pay value that is at least as large as the range of prices ($3.00/dozen) considered in this study.

In aggregate, a $1/dozen price change has the potential to affect market share by a larger amount than the provision of any label information. In the control condition with no additional information, addition of a non-GMO, organic, or omega 3 labels have larger effects on market shares than provision of a cage free label.

Information had relatively small effects on consumer demand for cage free eggs, but all three types of information studied here served to increase mean willingness-to-pay values, while invoking greater dispersion (or disagreement) in willingness-to-pay. The findings suggest the potential for market share of cage free to rise in the future as consumers gain more information and learn that unlabeled eggs are not cage free. However, there is likely some limit to these information effects. Consumers provided with video information that showed both cage and cage free systems tended to lower beliefs about animal welfare in cage free systems, perhaps removing misperceptions that cage free implies free range or small farm. Moreover, the two graphics that provided graphic information about cage free lowered median willingness-to-pay for cage free.

Ultimately, the results suggest there is potential for the market-share for cage free eggs to rise above the current state even at premiums as high as $1.00/dozen. However, even at much more modest price premiums, the potential for cage free eggs to attain majority market share is unlikely, particularly if conventional eggs advertise other desirable attributes.

Completely removing more affordable conventional eggs will significantly increase the share of consumers not buying eggs. Whether this is ultimately beneficial for retailers depends in the pre- and post-removal prices of cage free eggs and the added cost of cage free eggs.

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# APPENDICES

**Table A1. Percent of Consumers Choosing Options A, B, and C by Choice Scenario and Information Treatment**

| Choice Scenario | Control – No Info (N=506) | | | CSES – Video Info (N=504) | | |
|---|---|---|---|---|---|---|
| | Option A | Option B | No Purchase | Option A | Option B | No Purchase |
| 1 | 24% | 64% | 12% | 19% | 68% | 13% |
| 2 | 61% | 34% | 5% | 56% | 38% | 6% |
| 3 | 35% | 30% | 35% | 34% | 22% | 44% |
| 4 | 63% | 23% | 14% | 62% | 21% | 18% |
| 5 | 68% | 22% | 11% | 65% | 21% | 14% |
| 6 | 18% | 35% | 48% | 10% | 35% | 55% |
| 7 | 71% | 25% | 4% | 69% | 25% | 6% |
| 8 | 29% | 63% | 8% | 28% | 61% | 11% |
| 9 | 79% | 16% | 5% | 79% | 16% | 6% |
| 10 | 23% | 70% | 7% | 15% | 78% | 7% |
| 11 | 64% | 15% | 21% | 60% | 14% | 26% |
| 12 | 29% | 66% | 5% | 31% | 63% | 6% |

| Choice Scenario | CSES – Graphic Info (N=512) | | | HSUS – Graphic Info (N=514) | | |
|---|---|---|---|---|---|---|
| | Option A | Option B | No Purchase | Option A | Option B | No Purchase |
| 1 | 24% | 64% | 11% | 24% | 64% | 11% |
| 2 | 58% | 36% | 6% | 61% | 33% | 6% |
| 3 | 36% | 27% | 37% | 29% | 30% | 41% |
| 4 | 64% | 21% | 15% | 65% | 21% | 14% |
| 5 | 61% | 26% | 13% | 65% | 23% | 13% |
| 6 | 12% | 39% | 48% | 14% | 35% | 51% |
| 7 | 65% | 30% | 4% | 71% | 25% | 4% |
| 8 | 34% | 58% | 8% | 28% | 60% | 12% |
| 9 | 81% | 13% | 6% | 75% | 18% | 7% |
| 10 | 19% | 76% | 5% | 19% | 76% | 5% |
| 11 | 66% | 14% | 20% | 59% | 17% | 24% |
| 12 | 30% | 62% | 8% | 27% | 66% | 7% |

