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The US Public's Attitudes on Animal and Worker Welfare in the Dairy and Poultry Industries

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The social license between the US public and food producers has grown increasingly complex, especially as it relates to the treatment of farm animals and workers. In this study, we employ two best–worst-scaling experiments to elicit the public's preferences regarding animal and worker welfare farm practices within the dairy and poultry industries. Using a latent class modeling approach, we find that US consumers generally value animal welfare practices more than they value worker welfare practices. However, population subgroups with strong preferences for worker welfare practices exist, primarily among older, highly educated, Democrats living in the Northeastern United States.

Key words: agricultural production, animal welfare practices, best–worst scale analysis, worker welfare practices

Introduction

Through food purchasing, voting, and demanding business regulations, society grants a social license to food producers. If food does not meet socially acceptable requirements, consumers will not purchase the product, government legislation may be put in place, or retailers may require changes from their suppliers (called politics by other means; Schweikhardt and Browne, 2001). We have seen the public signaling changes to food producers through all three channels, especially in milk, meat, and egg production.

For dairy and poultry products, animal welfare is a key social responsibility attribute. Numerous food choice studies have documented that the public is willing to pay a price premium for animal welfare labels on both dairy and poultry products (Chang, Lusk, and Norwood, 2010; Heng, Hanawa Peterson, and Li, 2013; Olynk and Ortega, 2013; Van Loo et al., 2014; Lusk, 2019). Price premiums for labeling programs indicate financial support through purchase behavior. Additionally, there have been animal housing (deemed to impact animal welfare) government interventions through 19 state-level bills and ballot initiatives in the United States from 2002 to 2020 (Hopkins et al., 2021). Internationally, Bennett (1997) and Bennett and Blaney (2003) find that United Kingdom consumers were willing to pay for legislation that they perceived improved hen welfare. In addition to purchase behavior and government regulations through bills and ballot initiatives, there are also business regulations regarding animal welfare (Aramark, 2015; Walmart, 2015; Fair Food Program, 2019).

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Recently, there have been calls for improved agricultural worker welfare as well. Most of the mechanism for change thus far has been through politics by other means (i.e., business regulations). For example, even before moving toward using less antibiotics in chicken production (Strom, 2015), McDonald's had partnered with the Fair Food Program to purchase tomatoes from farms with certified working conditions (Fair Food Program, 2019). Aramark and Walmart made similar worker welfare commitments before selecting public animal welfare stances (Aramark, 2015; Walmart, 2015; Fair Food Program, 2019). Ice cream producer Ben and Jerry's signed the Milk with Dignity agreement, stating that they would only source milk from farms with good labor practices (Greenhouse, 2015; Scheiber, 2017). As the Fair Food Program label and its contemporaries (e.g., the Equitable Food Initiative) become more common in food markets, the public call for better working conditions for farm livestock workers may grow too.

There is evidence suggesting an explicit trade-off between animal and worker wellbeing in the implementation of farm practices. For example, comparing the cage-free aviary system to conventional cage housing systems in poultry production, cage-free systems are better for hen behavior, but worker health and safety decreases in cage-free environments (Coalition for Sustainable Egg Supply, 2015; Ochs et al., 2018). Do consumers' preferences reveal a recognition of this explicit trade-off? Which do they value more, animal or worker welfare? A recent study by Ochs et al. (2018) on the US public's perceptions of the benefits and drawbacks of cage-free aviary and enriched colony housing compared to conventional cage systems suggested that the public views animal and worker welfare as complementary concepts. For example, 72.8%, 71.6%, and 53.9% of respondents believed that the cage-free aviary had a positive impact on hen health and stress, hen behavior, and worker health and safety, respectively, over conventional cages. This finding contrasts scientific-based evidence indicating an inverse relationship between the adoption of a cage free system and hen health and stress and worker health and safety (Ochs et al., 2018). More research is needed on the dissonance between public beliefs about different hen housing systems and existing research on the benefits and drawbacks of each. Indeed, there is extensive research on consumers' preferences for non-cage production systems in the poultry industry (e.g., Chang, Lusk, and Norwood, 2010; Lusk, 2010; Heng, Hanawa Peterson, and Li, 2013; Van Loo et al., 2014; Lusk, 2019) and animal wellbeing under such systems (e.g., Regmi et al., 2015, 2016). Meanwhile, discussion on consumers' preferences for production in agriculture, in general, remains sparse (Howard and Allen, 2006, 2010; Drichoutis et al., 2017; Ochs et al., 2019b,a), as does research into consumers' preferences for agricultural workers' health outcomes (Coalition for Sustainable Egg Supply, 2015).

We seek to fill this gap and address the lack of information on consumers' attitudes toward worker welfare impacting practices in the farm industry. More specifically, we surveyed over 750 US individuals and utilized a best–worst scaling (BWS) approach to measure consumer preferences for both animal and worker welfare-enhancing farm practices in the dairy and poultry industries. The dairy industry was selected because it is one of the most contemporaneous sectors discussing worker welfare conditions, while the poultry industry was selected because of the explicit trade-off between animal and worker welfare. Selected farm practices in these sectors focused on breaks and meals, third-party verification of conditions, and varied health concerns for both animals and workers. Additionally, two farm practices that simultaneously improve animal and worker welfare, training of workers (dairy) and worker-to-animal ratios (poultry), were also examined. Exploring these practices with a BWS experiment allowed for a relative ranking of both worker welfare and animal welfare practices. Preference heterogeneity was also explored by evaluating differences in consumer attitudes across sociodemographic characteristics and other psychological factors.

By introducing worker welfare-enhancing practices within the discussion of animal welfare improvements, we explore how consumers make trade-offs between improvements in animal and worker welfare. Not only does this study facilitate discussion for this nascent topic area, but it also situates that discussion in the current public discourse on related farm practices (Greenhouse, 2015; Scheiber, 2017; O'Kane, 2019).

Research in animal and worker welfare has great practical application for various stakeholders, including farmers and policy makers. For instance, little attention has been paid to date to what worker welfare practices are considered most important to the public. Further, questions on whether producers should continue to prioritize animal welfare practices over worker welfare practices remain unanswered. It is important for producers to know the welfare practices most important to consumers to ensure that their products comply with such standards and remain in demand given consumers' social license to produce. As consumers, the public advocates for production practices with the purchases they make; they may boycott products they believe are produced unethically and/or be willing to pay a price premium for a verification that specific practices are used. In addition, producers may be limited in their ability to economically implement all possible animal and worker welfare-enhancing practices without pricing themselves out of the market. Hence, evidence on what animal and worker welfare practices are most important to consumers is crucially important to make informed farm decisions.

The proliferation of animal welfare legislation indicates that the public also uses legislation to convey its farm practice preferences. While we have thus far concentrated on animal welfare legislation, we also acknowledge the prevalence of worker welfare legislation discussions that are ongoing including the Fair Labor Standards Act (FLSA) and complementary laws like New York's Farm Laborers Fair Labor Practices Act (New York State Department of Labor, 2021) and the federal Fairness for Farm Workers Act (HR 3194, 2021). Our research informs policy makers on how the public views various agricultural labor measures. Without asking their constituents for their opinions on working conditions in agriculture; however, policy makers are operating with partial information.

Background and Farm Practice Identification

Prior studies have explored preferences for animal welfare practices in the dairy (Ellison, Brooks, and Mieno, 2017; Wolf and Tonsor, 2017) and poultry (Bennett, 1997; Bennett and Blaney, 2003; Ellison, Brooks, and Mieno, 2017; Heng, Hanawa Peterson, and Li, 2013; Van Loo et al., 2014) industries. Although past studies have looked at consumer preferences for worker welfare labels on food products (Drichoutis et al., 2017), only one prior research study includes a worker welfare attribute (Ochs et al., 2019b).[1] Further, no past research studies focus on consumer preferences for specific worker welfare practices in the livestock industry. This study explores how consumers make trade-offs between worker and animal welfare practices in both the dairy and poultry industries.

We selected these two industries for a number of reasons. The dairy industry faces controversy surrounding the working conditions on some farms. Due in part to these national discussions, the National Dairy Farm Program extended their areas of concentration to include workforce development in 2018 (Farmers Assuring Responsible Management, 2020). As they continue to refine what practices should be recommended in this program and as producers decide whether it is a program in which they would like to participate, it is advantageous to have public opinion data on worker welfare farm practices in the dairy industry. The poultry industry, on the other hand, has not received the same type of national attention regarding its working conditions. However, laws concerning animal welfare in the industry, like California's Propositions 2 and 12, are commonly up for debate. Therefore, the poultry industry serves as an interesting case study for understanding how worker welfare concerns may fit within already well-established concerns for farm animal welfare. Additionally, prior research suggests that explicit trade-offs may exist between animal and worker welfare in the poultry industry. For example, the Coalition for Sustainable Egg Supply (2015) posits

[1] Ochs et al. (2019b) does elicit consumer rankings of animal and worker welfare, but our study differs in three ways: First, while Ochs et al. elicited consumer preferences for rankings of animal and worker welfare (e.g., worker health and safety), our research focuses on consumer preferences for farming practices impacting both animal and worker welfare (e.g., access to food and water). Second, Ochs et al. included only one worker welfare attribute (worker health and safety), while our study is more balanced in the presentation of animal and worker welfare concerns. Third, Ochs et al. only studied hens, while our study focuses on both hens and dairy.

