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Consumer Willingness to Pay for Livestock Credence Attribute Claim Verification

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A choice experiment was used to determine consumer value for verification of livestock production process attributes. Willingness to pay for verification of production process attributes varied for both milk and pork chops across attributes and verifying entity. Statistically significant evidence of social desirability bias was found by comparing estimates of consumer preferences solicited using direct and indirect questioning. Indirect questioning may yield more accurate representations of consumer value than direct questioning, and therefore more accurate estimates for agribusiness decision making.

Key Words: animal welfare, certification, consumer demand, credence attribute, social desirability bias, verification, willingness to pay

Introduction

Consumers are increasingly sensitive to food production processes. Livestock products in particular arouse consumer sentiment regarding livestock treatment and animal welfare (Frewer et al., 2005). Beyond animal welfare concerns, consumers also are considering other production process attributes—such as environmental impact, food safety implications, and social implications of production methods—when selecting food products.

Consumers select the bundle of food products that provides them with the largest utility, as long as they can accurately determine the quality attributes of those food products (Caswell, 1998). Consumer confidence in the information available regarding food process attributes may depend on several factors, including the specific livestock product, which attribute is verified, and the source of verification information.

Caswell and Mojduszka (1996) categorized food product traits as search, experience, or credence attributes. They classified an attribute as a search attribute if consumers were able to identify quality before purchase through either inspection or research; when consumers were able to determine quality after purchasing and consuming the product, but not prior to purchase, they classified it as an experience attribute. In contrast, a credence attribute is classified as one for which quality could not be assessed even after the product was purchased and consumed.

Specific to livestock rearing, claims surrounding animal rearing, handling, and housing practices all encompass credence attributes of the production process. There are many challenges associated with verifying livestock production process attributes due to the multi-stage rearing process in many species, transfer of ownership throughout an animal's life, and

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complicated production systems which may change throughout the animal's life. Communicating animal welfare aspects of production systems to consumers can be complicated by the difficulty of verifying claims through product testing.

A number of recent studies have assessed consumer willingness to pay (WTP) for animal welfare attributes in meat products (Carlsson, Frykblom, and Lagerkvist, 2007a,b; Lijenstolpe, 2008; Lusk, Norwood, and Pruitt, 2006; Tonsor, Olynk, and Wolf, 2009). Fisher (1993) determined that indirect questioning reduced social desirability bias. Recently, Lusk and Norwood (2009a) sought to determine if indirect questioning could reduce social desirability bias, defined as consumers' incentive to self-report answers on socially sensitive topics (specifically farm animal welfare) in ways that conform to perceived social norms. They found meaningful differences in answers to direct and indirect questioning and concluded that responses to indirect questioning are likely more accurate representations of people's opinions than responses to direct questioning.

This study has two objectives: (*a*) to estimate consumer WTP for verification of production process attribute claims by different verifying parties and over two different livestock products, pork chops and milk, and (*b*) to assess evidence of social desirability bias across pork chops and milk for different verified production process attributes.

Four different production process attributes were assessed in this analysis: individual crates/stalls, pasture access, antibiotic use, and certified trucking/transport. Verification was performed by a private third-party group, a consumer group, the USDA's Process Verified Program (PVP),[1] or the producer (self-verification). This research also analyzes potential social desirability bias in how consumers report their own values for animal welfare attributes. Identification of consumer WTP for verification by various parties can inform producer and marketer choice regarding verifying programs. Analysis evaluating potential social desirability bias in self-reported values for animal welfare production process attributes aids in guiding future data collection techniques for consumer WTP assessments. Understanding of potential social desirability bias informs producers and marketers as to potential biases which may exist in consumer valuation estimates.

Survey Instrument and Choice Experiment

An online consumer survey of representative consumers from throughout the United States was conducted to collect information about consumer valuation of verification by various parties and consumer perceptions regarding animal welfare, animal handling systems, and production processes used in livestock rearing. A total of 1,334 respondents completed the survey; 669 respondents completed the survey with a choice experiment for pork chops and 665 respondents completed the survey with a choice experiment for milk. The survey instrument was designed to elicit consumer preferences regarding valuation for and preferences surrounding verification of claims associated with livestock rearing techniques. In addition to questions related to preferences for animal rearing techniques and verification of claims regarding production processes employed, sociodemographic information was collected from each respondent.