**Table A2. Multinomial Logit Estimates for Control with No Information**

| Variable | Unweighted | Weighted by Egg Purchase Volume | Remove Potentially Unreliable Respondents |
|---|---|---|---|
| *Parameter Estimates* | | | |
| None | -2.12 (0.062) | -2.072 (0.017) | -2.316 (0.072) |
| Price | -0.728 (0.020) | -0.706 (0.006) | -0.840 (0.023) |
| Cardboard vs. Styro | 0.210 (0.031) | 0.201 (0.009) | 0.223 (0.037) |
| Brown vs. White | -0.151 (0.031) | -0.137 (0.009) | -0.148 (0.037) |
| Cage free | 0.422 (0.038) | 0.406 (0.011) | 0.466 (0.045) |
| Organic | 0.401 (0.040) | 0.448 (0.011) | 0.422 (0.046) |
| Omega 3 | 0.390 (0.033) | 0.421 (0.009) | 0.431 (0.039) |
| Natural | 0.108 (0.031) | 0.111 (0.009) | 0.119 (0.037) |
| Non-GMO | 0.485 (0.034) | 0.510 (0.009) | 0.552 (0.040) |
| | | | |
| *Willingness-to-Pay ($/dozen)* | | | |
| Cardboard vs. Styro | $0.29 | $0.28 | $0.27 |
| Brown vs. White | -$0.21 | -$0.19 | -$0.18 |
| Cage free | $0.58 | $0.57 | $0.55 |
| Organic | $0.55 | $0.63 | $0.50 |
| Omega 3 | $0.53 | $0.60 | $0.51 |
| Natural | $0.15 | $0.16 | $0.14 |
| Non-GMO | $0.67 | $0.72 | $0.66 |
| | | | |
| Number of choices | 6072 | 6024 | 4740 |
| Number of individuals | 506 | 502 | 395 |

Note: one asterisk represents statistical significance at the 0.05 level or lower; numbers in parentheses are standard errors.

**Table A3. MNL Estimates by Treatment**

| Variable | Treatment 1 | Treatment 2 | Treatment 3 | Treatment 4 | pooled |
|---|---|---|---|---|---|
| None | -2.12 (0.062) | -2.05 (0.062) | -1.996 (0.061) | -2.02 (0.06) | -2.041 (0.03) |
| Price | -0.728 (0.02) | -0.818 (0.021) | -0.753 (0.021) | -0.737 (0.02) | -0.756 (0.01) |
| Cardboard | 0.21 (0.031) | 0.103 (0.032) | 0.14 (0.031) | 0.136 (0.031) | 0.148 (0.016) |
| Brown | -0.151 (0.031) | -0.155 (0.033) | -0.156 (0.031) | -0.198 (0.031) | -0.164 (0.016) |
| Cage free | 0.422 (0.038) | 0.585 (0.041) | 0.621 (0.04) | 0.415 (0.038) | 0.507 (0.02) |
| Organic | 0.401 (0.04) | 0.364 (0.041) | 0.385 (0.039) | 0.388 (0.04) | 0.384 (0.02) |
| Omega 3 | 0.39 (0.033) | 0.429 (0.035) | 0.411 (0.034) | 0.389 (0.033) | 0.403 (0.017) |
| Natural | 0.108 (0.031) | 0.088 (0.033) | 0.11 (0.031) | 0.16 (0.031) | 0.117 (0.016) |
| Non Gmo | 0.485 (0.034) | 0.492 (0.036) | 0.575 (0.035) | 0.493 (0.034) | 0.511 (0.017) |
| N choices | 6072 | 6048 | 6144 | 6168 | 24432 |
| N people | 506 | 504 | 512 | 514 | 2036 |
| LLF | -5240.35 | -4363.72 | -5323.98 | -5395.27 | -21240.58 |

**Table A4. Willingness-to-Pay ($/dozen) Estimates by Treatment from Multinomial Logit**

| Variable | Treatment 1 | Treatment 2 | Treatment 3 | Treatment 4 |
|---|---|---|---|---|
| Cardboard | $0.29 [0.2, 0.37]a | $0.13 [0.05, 0.2] | $0.19 [0.1, 0.27] | $0.19 [0.1, 0.27] |
| Brown | -$0.21 [-0.29, -0.12] | -$0.19 [-0.27, -0.11] | -$0.21 [-0.29, -0.12] | -$0.27 [-0.35, -0.18] |
| Cage free | $0.58 [0.49, 0.67] | $0.72 [0.64, 0.79] | $0.82 [0.74, 0.91] | $0.56 [0.47, 0.65] |
| Organic | $0.55 [0.45, 0.65] | $0.44 [0.36, 0.53] | $0.51 [0.42, 0.6] | $0.53 [0.43, 0.62] |
| Omega 3 | $0.53 [0.45, 0.62] | $0.52 [0.45, 0.6] | $0.55 [0.46, 0.63] | $0.53 [0.44, 0.61] |
| Natural | $0.15 [0.06, 0.23] | $0.11 [0.03, 0.18] | $0.15 [0.06, 0.23] | $0.22 [0.13, 0.3] |
| Non Gmo | $0.67 [0.58, 0.75] | $0.6 [0.52, 0.68] | $0.76 [0.68, 0.85] | $0.67 [0.58, 0.75] |