Table 1. Animal and Worker Welfare Practices Included in the Dairy Application

	Animal Welfare Practice	Worker Welfare Practice
Breaks	*AW_Breaks*: All cattle must have access to outdoor exercise areas for at least 4 hours per day, weather permitting.	*WW_Breaks*: All workers are provided paid 15-minute breaks for every 4 hours worked, and a 30-minute (meal) break between each 4-hour shift.
Third-party verification	*AW_Ver*: A third party verifies that appropriate cow care and facilities are provided on farm.	*WW_Ver*: A third-party verifies that appropriate human resource management and working conditions are provided on farm.
Treatment of sick	*AW_Sick*: Sick cows are promptly treated or euthanized.	*WW_Sick*: Workers are paid sick time off.
Health plans	*AW_Health*: A herd health plan is developed with the help of a veterinarian.	*WW_Health*: Workers are provided medical insurance.
Training	*Training*: There is a consistent training program for owners and workers focusing on principles of cow care and handling that increase both animal and worker welfare.	

that cage-free aviary systems improve hen health but can depress worker respiratory health compared to conventional caged systems. As such, we used these two industries and formulated farm animal and worker welfare practices for each. The following subsections describe the farm practice selection in each industry.

Dairy Industry Welfare Practices Selection

While our initial experiment idea was inspired by the Coalition for Sustainable Egg Supply (2015) and Scheiber (2017), the practical work of choosing farm practices stems from the dairy industry animal welfare practices reported in Wolf and Tonsor (2017). Using the nine animal welfare practices developed by the authors as a base, we identify parallel worker welfare practices to elicit trade-offs between animal welfare and worker welfare enhancements. The final list includes four animal welfare practices, four worker welfare practices, and one practice benefiting both parties (see Table 1). The four practices primarily benefiting a single party (animal or workers) can be categorized as pertaining to breaks, third-party verification, treatment of sick, and health plans.

These farm practices were not chosen just because of their relationship to animal and worker welfare but also for their individual merits. Prior research has indicated that cow access to outdoor spaces is desirable to consumers (Wolf, Tonsor, and Olynk, 2011), and it is a condition certified by some labeling programs (e.g., organic and animal welfare approved). For workers, prior research has shown that, "in general, regular rest breaks can be an effective means of maintaining performance, managing fatigue and controlling the accumulation of risk over prolonged task performance" (Tucker, 2003, p. 123). Despite this, US federal law does not require employers to provide employees lunch or coffee breaks (US Department of Labor, 2020a), and less than half of all states have adopted such legislation (US Department of Labor, 2020b).

The second group of welfare practices, third-party verification, is not specific to a law or government action, as with organic labeling being certified by the USDA, but rather is an option available in the private sector that may help strengthen consumer trust (Wolf and Tonsor, 2017). Hence, third-party verification may serve as a vehicle to boost demand for food produced under certain welfare practices. To this end, third-party verification is often a component of animal welfare labeling programs, such as the USDA Processed Verified Program (US Department of Agriculture, 2022), and worker welfare labeling programs, like the Fair Food Program (2022).

Table 2. Nine Animal and Worker Welfare Practices Included in the Poultry Application

	Animal Welfare Practice	Worker Welfare Practice
Meals	*AW_Meals*: Hens have constant access to food and water	*WW_Breaks*: All workers are provided paid 15- minute breaks for every 4 hours worked, and a half hour30-minute (meal) break between each 4- hour shift.
Third-party verification	*AW_Ver*: A third-party verifies that appropriate hen care and facilities are provided on farm	*WW_Ver*: A third-party verifies that appropriate human resource management practice and working conditions are provided on farm
Treatment of sick	*AW_Sick*: Sick animals are promptly treated or euthanized	*WW_Sick*: Workers are paid sick time off
Cage system	*AW_Cage*: An aviary or free-range housing system is used which does not constrain hens to individual or small-group cages.	*WW_ Cage*: Workers are provided proper respiratory (safety) protection (a N95 mask or respirator)
Flock size	*Flock_Size*: Flock size is not increased without space and staffing capacities within determined ratios, which not only ensures hen space but also restricts the burdens on workers.	

Several farm practices are regulated by certification programs. Many such animal welfare programs include animal health and sickness provisions (Wolf and Tonsor, 2017). Part of the necessity to include such elements is due to the public's concern about animal health and safety. For example, undercover dairy farm animal welfare videos have generated outcry at the treatment of some sick and lame animals (Wolf and Tonsor, 2017; O'Kane, 2019). The treatment of sick and health plan farm practices that we have included help address these ongoing concerns.[2] Providing paid sick time off was deemed analogous to promptly treating injured or sick cows, as it allows workers a degree of financial security as they proactively treat illness.

Finally, as previously alluded to, the joint farm practice was worker training. Consistent training focusing on cow care and handling was deemed to not only enhance the humane treatment of cattle but to increase workers' safety and efficiency. Further, it is likely that humane treatment of cows will increase cow efficiency (Breuer et al., 2000).

Poultry Industry Welfare Practices Selection

Prior studies documented that consumers are willing to pay a price premium for animal welfare enhancements in animal production; this premium varies across species (Ellison, Brooks, and Mieno, 2017; Clark et al., 2017) and animal products from the same species (see, e.g., McKendree et al., 2013; Olynk and Ortega, 2013; Bir, Delgado, and Widmar, 2021). Hence, it is possible that they value the relative welfare of animals and workers differently across species and animal products as well. Therefore, once the animal and worker welfare practices in the dairy industry were determined, we sought analogous practices in poultry farm practices, aiding preference comparisons between animal and worker welfare across industries. We maintain five of the farm practices from the dairy study for the poultry application: third-party verification and treatment of sick for both animals and workers, and worker breaks (see Table 2).

For poultry, the benefit of breaks for animals was reimagined for its more basic benefit of ensuring a meal break for workers. Access to feed and water (*AW_Meals*) was therefore analogous

[2] The herd health plan was the only animal welfare practice included in this study but not in Wolf and Tonsor (2017). It was included in McKendree, Tonsor, and Wolf (2018) for beef cattle. It was chosen here for its similarity to providing health insurance (which explains and reduces the costs of human health maintenance), a topic that has been hotly debated at the national and state levels.

for chicken welfare. Cage-free practices encompass both this practice and *AW_Cage* (described shortly). As legislation permitting only cage-free production has passed in states like California and Michigan, it is interesting to see how people nationally view these practices, especially compared to other potential animal welfare-enhancing practices (Morris, 2017).

Next, we include a farm practice pair that would explore the potential trade-off between improvements for hens and damage for workers via the cage-free system. Note that since all farm practices were phrased as improvements for either animals or workers, we did not mention the research and potential negative human effects of the *AW_Cage* variable either in its description or as the negative of that practice for worker welfare practice (i.e., individual battery cages are used to reduce airborne dust and pathogens for workers). Rather, we chose to frame the worker welfare improving system as respiratory equipment, which would likely improve worker conditions in any poultry system, but particularly as a way of improving upon a perhaps already adopted cage-free system on behalf of workers. Finally, the joint beneficiary farm practice was changed from *Training* to *Flock_Size*. A consistent flock-size-to-worker ratio theoretically enhances animal wellbeing by ensuring proper care but also prevents the workload from being overwhelming for workers; for example, increased flock size (independent of the number of workers) was positively correlated with cumulative mortality (Chou, Jiang, and Hung, 2004).

Experimental Procedures and Data

Best Worst Scale Design

To determine the relative importance the US general population places on the practices listed in Tables 1 and 2, we utilized a best–worst scaling (BWS) approach, which offers many theoretical and practical benefits compared with other, traditional preference elicitation techniques (Louviere, Flynn, and Marley, 2015). BWS is preferred to Likert scales as it requires respondents to make trade-offs between objects and represents a well-understood measure (Finn and Louviere, 1990; Lusk and Briggeman, 2009; Wolf and Tonsor, 2013; Caputo and Lusk, 2020). Unlike Likert scales, BWS further eliminates scale issues in that the terms "most important" and "least important" mean the same across individuals, whereas a "4" rating on a Likert scale may mean something different, perhaps a "5" rating, to someone else.