[1] The Grain Inspectors, Packers and Stockyards Administration (GIPSA) PVP has official procedures in place for verification of products assigned to GIPSA and services associated with marketing these products (USDA, 2007). Verification services through GIPSA are voluntary and provided to producers, marketers, processors, and other associated service providers of agricultural products for a fee.

Given their comparatively low costs and quick completion times, online surveys are becoming more popular among researchers (Louviere et al., 2008; Gao and Schroeder, 2009). Hudson et al. (2004) found that internet surveys did not exhibit nonresponse bias. Fleming and Bowden (2009) and Marta-Pedroso, Freitas, and Domingos (2007) reported similar results by comparing a web-based survey with conventional mail and in-person interview surveys. In a comparison to mail and internet modes of conducting choice experiments, Olsen (2009) also observed no difference in mean WTP estimates. To our knowledge, this paper presents the first evaluation of social desirability bias in estimating consumer food demand using choice experiments conducted through an online survey with a nationally representative sample.

The survey was conducted in October and November of 2008 through Decipher, Inc., a marketing research services provider specializing in online survey programming, data collection, data processing, and custom technology development. The survey was administered online to U.S. households; participants were recruited from a large opt-in panel by Survey Sampling International to be representative of the U.S. population, at least 18 years of age, and familiar with the food consumption patterns of their household (Louviere et al., 2008). Summary statistics of respondent demographics are displayed in table 1.

Choice Experiment

Choice experiments allow an examination of tradeoffs among alternatives by replicating realistic purchasing situations and allowing evaluation of multiple attributes (Lusk, Roosen, and Fox, 2003). We estimated consumer WTP for verification by various parties for four different attributes over two different livestock products. Table 2 summarizes the attributes and attribute levels evaluated in the choice experiments for both pork chops and milk. Appendix A defines the attributes and verifying entities provided to survey respondents in preparation for the choice experiment. To reduce potential survey fatigue, consumers were randomly allocated a choice experiment for only one livestock product.

The choice experiments incorporated five aspects of animal rearing and verification entity. Consumers received information about whether individual crates/stalls were permitted or not permitted, pasture access was required or not required, antibiotic use was permitted or not permitted, certified trucking/transport was required or not required, and whether the certification entity was the USDA-PVP, the producer (i.e., self-certification), a private third party, or a consumer group. In addition to the five aspects of animal rearing and verification, consumers were presented with three different price levels for each livestock product: boneless pork chops were offered at \$3.24/lb., \$3.99/lb., or \$4.79/lb., and milk at \$2.99/gallon, \$3.99/gallon, or \$4.99/gallon. These prices were selected to be consistent and comparable with retail prices at the time the survey was administered in 2008. Appendix B presents an example scenario from the pork chop attributes choice experiment. A main effects plus two-way interaction effects design was employed to select choice scenarios (Lusk and Norwood, 2005). Specifically, the SAS procedures *PLAN* and *OPTEX* were used to identify an experimental design maximizing D-efficiency (92.045). The final choice design resulted in 14 choice sets, which were blocked into two groups of seven to keep the task reasonable for individual participants (Tonsor et al., 2005). The order of choice sets was randomized to mitigate any ordering impacts (Loureiro and Umberger, 2007). To assess how exposure to alternative information impacts consumers, each participant was randomly presented with one of four information scenarios: (*a*) base information, (*b*) consumer group information, (*c*) industry information, or (*d*) industry and consumer group information (Fox, Hayes, and Shogren, 2002). Appendix C contains copies of each of these information treatments for both the pork and milk surveys.