[a]Numbers in brackets are 95% confidence intervals

**Table A5. Latent Class Logit Estimates by Treatment**

| Variable | Treatment 1 | Treatment 2 | Treatment 3 | Treatment 4 |
|---|---|---|---|---|
| *Class 1* | | | | |
| None | -6.018 (0.395) | -7.086 (0.634) | -5.111 (0.314) | -6.485 (0.685) |
| Price | -3.606 (0.284) | -3.532 (0.367) | -2.472 (0.136) | -3.725 (0.4) |
| Carton | -0.305 (0.197) | -0.422 (0.312) | -0.157 (0.147) | -0.826 (0.269) |
| Brown | -0.6 (0.22) | -1.34 (0.221) | -0.824 (0.148) | -0.926 (0.234) |
| cagefree | 0.427 (0.23) | -0.439 (0.304) | 0.229 (0.185) | 1.08 (0.335) |
| Organic | 1.148 (0.263) | 0.177 (0.307) | 0.287 (0.18) | 1.146 (0.286) |
| Omega | 1 (0.218) | 0.724 (0.302) | 0.357 (0.167) | 1.169 (0.223) |
| Natural | 0.582 (0.22) | 0.398 (0.25) | 0.077 (0.147) | 1.206 (0.31) |
| nongmo | 0.835 (0.178) | -0.087 (0.255) | 0.427 (0.15) | 0.345 (0.171) |
| *Class 2* | | | | |
| none | -5.713 (0.488) | 2.075 (0.984) | -2.939 (0.313) | 0.346 (0.88) |
| price | -1.474 (0.107) | -0.668 (0.242) | -0.103 (0.048) | -0.287 (0.219) |
| carton | -0.023 (0.089) | 2.006 (0.888) | 0.246 (0.059) | 1.315 (0.53) |
| brown | 0.176 (0.115) | 1.259 (0.514) | -0.085 (0.056) | 0.909 (0.383) |
| cagefree | 0.423 (0.111) | 6.041 (1.055) | 0.758 (0.076) | 3.307 (0.778) |
| organic | 0.245 (0.121) | -0.337 (0.501) | 0.214 (0.082) | 0.377 (0.394) |
| omega | 0.471 (0.113) | -0.659 (0.646) | 0.193 (0.058) | -0.165 (0.277) |
| natural | 0.063 (0.084) | -0.642 (0.504) | 0.086 (0.055) | 0.235 (0.293) |
| nongmo | 0.681 (0.12) | 1.329 (0.544) | 0.549 (0.063) | 1.684 (0.473) |
| *Class 3* | | | | |
| none | -3.63 (0.622) | -3.737 (0.45) | -6.54 (0.6) | -5.994 (0.397) |
| price | -2.331 (0.795) | -0.167 (0.058) | -1.614 (0.125) | -1.623 (0.089) |
| carton | 0.2 (0.578) | 0.092 (0.064) | -0.212 (0.116) | -0.195 (0.117) |
| brown | -6.471 (1.6) | -0.09 (0.065) | 0.307 (0.153) | 0.31 (0.142) |
| cagefree | 1.851 (0.854) | 0.242 (0.08) | 0.312 (0.132) | 0.318 (0.138) |
| organic | 2.868 (1.175) | 0.329 (0.092) | 0.389 (0.137) | 0.16 (0.138) |
| omega | 2.416 (1.174) | 0.125 (0.064) | 0.689 (0.108) | 0.547 (0.105) |
| natural | -0.488 (0.472) | 0.18 (0.061) | 0.123 (0.094) | 0.024 (0.093) |
| nongmo | 4.206 (1.683) | 0.348 (0.068) | 0.95 (0.152) | 0.996 (0.139) |
| *Class 4* | | | | |
| none | -2.46 (0.245) | -4.499 (0.218) | -1.691 (0.31) | -3.171 (0.298) |
| price | -0.199 (0.048) | -1.601 (0.068) | -1.728 (0.205) | -0.06 (0.048) |
| carton | 0.369 (0.057) | -0.071 (0.082) | 0.462 (0.184) | 0.135 (0.062) |
| brown | 0.12 (0.055) | 0.238 (0.103) | 0.662 (0.165) | -0.244 (0.062) |
| cagefree | 0.624 (0.07) | 0.716 (0.118) | 2.39 (0.341) | 0.177 (0.074) |
| organic | 0.404 (0.079) | 0.391 (0.1) | 0.769 (0.232) | 0.275 (0.083) |
| omega | 0.168 (0.056) | 0.668 (0.086) | -0.068 (0.186) | 0.118 (0.057) |
| natural | 0.182 (0.054) | 0.156 (0.073) | 1.124 (0.281) | 0.229 (0.056) |
| nongmo | 0.43 (0.061) | 0.938 (0.098) | 0.769 (0.195) | 0.3 (0.063) |