For each application (dairy and poultry), we used an object case (case 1) balanced incomplete block design (see Louviere, Flynn, and Marley, 2015) in which each of the nine farm practices was considered as a distinct object. The design resulted in 12 questions, each with six farm practices (see Figure S1 in the online supplement for an example choice question).[3] Each practice appeared eight times overall, while pairs of practices appeared five times throughout the 12 questions. During the experiment, respondents were asked to select the "most important" and "least important" farm practice within each choice set or BWS question. During the data collection, the order of the farm practices within each question and the question order were randomized across respondents.

Survey Design

In addition to the BWS questions, the survey included sociodemographic questions and psychometric scales, including scales on perceptions of animal treatment (Kendall, Lobao, and Sharp, 2006), animal utility (Kendall, Lobao, and Sharp, 2006), in-group identification (Lyons, Coursey, and Kenworthy, 2013), and illegal aliens (Ommundsen et al., 2002).

The animal treatment and animal utility scales from Kendall, Lobao, and Sharp (2006) each contained three questions on a Likert scale from 1 to 5 with the final scale variable sum ranging from 3 to 15. Low scores on the animal treatment scale reflected low concern for animal well-

[3] The online supplement is available at www.jareonline.org.

being. Low scores on the animal utility scale reflected a high animal utilitarian orientation, meaning the respondent believed animals should be used for human purposes like cosmetics testing and hunting. The in-group identification scale (nine questions) from Lyons, Coursey, and Kenworthy (2013) included statements like "Being an American is central to my sense of who I am." The final scale variable was continuous and ranged from 1, low American in-group identification, to 5, strong national in-group identification. The illegal aliens scale (20 questions) from Ommundsen et al. (2002) included statements like "All illegal aliens deserve the same rights as US citizens." The original scale variable was continuous, ranging from −10 to 10. We further reduced the scale to a three-level categorical variable where −1 indicated that the respondent had overall negative views toward illegal aliens, 0 indicated that the respondent was neutral toward illegal aliens, and 1 indicated that the respondent had overall favorable views toward illegal aliens.

Data

The BWS survey was implemented in Qualtrics, which also administered the data collection. Adults who had purchased eggs and milk in the last 3 months were eligible to participate.[4] Participants were randomly assigned to either a milk (dairy) or egg (poultry) survey, with each following the same structure. Table S1 in the online supplement reports summary statistics of the basic demographics and variable definitions. The final sample resulted in 778 viable respondents, with 416 in the dairy experiment and 362 in the poultry experiment.[5]

More women participated than men, a common occurrence in online research studies of primary shoppers (Lusk, 2011; Grebitus, Lusk, and Nayga, 2013). Most respondents were between 30 and 64 years of age, with the proportion of seniors approximating that found in the United States. Around one-third of the sample had at least a bachelor's degree, similar to the US population (US Census Bureau, 2020). Our sample income was below national levels: Only 27.9% of US households had income below $35,000 and 30.4% had income over $100,000 in 2018 (Semega et al., 2019). In our sample, the Midwest was over-represented, while the West was under-represented. In 2018, 33% and 26% of registered voters identified as Democrats and Republicans, respectively (Jones, 2018); our sample is approximately representative, except that our dairy sample includes more Republicans than would be representative.

Empirical Analysis

BWS is consistent with random utility theory (RUT), which assumes that people choose the item that provides the greatest utility.[6] According to RUT, the probability that the respondent n selects item j (as best) and k (as worst) out of J items in BWS question t is the probability that the difference in utility of the selected items (U_{njt} and U_{nkt}) is greater than all other $J(J-1)-1$ possible differences within each BWS question (Lusk and Briggeman, 2009; Caputo and Lusk, 2020). Utility is comprised of two components: the difference in utility between the j best and the k worst practices ($\beta_{jt} - \beta_{kt}$) and a random error term (ε_{njt}):

$$U_{njt} = \left(\beta_{jt} - \beta_{kt}\right) + \varepsilon_{njt}, \tag{1}$$

[4] We sampled primary shoppers of milk or eggs as the farm practices analyzed in this study refer to animal and worker practices in these industries. We postulate that this group's level of involvement and interest in such practices is higher than that of consumers who do not purchase any of these products.

[5] More individuals were surveyed. However, after running Malone and Lusk's (2018) Random Response Shares model, we dropped respondents with over 90% probability of being in the random class. Respondents in the random class had random, or untrustworthy, answers or were indifferent between options.

[6] BWS is also consistent with fixed utility or constant utility theory. Such theories are more applicable to psychology than economics and will be ignored here, as differences are miniscule between both theories in this application (Louviere, Flynn, and Marley, 2015, p. 12).

where $\boldsymbol{\beta}$ is the vector of estimated parameters of the j best and k worst practices relative to a baseline practice. In this application, for each case (dairy and poultry), we selected nine farm practices (described in Tables 1 and 2); respondents, who were randomly allocated to either the dairy or poultry study, were asked to respond to 12 questions (T = total number of best–worst questions = 12). Each choice question included six items or farm practices ($J = 6$), requiring respondents to choose from among $J(J-1) = 30$ most important–least important farm practice pairs. The variable *WW_Sick* was chosen as the baseline as it had the lowest best–worst choice frequency.

The resulting model can be estimated using models that either assume preference homogeneity or allow preferences to vary across respondents. We use a latent class (LC) model as recent studies have found preferences for animal welfare practices to differ within a population when utilizing BWS (McKendree, Tonsor, and Wolf, 2018). LC models identify the mean importance parameters shared by groups of individuals but that differ across groups. Additionally, group size can be estimated such that the relative strength of any preference group can be identified. This is constructed based on the individual probabilities of a respondent being in a specific class given their preferences.

Formally, the unconditional probability of a best–worst pair being selected by respondent n who belongs to the latent class s can be represented as follows:

$$P_{nj|s} = \sum_{S} \pi_S \prod_{t=1}^{T} \frac{e^{[\beta_{jt|s} - \beta_{kt|s}]}}{\sum_{l=1}^{J} \sum_{m=1}^{J} e^{[\beta_{lt|s} - \beta_{mt|s}] - J}}. \tag{2}$$

Based on equation (2), parameters in the observed portion of the utility can be estimated by maximizing the log-likelihood function. Parameters estimated from equation (2) are not readily interpretable. Thus, we calculate the share of preferences for each farm practice j within each latent class s, $\Upsilon_{j|s}$. The forecasted probability that a farm practice is picked as most important is equal to

$$\Upsilon_{j|s} = \frac{e^{\widehat{\beta_J}|s}}{\sum_{k=1}^{J} e^{\widehat{\beta_l}|s}}. \tag{3}$$

As probabilities, the preference shares for all nine farm practices are positive and sum to 1, allowing for meaningful interpretation. As the preference share is computed with a ratio scale, if the share of preferences is twice as large for one farm practice as for another, then that farm practice is twice as preferred. Further, if all farm practices were equally valued, they would each have preference share of 1/9=0.111. Thus, if a practice's preference share is below 0.111, we can say that the practice is generally deemed less important than the other practices with shares above 0.111. In each application (dairy and poultry), following Caputo and Lusk (2020) and McKendree, Tonsor, and Wolf (2018), the preference shares of each practice were computed by using the Krinsky and Robb (1986) bootstrapping method, employing 1,000 draws from multivariate normal distributions, which also allows for the construction of confidence intervals.

Next, we conduct an *ex post* segmentation analysis. Using class membership probabilities, participants were sorted into a class identified in the LC model if their likelihood of being in that particular class was greater than 0.50. Then demographic and psychosocial characteristics across classes are comparable.

Results

In this section, we report the LC models for both the dairy and poultry BWS applications. In each application, the optimal number of classes in the LC model was selected in accordance with the usual information criteria for non-nested models, including Akaike Information Criteria (AIC), modified Akaike Information Criteria (3AIC), and the Bayesian Information Criteria (BIC). Additionally, attention was paid to the cluster size to ensure each group represented a sizable portion of the

Table 3. Latent Class Modeling Shares for US Public's View on the Importance of Selected Production Practices in the Dairy Industry

Production Practice	Class 1: Animal-Welfare Oriented (57.25% of sample)	Class 2: Concerned with Animal Sickness, and Worker Health (36.25% of sample)	Class 3: Concerned with Worker Health (6.5% of sample)
AW_Breaks	0.111 [0.100, 0.122]	0.15 [0.132, 0.169]	0.061 [0.027, 0.117]
WW_Breaks	0.024 [0.021, 0.027]	0.079 [0.070, 0.088]	0.093 [0.062, 0.129]
AW_Ver	0.128 [0.118, 0.139]	0.031 [0.027, 0.034]	0.006 [0.003, 0.009]
WW_Ver	0.096 [0.088, 0.105]	0.023 [0.021, 0.026]	0.011 [0.006, 0.018]
AW_Sick	0.187 [0.173, 0.203]	0.272 [0.248, 0.296]	0.045 [0.027, 0.069]
WW_Sick	0.015 [0.013, 0.017]	0.072 [0.062, 0.081]	0.13 [0.086, 0.182]
AW_Health	0.121 [0.111, 0.131]	0.059 [0.052, 0.066]	0.005 [0.003, 0.008]
WW_Health	0.032 [0.029, 0.036]	0.143 [0.129, 0.158]	0.632 [0.509, 0.746]
Training	0.285 [0.267, 0.304]	0.171 [0.154, 0.189]	0.017 [0.009, 0.028]

Notes: 95% confidence intervals derived following Krinsky and Robb (1986) are reported in brackets.

population across both the dairy and poultry studies as well as comparability across the poultry and dairy experiments. Based on these criteria (see Table S2) we selected the three-class LC model for both the dairy and poultry applications. The following subsections report the results of each.