Table 1. Summary Statistics for Respondent Demographic Measures

	Respondents Completing Pork Chop Choice Experiment ($N = 669$)			Respondents Completing Milk Choice Experiment ($N = 665$)		
Variable Description	Frequency (%)	Mean	Standard Deviation	Frequency (%)	Mean	Standard Deviation
Age		52.70	14.05		52.60	13.19
Proportion Who Are Female		0.70	0.46		0.72	0.45
Number of Adults in Household		2.03	0.88		2.03	0.83
Number of Children in Household		0.46	0.96		0.46	1.01
Annual Household Income ($000s):						
< $20	13.5			15.8		
$20 to $40	30.1			27.1		
$40 to $60	21.8			20.3		
$60 to $80	14.0			16.6		
$80 to $100	9.5			8.7		
$100 to $120	3.4			5.1		
$120 to $140	2.7			2.2		
$140 to $160	2.9			1.5		
$160 to $180	0.9			0.6		
> $180	1.2			2.1		
Respondent's Level of Education:						
■ Did not graduate from high school	3.6			1.8		
■ Graduated from high school; did not attend college	20.8			20.9		
■ Attended college; no degree earned	27.2			28.6		
■ Attended college; Associate or trade degree earned	15.5			16.4		
■ Attended college; B.S. or B.A. degree earned	19.0			19.8		
■ Graduate or advanced degree earned (M.S., M.A., Ph.D., J.D.)	11.5			11.0		
■ Other (please explain): __________	2.4			1.5		

Table 2. Pork Chop and Milk Attributes and Attribute Levels Evaluated in Choice Experiments

Product Attribute	Milk Attribute Levels	Pork Chop Attribute Levels
Price	$2.99/gallon $3.99/gallon $4.99/gallon	$3.24/lb. $3.99/lb. $4.79/lb.
Individual Crates/Stalls	■ Not Permitted ■ Permitted	
Pasture Access	■ Not Required ■ Required	
Antibiotic Use	■ Not Permitted ■ Permitted	
Certified Trucking/Transport	■ Not Required ■ Required	
Certification Entity	■ Self-Certification ■ Consumer Group ■ Private, Third Party ■ USDA-PVP	

The choice experiments were simulated shopping experiences which did not include the exchange of real livestock products or money, although the included instructions stated:

> The experience from previous similar surveys is that people often state a higher willingness to pay than what one actually is willing to pay for the good. It is important that you make your selections like you would if you were actually facing these choices in your retail purchase decisions, noting that allocation of funds to these products means you will have less money available for other purchases.

This information was provided to survey participants as part of a strategy of "cheap-talk" aimed to reduce hypothetical bias by informing participants of this bias prior to participation (Lusk, 2003).

Valuations obtained in both hypothetical and nonhypothetical settings may be significantly influenced by social desirability bias, which is of increasing concern (Lusk and Norwood, 2009b). Social desirability bias reflects the fact that people feel incentive to provide socially acceptable answers to self-reported questions about happiness, well-being, health, and attitudes that may deviate from true answers (Lusk and Norwood, 2009a). Lusk and Norwood discussed potential biases, which can occur when individuals derive satisfaction from indicating they are willing to pay for a good, either to please the researchers or themselves. Because animal welfare and the treatment of livestock animals used in food production can be emotional issues, it is conceivable that consumers might exhibit bias when answering related questions.

In this study, seven scenarios were presented to respondents, who were asked to select their own preferred alternative from two livestock products or a no-purchase option (direct questioning), and seven additional scenarios repeated the same choices but asked participants to select what they believed the average American would choose (indirect questioning). Survey participants were randomly selected for the ordering of direct and indirect choice experiment scenarios, resulting in half of the respondents completing direct questioning before indirect questioning and the remaining half initially completing indirect questioning.

Fisher (1993) compared direct and indirect questioning in an effort to determine the ability of indirect questioning to reduce social desirability bias; indirect questioning reduced social desirability bias on those variables that were subject to social influence and had no significant effect on socially neutral variables. Lusk and Norwood (2009a) tested indirect questioning as a method for mitigating social desirability bias on the topic of farm animal well-being. They concluded that the main assumption behind using indirect questioning is that people are relatively unconcerned with answering in ways which make other people look good. Testing for statistically significant evidence of social desirability bias across different livestock products and attributes allows us not only to identify bias existence, but to begin to understand whether bias may differ across products or attributes.