| | | | | |
|---|---|---|---|---|
| *Class 5* | | | | |
| None | 0 | 0 | 0 | 0 |
| Price | 0 | 0 | 0 | 0 |
| Carton | 0 | 0 | 0 | 0 |
| Brown | 0 | 0 | 0 | 0 |
| cagefree | 0 | 0 | 0 | 0 |
| Organic | 0 | 0 | 0 | 0 |
| Omega | 0 | 0 | 0 | 0 |
| Natural | 0 | 0 | 0 | 0 |
| nongmo | 0 | 0 | 0 | 0 |
| | | | | |
| *Class Probabilities* | | | | |
| Class 1 | 0.245 (0.021) | 0.221 (0.02) | 0.246 (0.022) | 0.303 (0.023) |
| Class 2 | 0.279 (0.027) | 0.082 (0.013) | 0.3 (0.024) | 0.062 (0.015) |
| Class 3 | 0.054 (0.011) | 0.204 (0.021) | 0.261 (0.028) | 0.252 (0.024) |
| Class 4 | 0.312 (0.026) | 0.371 (0.025) | 0.104 (0.02) | 0.259 (0.023) |
| Class 5 | 0.110 (0.017) | 0.122 (0.017) | 0.087 (0.015) | 0.124 (0.017) |

**Table A6. Effects of Demographics on Willingness-to-Pay ($/dozen) for Cage Free Eggs**

| Variable | Estimate | Standard Error | P-Value |
|---|---|---|---|
| Intercept | 1.132 | 0.623 | 0.069 |
| Treatment 1 | -0.742 | 0.172 | <.0001 |
| Treatment 2 | -0.599 | 0.173 | 0.001 |
| Treatment 3 | 0.488 | 0.171 | 0.004 |
| Treatment 4 | 0.000 | . | . |
| region1 | 0.094 | 0.197 | 0.634 |
| region2 | -0.315 | 0.187 | 0.093 |
| region3 | -0.207 | 0.166 | 0.213 |
| region4 | 0.000 | . | . |
| female | 0.043 | 0.135 | 0.751 |
| age18_24 | 0.953 | 0.405 | 0.019 |
| age25_34 | 0.880 | 0.398 | 0.027 |
| age35_44 | 0.553 | 0.396 | 0.163 |
| age45_54 | 0.405 | 0.388 | 0.296 |
| age55_64 | -0.054 | 0.387 | 0.888 |
| age65_74 | -0.250 | 0.396 | 0.529 |
| age75_94 | 0.000 | . | . |
| married | 0.164 | 0.144 | 0.257 |
| Buyper | 0.006 | 0.003 | 0.083 |
| Hhsize | -0.012 | 0.066 | 0.851 |
| child | -0.146 | 0.182 | 0.424 |
| foodstamp | 0.371 | 0.178 | 0.037 |
| college | 0.082 | 0.143 | 0.567 |
| inc0_19 | 0.009 | 0.369 | 0.980 |
| inc20_39 | -0.085 | 0.345 | 0.804 |
| inc40_59 | 0.064 | 0.341 | 0.851 |
| inc60_79 | 0.301 | 0.346 | 0.386 |
| inc80_99 | 0.463 | 0.359 | 0.198 |
| inc100_119 | 0.715 | 0.394 | 0.070 |
| inc120_139 | 0.298 | 0.430 | 0.489 |
| inc140_159 | 0.964 | 0.443 | 0.030 |
| inc160_200 | 0.000 | . | . |
| hispanic | -0.003 | 0.189 | 0.987 |
| white | -0.390 | 0.223 | 0.080 |
| black | -0.049 | 0.278 | 0.859 |