Results of the Dairy Application

Table 3 reports the shares of preferences of the nine practices calculated using the coefficients from the LC model (the results from the LC model are reported in Table S3) and the Krinsky and Robb (1986) confidence intervals. We will begin by describing the largest class, Class 1, and proceed in decreasing order of class size (or class membership). Class 1 comprises over 57.25% of respondents. Training, which benefits both animals and workers, is the most preferred farm practice among the US public: 28.5% of respondents view training as the most desirable practice. Turning to the animal and worker welfare policy pairs, the animal welfare practice was always ranked as more important than its corresponding worker welfare practice. For example, treatment of sick animals was ranked second (18.7%), while sick leave for workers was ranked last, in ninth place (1.5%). This result emphasizes a clear preference pattern for animal welfare practices over worker welfare practices in this class. Hence, we named this class "Animal welfare oriented."

Class 2 has an associated class membership probability of 36.25%. In this class, respondents show diverse preference intensity for the various animal welfare practices included in the study. Similar to Class 1, generally, the worker welfare practices are evaluated as less important than their animal welfare practice counterparts. For example, treatment of sick animals ranks as the most important practice (*AW_Sick* = 27%). One notable exception is "Workers are provided medical insurance" (*WW_Health*), which is considered the third most important practice by 14.3% of our respondents. Training is considered the second most important practice by 17.1% of our respondents,

which benefits both workers and animals. We refer to this class as "Concerned with animal sickness and worker health."

Class 3 includes 6.50% of our sampled population. Unlike Classes 1 and 2, this class generally expresses a higher share of preferences for worker welfare practices compared to animal welfare practices. The top three ranked practices were all worker welfare improving. The worker health plans policy (Workers are provided medical insurance) is chosen as most important over 60% of the time. Practices like "Workers are paid sick time off" (*WW_Sick*) and "All workers are provided paid 15-minute breaks for every 4 hours worked and a half hour (meal) break between each 4-hour shift" (*WW_Breaks*) are considered as most important by 13% and 9.3% of our respondents. None of the shares of preferences for animal welfare practices exceed 6%, with most near 0. We call this class "Worker welfare oriented."

To further explore differences in preferences across classes, we also compared classes in terms of sociodemographics and other psychological factors via the psychometric scales discussed in the experimental procedures and data section (see Table S4). There are many sociodemographic and psychological factors that distinguish the classes in the dairy application. In particular, Class 3 is quite different from Classes 1 and 2. Class 3 is the oldest, with no members under 30 years old. It also has the highest income, with over 22% of members making over $100,000 a year. Members of Class 3 are more likely to be Democrats, more likely to live in the Northeastern United States, and less likely to be Republicans than members of other classes. Class 3 is also comprised of members with the lowest animal treatment scale scores and highest illegal aliens scale scores compared to Classes 1 and 2. This result validates the share of preferences for worker welfare practices that are valued more than animal welfare practices among Class 3 members. On the other hand, Classes 1 and 2 are mostly represented by consumers who show positive attitudes toward animal welfare issues, according to the animal treatment scale. Class 1 has fewer Democrats, more Republicans, high animal treatment scores, and low views toward illegal aliens compared to Classes 2 and 3. Class 2 is the youngest group.

Results of the Poultry Application

Table 4 reports the poultry application preference shares, which were calculated from the coefficients reported in Table S5 using equation (3). As in the dairy application, we begin by describing the largest class, Class 1, and proceed in decreasing order of class size. For Class 1 (47% of the sample), the preferred beneficiary of the welfare practice is always animals between welfare practice pairs. The two most important practices to this group are for the benefit of hens (*AW_Sick* and *AW_Meals*, with over 20% of respondents each). The four lowest priority practices benefit workers. The worker practices rank from sixth to ninth: *WW_Ver* (7%), *WW_Cage* (6%), *WW_Meal* (2%), and *WW_Sick* (1%). We refer to this class as "Animal welfare oriented."

Class 2 (43% of the population) has indistinct preferences in that there is no clear explanation for members' preference rankings. Within each practice pair, sometimes the animal welfare practice is deemed more important (e.g., sick practices, *AW_Sick* = 23%, *WW_Sick* = 7%) and sometimes the worker welfare practice is deemed more important (e.g., cage-related practices, *AW_Cage* = 5%, *WW_Cage* = 22%). The three most important policies have about equal shares of preferences: treatment of sick animals (*AW_Sick* = 23%), respiratory equipment for workers (*WW_Cage* = 22%), and access to food and water for hens (*AW_Meals* = 20%). We characterize this group based on these most important preferences, referring to Class 2 as "Animal and worker welfare oriented."

Class 3 (10% of the population) devotes significant attention to their perceived most important practice, prompt treatment of sick animals. With an importance share of 63%, this practice is 3 times more important to Class 3 members than the next most important practice, *AW_Meals* (22%). On the other hand, respondents in this class would, on average, devote less than 1% of preference shares to each verification practice (1% for *AW_Ver*, 0% for *WW_Ver*). We refer to this class as "Concerned with animal sickness."

Table 4. Latent Class Modeling Shares for US Public's View on the Importance of Selected Production Practices in the Poultry Industry

Production Practice	Class 1: Animal-Welfare Oriented (46.56% of sample)	Class 2: Animal and Worker Oriented (43.00% of sample)	Class 3: Concerned with Animal Sickness (10.41% of sample)
AW_Meals	0.203 [0.185, 0.222]	0.204 [0.185, 0.223]	0.222 [0.168, 0.284]
WW_Meals	0.018 [0.016, 0.021]	0.088 [0.079, 0.097]	0.008 [0.005, 0.014]
AW_Ver	0.111 [0.099, 0.123]	0.044 [0.039, 0.049]	0.005 [0.003, 0.007]
WW_Ver	0.066 [0.059, 0.075]	0.048 [0.043, 0.053]	0.003 [0.002, 0.005]
AW_Sick	0.23 [0.211, 0.252]	0.229 [0.210, 0.250]	0.627 [0.540, 0.701]
WW_Sick	0.009 [0.008, 0.010]	0.071 [0.063, 0.080]	0.01 [0.006, 0.015]
AW_Cage	0.174 [0.158, 0.190]	0.047 [0.042, 0.052]	0.047 [0.030, 0.071]
WW_Cage	0.064 [0.056, 0.072]	0.218 [0.201, 0.238]	0.024 [0.014, 0.038]
Flock_Size	0.126 [0.113, 0.140]	0.052 [0.046, 0.058]	0.055 [0.037, 0.077]

Notes: 95% confidence intervals derived following Krinsky and Robb (1986) are reported in brackets.

All three classes rank *AW_Sick* as the most important policy, and *AW_Meals* is always ranked second or third most important. It is clear from these results that attending to animal health quickly and ensuring constant access to food and water should be the priority in the poultry industry.[7]

Now we address whether there are more observable characteristics that describe members of each group beyond animal and worker welfare farm practice preferences (see Table S6). The three classes are distinguishable via income, the animal treatment scale, and the illegal aliens scale. Class 1 has the highest animal treatment (and animal utility, although not statistically significant) scale scores. Class 2 has the highest illegal aliens score. Class 3 has a higher income than the other classes and the lowest illegal aliens scale score.

Conclusions and Implications

The US public is placing increasing pressure on livestock, dairy, and poultry producers to treat their animals as the public deems most acceptable.[8] Understanding which farm practices consumers deem acceptable or unacceptable is important to producers who wish to maintain their social license to produce. If a producer uses practices deemed unacceptable to the public, they may face decreased demand and/or willingness to pay for their product (reduced revenue), legislation

[7] It is worth stressing here that we make no claims about the proportion of industry producers already implementing this practice and therefore whether there is need for change. Our results provide commentary on the farm practices that are currently implemented and that could be implemented in the poultry industry. For instance, constant access to food and water is a criterion of cage-free certification, so all producers who have adopted this production method would already have implemented this desired farm practice.

[8] Ochs et al. (2019a) find evidence of information gaps between public perceptions of and research on animal and worker welfare across poultry housing environments. They posit that consumer preferences for hen housing systems are malleable, changing when given—for instance—more information about different housing systems (conventional, enriched colony, and cage free).

imposing production changes, and/or requirements by other businesses in the supply chain to change. Proactively adopting desired practices could continue market access, increase revenues, and/or maintain autonomy over how such practices are implemented. Insight into public opinion can also assist policy makers in determining when to intervene in business affairs based on notions of social acceptability.