Model $R^2 = 0.07$

**Table A7. Effects of Food Values on Willingness-to-Pay ($/dozen) for Cage Free Eggs**

| Variable | Estimate | Standard Error | P-Value |
|---|---|---|---|
| Intercept | 2.496 | 0.141 | <.0001 |
| Treatment 1 | -0.815 | 0.163 | <.0001 |
| Treatment 2 | -0.586 | 0.163 | 0.000 |
| Treatment 3 | 0.456 | 0.161 | 0.005 |
| Treatment 4 | 0.000 | . | . |
| Natural | 0.440 | 0.098 | <.0001 |
| Taste | 0.051 | 0.108 | 0.638 |
| Price | -0.526 | 0.110 | <.0001 |
| Safety | -0.007 | 0.102 | 0.945 |
| Convenience | -0.037 | 0.100 | 0.714 |
| Nutrition | 0.166 | 0.099 | 0.094 |
| Novelty | 0.305 | 0.125 | 0.015 |
| Origin | 0.170 | 0.099 | 0.088 |
| Fairness | 0.391 | 0.107 | 0.000 |
| Appearance | 0.120 | 0.103 | 0.245 |
| Environment | 0.322 | 0.106 | 0.002 |
| Animal Welfare | 0.553 | 0.105 | <.0001 |
| Size | 0.000 | . | . |

Model $R^2 = 0.16$

**Table A8. Effects of Label Beliefs on Willingness-to-Pay ($/dozen) for Cage Free Eggs**

| Variable | Estimate | Standard Error | P-Value |
|---|---|---|---|
| Intercept | 1.724 | 0.130 | <.0001 |
| Treatment 1 | -0.773 | 0.167 | <.0001 |
| Treatment 2 | -0.542 | 0.168 | 0.001 |
| Treatment 3 | 0.449 | 0.165 | 0.007 |
| Treatment 4 | 0.000 | . | . |
| *Relative Beliefs about* | | | |
| Health[a] | 0.382 | 0.060 | <.0001 |
| Expense | -0.208 | 0.044 | <.0001 |
| Taste | 0.214 | 0.068 | 0.002 |
| Safety | 0.150 | 0.062 | 0.016 |
| Animal Welfare | 0.053 | 0.046 | 0.245 |

Model $R^2 = 0.11$

[a]Difference in beliefs about healthiness of eggs with cage free label and healthiness of eggs with no label (both scales ranged from 1 to 5, which means the difference ranges from -4 to +4)

**Table A9. Effects of Beliefs about Egg Production on Willingness-to-Pay ($/dozen) for Cage Free Eggs**

| Variable | Estimate | Standard Error | P-Value |
|---|---|---|---|
| Intercept | 0.757 | 0.306 | 0.014 |
| Treatment 1 | -0.700 | 0.170 | <.0001 |
| Treatment 2 | -0.372 | 0.175 | 0.033 |
| Treatment 3 | 0.538 | 0.169 | 0.002 |
| Treatment 4 | 0.000 | . | . |
| % of eggs cage free | 0.114 | 0.081 | 0.160 |
| Egg laying hens are generally well treated[a] | -0.238 | 0.060 | <.0001 |
| All cage free eggs are brown[a] | -0.061 | 0.065 | 0.348 |
| Brown eggs come from chickens with brown feathers[a] | 0.125 | 0.057 | 0.027 |
| Trap[b] | 0.545 | 0.168 | 0.001 |
| Brown eggs are more nutritious than white eggs[a] | 0.158 | 0.061 | 0.010 |
| Cage free hens lay more eggs than caged hens[a] | 0.267 | 0.066 | <.0001 |

Model $R^2 = 0.07$

[a]Scale ranges from 1 (strongly disagree) to 5 (strongly agree)

[b]Takes the value of 1 for individuals who incorrectly answered the trap question