This study aims to determine which farm practices are considered most important by the US public and whether there is a consistent preference for either animals or workers in these rankings. To answer these questions, we conducted an online survey of the US public and employed two best–worst scaling (BWS) experiments, one each for dairy cows and hens. The BWS data were then analyzed using a latent class (LC) model followed by an *ex post* segmentation analysis. We find that in both the dairy and poultry applications, the public is most concerned with sick animals being promptly treated. To illustrate, together with training, animal sickness was the most important policy for dairy cows for 93.5% of the population (Classes 1 and 2), while animal sickness was the most important policy across every class in the poultry application.

Our findings have direct implications for the dairy and poultry industries as well as future research. The dairy and poultry industries should emphasize how they care for sick animals promptly in communications and messaging with consumers, policy makers, and downstream supply chain buyers. While more research is needed into why promptly treating sick animals is prioritized, it is possible that consumers conflate animal illness with concerns about food safety, creating a "halo effect" (Lim, Hu, and Nayga Jr, 2021). People may feel that food products made from sick animals could also make consumers sick.[9] Parsing out the proper messaging of how sick animals are treated may be a necessity to maintain public trust in their animal-product food system.

Our results also indicate that people are more animal welfare oriented than worker welfare oriented. Prior studies have also found a preference for animal welfare over worker welfare. Howard and Allen (2006, 2010) explore five social responsibility attributes, including humane treatment of animals and a living wage for workers. Humane treatment of animals always wins in forced-choice paired comparisons, including when directly paired against a living wage, suggesting that worker welfare is less important than other production concerns such as animal welfare. Yet attitudes toward worker welfare remain an understudied area. Only a few studies have looked into this research domain, and most of them have focused on consumer demand for worker welfare labels (Drichoutis et al., 2017) or consumer attitudes and behavior around welfare related to different hen housing systems (Ochs et al., 2018, 2019b,a). Studies focusing on the trade-offs between animal and worker welfare are needed at both the consumer and the producer level.

For example, future work is required to assess how the public evaluates both animal and worker welfare with respect to recent developments related to cage-free mandates (Morris, 2017) and major retailers going cage-free within commitment deadlines (Shanker and Pollard, 2021). Despite these recent developments and the implications of cage-free housing systems for workers, it remains unclear whether preferences for farming practices translate into premiums for food products produced under animal and worker welfare standards. Producers' viability is challenged not only by pressures to maintain their social license to produce but also operations' economic profitability. Cost-benefit analysis research, which merges consumer and producer preferences regarding individual animal and worker welfare farm practices, is also needed.

Another potential extension of this project would be analyzing how preferences for farm production practices evolve over time due to external shocks. Our study was conducted before the COVID-19 pandemic. Several critical legislative changes affecting farm workers were passed or proposed during the pandemic to either provide temporary relief (e.g., the Families First Coronavirus Response Act (FFCRA), enacted in 2020) or long-term care adjustments (e.g., the Fairness for Farm Workers Act). Subsequent improvements in care as well as COVID-19 might lead to adjustments of general preferences for farm worker welfare. For instance, Luckstead, Nayga, and Snell (2021)

[9] See Ritter et al. (2019), who discuss consumers' perceived relationship between antibiotic treatment in animals and antimicrobial resistance in humans.

find that attitudes toward H-2A workers (temporary foreign workers in agriculture) improved, with people being more empathetic later during the pandemic than earlier.

These ongoing policy regulations and discussions further suggest that more regulation regarding agricultural worker welfare could be enacted. It will be interesting to see whether recent experiences have sparked the public and legislators to consider adjusting agricultural labor laws, particularly regarding health. Will our results that most individuals value animal welfare over worker welfare hold 5 years from now?

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References

Aramark. 2015. "Aramark Establishes Animal Welfare Policy." Available online at https://www.aramark.com/about-us/news/aramark-general/aramark-establishes-animal-welfare-policy [Accessed July 29, 2020].

Bennett, R. 1997. "Farm Animal Welfare and Food Policy." *Food Policy* 22(4):281–288. doi: 10.1016/S0306-9192(97)00019-5.

Bennett, R. M., and R. J. Blaney. 2003. "Estimating the Benefits of Farm Animal Welfare Legislation Using the Contingent Valuation Method." *Agricultural Economics* 29(1):85–98. doi: 10.1111/j.1574-0862.2003.tb00149.x.

Bir, C., M. S. Delgado, and N. O. Widmar. 2021. "U.S. Consumer Demand for Traditional and Greek Yogurt Attributes, Including Livestock Management Attributes." *Agricultural and Resource Economics Review* 50(1):99–126. doi: 10.1017/age.2020.12.

Breuer, K., P. Hemsworth, J. Barnett, L. Matthews, and G. Coleman. 2000. "Behavioural Response to Humans and the Productivity of Commercial Dairy Cows." *Applied Animal Behaviour Science* 66(4):273–288. doi: 10.1016/S0168-1591(99)00097-0.

Caputo, V., and J. L. Lusk. 2020. "What Agricultural and Food Policies Do U.S. Consumer Prefer? A Best-Worst Scaling Approach." *Agricultural Economics* 51(1):75–93. doi: 10.1111/agec.12542.

Chang, J. B., J. L. Lusk, and F. B. Norwood. 2010. "The Price of Happy Hens: A Hedonic Analysis of Retail Egg Prices." *Journal of Agricultural and Resource Economics* 35(3):406–423. doi: 10.22004/ag.econ.97855.

Chou, C., D. Jiang, and Y. Hung. 2004. "Risk Factors for Cumulative Mortality in Broiler Chicken Flocks in the First Week of Life in Taiwan." *British Poultry Science* 45(5):573–577. doi: 10.1080/000716604000006248.

Clark, B., G. B. Stewart, L. A. Panzone, I. Kyriazakis, and L. J. Frewer. 2017. "Citizens, Consumers and Farm Animal Welfare: A Meta-Analysis of Willingness-to-Pay Studies." *Food Policy* 68:112–127. doi: 10.1016/j.foodpol.2017.01.006.

Coalition for Sustainable Egg Supply. 2015. *Final Research Results Report*. Gladstone, MO: Center for Food Integrity. Available online at http://www2.sustainableeggcoalition.org/final-results.

Drichoutis, A. C., A. Vassilopoulos, J. L. Lusk, and R. M. Nayga. 2017. "Consumer Preferences for Fair Labour Certification." *European Review of Agricultural Economics* 44(3):455–474. doi: 10.1093/erae/jbx002.

Ellison, B., K. Brooks, and T. Mieno. 2017. "Which Livestock Production Claims Matter Most to Consumers?" *Agriculture and Human Values* 34(4):819–831. doi: 10.1007/s10460-017-9777-9.

Fair Food Program. 2019. "Current Partners." Available online at https://fairfoodprogram.org/partners/ [Accessed July 29, 2019].

———. 2022. "About." Available online at https://fairfoodprogram.org/about/ [Accessed July 11, 2022].

Farmers Assuring Responsible Management. 2020. "What Is FARM?" Available online at https://nationaldairyfarm.com/what-is-farm/ [Accessed July 23, 2020].

Finn, A., and J. Louviere. 1990. "Shopping-Center Patronage Models: Fashioning a Consideration Set Segmentation Solution." *Journal of Business Research* 21(3):259–275. doi: 10.1016/0148-2963(90)90032-9.

Grebitus, C., J. L. Lusk, and R. M. J. Nayga. 2013. "Effect of Distance of Transportation on Willingness to Pay for Food." *Ecological Economics* 88:67–75. doi: 10.1016/j.ecolecon.2013.01.006.

Greenhouse, S. 2015, July 4. "Farm Labor Groups Make Progress on Wages and Working Conditions." *New York Times*. Available online at https://www.nytimes.com/2015/07/04/business/economy/farm-labor-groups-make-progress-on-wages-and-working-conditions.html.

Grijalva, R. M. 2021. "H.R.3194: Fairness for Farm Workers Act." Available online at https://www.congress.gov/bill/117th-congress/house-bill/3194 [Accessed February 20, 2023].

Heng, Y., H. Hanawa Peterson, and X. Li. 2013. "Consumer Attitudes toward Farm-Animal Welfare: The Case of Laying Hens." *Journal of Agricultural and Resource Economics* 38(3):418–434. doi: 10.22004/ag.econ.165936.

Hopkins, K. A., M. G. S. McKendree, K. A. Schaefer, and E. D. Rice. 2021. "Resolving the Reality Gap in Farm Regulation Voting Models." Paper presented at the annual meeting of the Agricultural and Applied Economics Association, Austin, Texas, August 1–3. doi: 10.22004/ag.econ.312710.

Howard, P. H., and P. Allen. 2006. "Beyond Organic: Consumer Interest in New Labelling Schemes in the Central Coast of California." *International Journal of Consumer Studies* 30(5):439–451. doi: 10.1111/j.1470-6431.2006.00536.x.

———. 2010. "Beyond Organic and Fair Trade? An Analysis of Ecolabel Preferences in the United States: Beyond Organic and Fair Trade?" *Rural Sociology* 75(2):244–269. doi: 10.1111/j.1549-0831.2009.00009.x.

Jones, B. 2018. *Wide Gender Gap, Growing Educational Divide in Voters' Party Identification*. Washington, DC: Pew Research Center. Available online at https://www.pewresearch.org/politics/2018/03/20/wide-gender-gap-growing-educational-divide-in-voters-party-identification/ [Accessed July 30, 2020].

Kendall, H. A., L. M. Lobao, and J. S. Sharp. 2006. "Public Concern with Animal Well-Being: Place, Social Structural Location, and Individual Experience." *Rural Sociology* 71(3):399–428. doi: 10.1526/003601106778070617.

Krinsky, I., and A. L. Robb. 1986. "On Approximating the Statistical Properties of Elasticities." *Review of Economics and Statistics* 68(4):715–719. doi: 10.2307/1924536.

Lim, K. H., W. Hu, and R. M. Nayga Jr. 2021. "Consumer Preference for Grass-Fed Beef: A Case of Food Safety Halo Effect." *Journal of Agricultural and Resource Economics* 46(3):447–463. doi: 10.22004/ag.econ.307458.

Louviere, J. J., T. N. Flynn, and A. A. J. Marley. 2015. *Best-Worst Scaling*. Cambridge, UK: Cambridge University Press.

Luckstead, J., R. M. Nayga, and H. A. Snell. 2021. "Labor Issues in the Food Supply Chain amid the COVID-19 Pandemic." *Applied Economic Perspectives and Policy* 43(1):382–400. doi: 10.1002/aepp.13090.

Lusk, J. 2010. "The Effect of Proposition 2 on the Demand for Eggs in California." *Journal of Agricultural & Food Industrial Organization* 8(1):1–20. doi: 10.2202/1542-0485.

Lusk, J. L. 2011. "External Validity of the Food Values Scale." *Food Quality and Preference* 22(5):452–462. doi: 10.1016/j.foodqual.2011.02.009.

———. 2019. "Consumer Preferences for Cage-Free Eggs and Impacts of Retailer Pledges." *Agribusiness* 35(2):129–148. doi: 10.1002/agr.21580.

Lusk, J. L., and B. C. Briggeman. 2009. "Food Values." *American Journal of Agricultural Economics* 91(1):184–196. doi: 10.1111/j.1467-8276.2008.01175.x.

Lyons, P. A., L. E. Coursey, and J. B. Kenworthy. 2013. "National Identity and Group Narcissism as Predictors of Intergroup Attitudes toward Undocumented Latino Immigrants in the United States." *Hispanic Journal of Behavioral Sciences* 35(3):323–335. doi: 10.1177/0739986313488090.

Malone, T., and J. L. Lusk. 2018. "A Simple Diagnostic Measure of Inattention Bias in Discrete Choice Models." *European Review of Agricultural Economics* 45(3):455–462. doi: 10.1093/erae/jby005.

McKendree, M. G. S., N. Olynk Widmar, D. L. Ortega, and K. A. Foster. 2013. "Consumer Preferences for Verified Pork-Rearing Practices in the Production of Ham Products." *Journal of Agricultural and Resource Economics* 38(3):397–417. doi: 10.22004/ag.econ.165935.

McKendree, M. G. S., G. T. Tonsor, and C. A. Wolf. 2018. "Animal Welfare Perceptions of the U.S. Public and Cow-Calf Producers." *Journal of Agricultural and Applied Economics* 50(4):544–578. doi: 10.1017/aae.2018.14.

Morris, C. A. 2017. "USDA Graded Cage-Free Eggs: All They're Cracked Up To Be." *USDA Food & Nutrition Blog*, September 13. Washington, DC: US Department of Agriculture. Available online at https://www.usda.gov/media/blog/2016/09/13/usda-graded-cage-free-eggs-all-theyre-cracked-be.

New York State Department of Labor. 2021. "Farm Laborers Fair Labor Practices Act." Available online at https://dol.ny.gov/farm-laborers-fair-labor-practices-act [Accessed July 11, 2022].

Ochs, D. S., C. A. Wolf, N. J. Widmar, and C. Bir. 2019a. "Is There a 'Cage-Free' Lunch in U.S. Egg Production? Public Views of Laying-Hen Housing Attributes." *Journal of Agricultural and Resource Economics* 44(2):345–361. doi: 10.22004/ag.econ.287982.

Ochs, D. S., C. A. Wolf, N. J. O. Widmar, and C. Bir. 2018. "Consumer Perceptions of Egg-Laying Hen Housing Systems." *Poultry Science* 97(10):3390–3396. doi: 10.3382/ps/pey205.

Ochs, D. S., C. A. Wolf, N. O. Widmar, C. Bir, and J. Lai. 2019b. "Hen Housing System Information Effects on US Egg Demand." *Food Policy* 87:101743. doi: 10.1016/j.foodpol.2019.101743.

O'Kane, C. 2019, June 7. "Fair Oaks Farms under Investigation after Undercover Video Exposes Animal Abuse." *CBS News*. Available online at https://www.cbsnews.com/news/after-undercover-video-exposes-animal-abuse-at-fair-oaks-farms-grocery-store-removes-products/.

Olynk, N. J., and D. L. Ortega. 2013. "Consumer Preferences for Verified Dairy Cattle Management Practices in Processed Dairy Products." *Food Control* 30(1):298–305.

Ommundsen, R., T. Hak, S. Mörch, K. S. Larsen, and K. Van der Veer. 2002. "Attitudes toward Illegal Immigration: A Cross-National Methodological Comparison." *Journal of Psychology* 136(1):103–110. doi: 10.1080/00223980209604142.

Regmi, P., T. Deland, J. Steibel, C. Robison, R. Haut, M. Orth, and D. Karcher. 2015. "Effect of Rearing Environment on Bone Growth of Pullets." *Poultry Science* 94(3):502–511. doi: 10.3382/ps/peu041.

Regmi, P., N. Nelson, J. Steibel, K. Anderson, and D. Karcher. 2016. "Comparisons of Bone Properties and Keel Deformities between Strains and Housing Systems in End-of-Lay Hens." *Poultry Science* 95(10):2225–2234. doi: 10.3382/ps/pew199.

Ritter, G. D., G. R. Acuff, G. Bergeron, M. W. Bourassa, B. J. Chapman, J. S. Dickson, K. Opengart, M. J. Salois, R. S. Singer, and C. Storrs. 2019. "Antimicrobial-Resistant Bacterial Infections from Foods of Animal Origin: Understanding and Effectively Communicating to Consumers." *Annals of the New York Academy of Sciences* 1441(1):40–49. doi: 10.1111/nyas.14091.

Scheiber, N. 2017, October 3. "Ben & Jerry's Strikes Deal to Improve Migrant Dairy Workers' Conditions." *New York Times*. Available online at https://www.nytimes.com/2017/10/03/business/ben-jerrys-migrant-workers.html.

Schweikhardt, D. B., and W. P. Browne. 2001. "Politics by Other Means: The Emergence of a New Politics of Food in the United States." *Review of Agricultural Economics* 23(2):302–318.

Semega, J., M. Kollar, J. Creamer, and A. Mohanty. 2019. "Table A-2. Households by Total Money Income, Race, and Hispanic Origin of Householder: 1967 to 2018." Washington, DC: US Census Bureau. Available online at https://www2.census.gov/programs-surveys/demo/tables/p60/266/tableA2.xls.

Shanker, D., and A. Pollard. 2021, November 17. "Many Hens Are Still Stuck in Cages Despite Cage-Free Egg Pledges, Group Says." *Bloomberg*. Available online at www.bloomberg.com/news/articles/2021-11-17/many-hens-stuck-in-cages-despite-company-pledges-group-says.

Strom, S. 2015, March 5. "McDonald's Moving to Limit Antibiotic Use in Chickens." *New York Times*. Available online at https://www.nytimes.com/2015/03/05/business/mcdonalds-moving-to-antibiotic-free-chicken.html.

Tucker, P. 2003. "The Impact of Rest Breaks upon Accident Risk, Fatigue and Performance: A Review." *Work & Stress* 17(2):123–137. doi: 10.1080/0267837031000155949.

US Census Bureau. 2020. "QuickFacts: United States." Washington, DC: US Census Bureau. Available online at https://www.census.gov/quickfacts/fact/table/US/PST045219 [Accessed July 24, 2020].

US Department of Agriculture. 2022. "Process Verified Program." Washington, DC: USDA Agricultural Marketing Service. Available online at https://www.ams.usda.gov/services/auditing/process-verified-programs [Accessed July 11, 2022].

US Department of Labor. 2020a. "Breaks and Meal Periods." Washington, DC: US Department of Labor. Available online at http://www.dol.gov/general/topic/workhours/breaks [Accessed July 28, 2020].

———. 2020b. "Minimum Length of Meal Period Required under State Law for Adult Employees in Private Sector 1." Washington, DC: US Department of Labor. Available online at http://www.dol.gov/agencies/whd/state/meal-breaks [Accessed July 28, 2020].

Van Loo, E. J., V. Caputo, R. M. Nayga, and W. Verbeke. 2014. "Consumers' Valuation of Sustainability Labels on Meat." *Food Policy* 49:137–150. doi: 10.1016/j.foodpol.2014.07.002.

Walmart. 2015, May 22. "Walmart U.S. Announces New Animal Welfare and Antibiotics Positions." *Walmart*. Available online at https://corporate.walmart.com/newsroom/2015/05/22/walmart-u-s-announces-new-animal-welfare-and-antibiotics-positions.

Wolf, C., G. Tonsor, and N. J. Olynk. 2011. "Understanding U.S. Consumer Demand for Milk Production Attributes." *Journal of Agricultural and Resource Economics* 36(2):326–342. doi: 10.22004/ag.econ.117186.

Wolf, C. A., and G. T. Tonsor. 2013. "Dairy Farmer Policy Preferences." *Journal of Agricultural and Resource Economics* 38(2):1–15. doi: 10.22004/ag.econ.158286.

———. 2017. "Cow Welfare in the U.S. Dairy Industry: Willingness-to-Pay and Willingness-to-Supply." *Journal of Agricultural and Resource Economics* 42(2):164–179. doi: 10.22004/ag.econ.257996.

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Online Supplement: The US Public's Attitudes on Animal and Worker Welfare in the Dairy and Poultry Industries

Danielle M. Kaminski, Vincenzina Caputo, and Melissa G.S. McKendree

Table S1. Summary Statistics of Basic Demographics

Variable	Definition	Dairy Sample	Poultry Sample	Total Sample	U.S. Population
Gender	1 if female; 0 otherwise	0.767 (0.423)[A]	0.761 (0.427)	0.764 (0.425)	0.508[B]
Age					
Young	1 if 18-29 years; 0 otherwise	0.118 (0.323)	0.152 (0.359)	0.134 (0.341)	N/A
Mid-age	1 if 30-64 years; 0 otherwise	0.714 (0.452)	0.677 (0.468)	0.697 (0.460)	N/A
Senior	1 if 65 years or older; 0 otherwise	0.168 (0.375)	0.171 (0.377)	0.170 (0.376)	0.165[B]
Education					
Low	1 if does not have high school degree; 0 otherwise	0.043 (0.204)	0.017 (0.128)	0.031 (0.172)	0.122[B]
Mid	1 if has a high school degree but not a bachelor's (4 year) degree; 0 otherwise	0.637 (0.481)	0.707 (0.456)	0.670 (0.471)	0.563[B]
High	1 if has bachelor's (4 year) degree or higher; 0 otherwise	0.320 (0.467)	0.276 (0.448)	0.299 (0.458)	0.315[B]
Income					
Low	1 if income below $35,000 annually; 0 otherwise	0.565 (0.496)	0.530 (0.500)	0.549 (0.498)	0.279[C]
Mid	1 if income between $35,000 and $100,000 annually; 0 otherwise	0.435 (0.496)	0.470 (0.500)	0.451 (0.498)	0.417[C]
High	1 if income above $100,000 annually; 0 otherwise	0.132 (0.339)	0.105 (0.307)	0.120 (0.325)	0.304[C]

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The material contained herein is supplementary to the article named in the title and published in the *Journal of Agricultural and Resource Economics* (*JARE*).

Table S1. – continued from previous page

Variable	Definition	Dairy Sample	Poultry Sample	Total Sample	U.S. Population
U.S. Census Region					
Northeast	1 if resides in Northeast U.S. Census region; 0 otherwise	0.190 (0.393)	0.174 (0.380)	0.183 (0.387)	0.171[D]
Midwest	1 if resides in Midwest U.S. Census region; 0 otherwise	0.281 (0.450)	0.260 (0.439)	0.271 (0.445)	0.208[D]
South	1 if resides in South U.S. Census region; 0 otherwise	0.382 (0.487)	0.392 (0.489)	0.387 (0.487)	0.382[D]
West	1 if resides in West U.S. Census region; 0 otherwise	0.147 (0.354)	0.174 (0.380)	0.159 (0.366)	0.239[D]
Political Party					
Democrat	1 if Democrat; 0 otherwise	0.325 (0.469)	0.315 (0.465)	0.32 (0.467)	0.33[E]
Republican	1 if Republican; 0 otherwise	0.320 (0.467)	0.296 (0.457)	0.308 (0.462)	0.26[E]
Psychometric Scales					
Animal Treatment	Ranges from 3 (low concern about animal well-being) to 15 (high concern about animal well-being)	11.298 (2.761)	11.337 (2.627)	11.316 (2.698)	N/A
Animal Utility	Ranges from 3 (low animal utilitarian orientation) to 15 (high animal utilitarian orientation)	10.421 (2.811)	10.577 (2.745)	10.494 (2.780)	N/A
In-group Identification	Ranges from 1 (low national (American) in-group identification) to 5 (high in-group id)	3.854 (0.764)	3.839 (0.801)	3.847 (0.781)	N/A
Illegal Aliens Scale	-1 if think negatively of illegal aliens; 1 if think positively of illegal aliens; 0 if neutral	-0.361 (0.908)	-0.365 (0.902)	-0.362 (0.905)	N/A
N		416	362	778	

[A] Numbers in parentheses are standard deviations
[B] Data from US Census Bureau, 2020
[C] Data from Semega et al., 2019
[D] Data from US Census Bureau, 2019
[E] Data from "Wide Gender Gap, Growing Educational Divide in Voters' Party Identification," 2018

Table S2. Latent Class Model Fit Criteria Comparison

Number of Latent Classes	**Two Classes**	**Three Classes**	**Four Classes**
Class Probabilities			
Dairy Application			
Class Probability 1	0.5947***	0.573***	0.347***
	(0.025)	(0.026)	(0.027)
Class Probability 2	0.405***	0.362***	0.356***
	(0.025)	(0.026)	(0.025)
Class Probability 3		0.065***	0.233***
		(0.013)	(0.025)
Class Probability 4			0.064***
			(0.014)
LLF	-14281.778	-14076.207	-13751.227
AIC	28597.556	28204.414	27572.454
3AIC	28614.556	28230.414	27607.454
BIC	28708.321	28373.819	27800.500
Poultry Application			
Class Probability 1	0.496***	0.466***	Does not converge
	(0.028)	(0.028)	
Class Probability 2	0.504***	0.430***	
	(0.028)	(0.028)	
Class Probability 3		0.104***	
		(0.018)	
Class Probability 4			
Class Probability 5			
LLF	-12280.729	-12099.916	
AIC	24595.458	24251.832	
3AIC	24612.458	24277.832	
BIC	24703.859	24417.622	

Table S3. Latent Class Model Coefficient Estimates for US Public's View on the Importance of Selected Production Practices in the Dairy Industry

Production Practice	Class 1: Animal Welfare Oriented	Class 2: Concerned with Animal Sickness and Worker Health	Class 3: Worker Welfare Oriented
AW_Breaks	2.006*** (0.068)[A]	0.741*** (0.091)	-0.797*** (0.307)
WW_Breaks	0.480*** (0.057)	0.094 (0.084)	-0.341 (0.211)
AW_Ver	2.152*** (0.072)	-0.857*** (0.089)	-3.139*** (0.258)
WW_Ver	1.859*** (0.069)	-1.125*** (0.088)	-2.528*** (0.248)
AW_Sick	2.527*** (0.069)	1.335*** (0.095)	-1.081*** (0.250)
WW_Sick		Baseline Farm Practice (0.00)	
AW_Health	2.096*** (0.069)	-0.200** (0.095)	-3.323*** (0.261)
WW_Health	0.771*** (0.058)	0.692*** (0.084)	1.599*** (0.278)
Training	2.952*** (0.068)	0.870*** (0.094)	-2.060*** (0.261)
Membership Percent	57.25%	36.25%	6.50%
Log Likelihood		-14076.207	
AIC		28204.414	
3AIC		28230.414	
BIC		28373.819	

[A] Standard errors are in parentheses. Asterisks (***, **, *) indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table S4. Summary Statistics of Basic Demographics and Chi-squared Test of Differences in Sample Average across Dairy Latent Classes

Variable	Class 1: Animal Welfare Oriented	Class 2: Concerned with Animal Sickness and Worker Health	Class 3: Worker Welfare Oriented	Chi-Squared Test[a]
N	242	147	27	
Gender	0.777	0.769	0.667	No
Age				
Young	0.112	0.150	0.000	Yes
Mid-age	0.690	0.735	0.815	No
Senior	0.198	0.116	0.185	No
Education				
Low	0.029	0.068	0.037	No
Mid	0.636	0.680	0.407	Yes
High	0.335	0.252	0.556	Yes
Income				
Low	0.587	0.476	0.851	Yes
Mid	0.413	0.524	0.148	Yes
High	0.132	0.116	0.222	No
U.S. Census Region				
Northeast	0.178	0.177	0.370	Yes
Midwest	0.281	0.299	0.185	No
South	0.397	0.367	0.333	No
West	0.145	0.156	0.111	No
Political Party				
Democrat	0.281	0.354	0.556	Yes
Republican	0.360	0.293	0.111	Yes
Psychometric Scales				
Animal Treatment	11.624	10.918	10.444	Yes
Animal Utility	10.504	10.170	11.037	No
In-group Identification	3.887	3.801	3.856	No
Illegal Aliens	-0.459	-0.286	0.111	Yes

[A]Yes indicates significance at 0.10 level.

Table S5. Latent Class Model Coefficient Estimates for US Public's View on the Importance of Selected Production Practices in the Poultry Industry

	Class 1: Animal Welfare Oriented	Class 2: Animal and Worker Oriented	Class 3: Concerned with Animal Sickness
Production Practice			
AW_Meals	3.157*** (0.087)[A]	1.064*** (0.084)	3.713*** (0.248)
WW_Meals	0.755*** (0.072)	0.222*** (0.077)	-0.121 (0.238)
AW_Ver	2.552*** (0.092)	-0.483*** (0.082)	-0.075*** (0.182)
WW_Ver	2.032*** (0.089)	-0.385*** (0.079)	-1.078*** (0.187)
AW_Sick	3.282*** (0.089)	1.179*** (0.081)	4.215*** (0.293)
WW_Sick	Baseline Farm Practice (0.00)		
AW_Cage	3.007*** (0.092)	-0.415*** (0.083)	1.595*** (0.304)
WW_Cage	2.002*** (0.086)	1.131*** (0.079)	0.916*** (0.245)
Flocksize	2.683*** (0.090)	-0.313*** (0.081)	1.753*** (0.259)
Membership Percent	46.56%	43.02%	10.41%
Log Likelihood	-12099.916		
AIC	24251.832		
3AIC	24277.832		
BIC	24421.237		

[A] Standard errors are in parentheses. Asterisks (***, **, *) indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table S6. Summary Statistics of Basic Demographics and Chi-squared Test of Differences in Sample Average across Poultry Latent Classes

Variable	Class 1: Animal welfare oriented	Class 2: Animal and worker oriented	Class 3: Concerned with animal sickness	Chi-squared Test[A]
N	169	155	38	
Gender	0.775	0.760	0.703	No
Age				
Young	0.124	0.194	0.105	No
Mid-age	0.722	0.619	0.711	No
Senior	0.154	0.187	0.184	No
Education				
Low	0.012	0.026	0.000	No
Mid	0.669	0.748	0.711	No
High	0.320	0.226	0.289	No
Income				
Low	0.580	0.516	0.368	Yes
Mid	0.420	0.484	0.632	Yes
High	0.118	0.084	0.132	No
U.S. Census Region				
Northeast	0.207	0.135	0.184	No
Midwest	0.243	0.265	0.316	No
South	0.361	0.413	0.447	No
West	0.189	0.187	0.053	No
Political Party				
Democrat	0.278	0.368	0.261	No
Republican	0.331	0.239	0.368	No
Psychometric Scales				
Animal Treatment	11.757	10.916	11.184	Yes
Animal Utility	10.988	10.097	10.710	No
In-group Identification	3.856	3.776	4.018	No
Illegal Aliens	-0.467	-0.213	-0.526	Yes

[A]Yes indicates significance at 0.10 level.

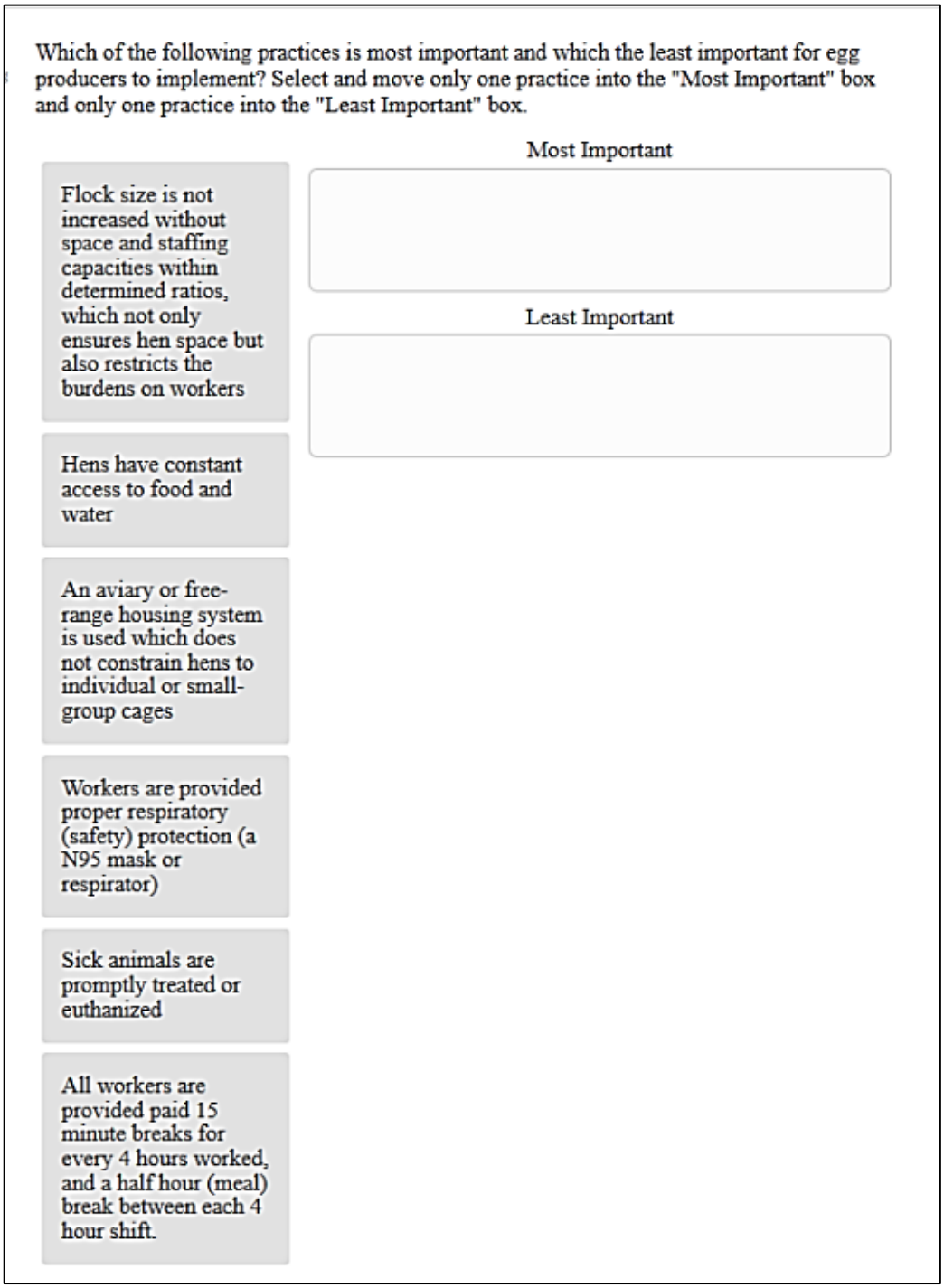

Figure S1. Worker and Animal Welfare Practices in the Poultry Industry BWS Sample Question

References

Semega, J., M. Kollar, J. Creamer, and A. Mohanty. 2019. "Table A-2. Households by Total Money Income, Race, and Hispanic Origin of Householder: 1967 to 2018." US Census Bureau. Available online at https://www2.census.gov/programs-surveys/demo/tables/p60/266/tableA2.xls.

US Census Bureau. 2019. "National Population Totals and Components of Change: 2010-2019: Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2019." Washington, DC: US Department of Commerce. Available online at https://www2.census.gov/programs-surveys/popest/tables/2010-2019/state/totals/nst-est2019-01.xlsx.

US Census Bureau. 2020. "US Census Bureau QuickFacts: United States." *Census.* Available online at https://www.census.gov/quickfacts/fact/table/US/PST045219. [Accessed Jul. 24, 2020].

Wide Gender Gap, Growing Educational Divide in Voters' Party Identification. 2018. Pew Research Center. Available online at https://www.pewresearch.org/politics/2018/03/20/1-trends-in-party-affiliation-among-demographic-groups/. [Accessed Jul. 30, 2020].