Research Methods

Random Utility Theory

Random utility theory assumes that economic agents seek to maximize their expected utility, subject to the choice set they are given. The individual's utility is considered a random variable because the researcher has incomplete information (Manski, 1977). Let utility be the sum of observable and unobservable components, $U_{jt} = V_{jt} + \varepsilon_{jt}$, where U_{jt} is the latent, unobservable utility for the *j*th alternative in choice scenario t; V_{jt} is the observable, systematic portion of utility determined by the attributes; and ε_{jt} is the random component of utility, independently and identically distributed over all alternatives and choice scenarios. The probability that alternative *j* will be selected is the probability that the added utility from this selection is greater than (or equivalent to) choosing another alternative presented in the choice experiment. The utilities associated with each alternative are not directly observable because they include an unobserved component. Therefore, the probability of selecting alternative *j* is given by:

$$\mathrm{P}(j) = \mathrm{P}(v_j + \varepsilon_j \geq v_k + \varepsilon_k), \quad j \neq k \,\forall\, j \in N,$$

where N is the total set of alternatives available to the participant (Boxall and Adamowicz, 2002; Adamowicz et al., 1998). The resulting probability that alternative *j* is selected can be expressed as:

$$\mathrm{P}(j) = \frac{e^{\mu \beta X_j}}{\sum_{k \in N} e^{\mu \beta X_k}},$$

where μ is a scale parameter which is inversely related to the variance of the error term (Lusk, Roosen, and Fox, 2003) and $\boldsymbol{\beta}$ is a vector of parameters (Boxall and Adamowicz, 2002; Adamowicz et al., 1998).[2]

Assuming the systematic component of the total utility U_{jt} is linear in parameters, the specification of the general model is given by:

$$V_j = \beta_1 x_{j1} + \beta_2 x_{j2} + \ldots + \boldsymbol{\beta}_n x_{jn}, \tag{1}$$

where x_{jn} is the *n*th attribute for alternative *j*, and $\boldsymbol{\beta}_n$ is a vector of parameters associated with the *n*th attribute of the *j*th alternative. Multinomial logit models assume that homogeneous preferences exist for the product attributes.

Random Parameters Logit

Recent literature and research suggest consumers possess heterogeneous preferences. Therefore, employing a model that allows heterogeneous preferences is appropriate (Lusk, Roosen, and Fox, 2003; Alfnes, 2004; Tonsor et al., 2005). A common method of evaluating preference heterogeneity is estimation of random parameters logit (RPL) models (also called mixed logit). The RPL model allows for random taste variation within the surveyed group of consumers. The RPL is free of the independence of irrelevant alternatives assumption and allows correlation in unobserved factors over time (Revelt and Train, 1998; Train, 2003; Tonsor et al., 2005). By using the RPL, we can directly estimate the heterogeneity in consumer preferences across the evaluated attributes.

The random utility of the consumer (U) underlies the RPL model. Following Tonsor et al. (2005), the utility of attribute *j* for individual *i* in choice set *t* in the RPL model is generally presented as follows:

$$U_{ijt} = v_{ijt} + \left[u_{ij} + \varepsilon_{ijt} \right],$$

[2] Following similar analyses, the scale parameter μ was assumed to equal one for the remainder of this analysis because it is unidentifiable in any given data set (Lusk, Roosen, and Fox, 2003).

where v_{ijt} is the systematic portion of the utility function, u_{ij} is an error term which is distributed normally over consumers and alternatives (but not choice sets), and ε_{ijt} is the stochastic error, independently and identically distributed over all consumers, attributes, and choice sets. A panel set of data is described here, in which the cross-sectional element is consumer i and the time-series component is choice scenario t (Alfnes, 2004; Tonsor et al., 2005).[3] In the random parameter logit model, the probability of consumer i choosing alternative j in choice set t is $P(U_{ijt} \geq U_{ikt})$, over all possible k attributes. Under the assumption that v_{ijt} is linear in parameters, the utility function can be expressed as:

$$v_{it} = \beta_{i1} x_{1it} + \beta_{i2} x_{2it} + \ldots + \beta_{ij} x_{ijt} \,,$$

where x_{ijt} is the jth attribute for choice set t, and $\boldsymbol{\beta}_j$ is a vector of preference parameters associated with the jth attribute of the tth alternative of the ith consumer (Alfnes, 2004; Tonsor et al., 2005).

The RPL model estimated in this analysis necessarily included the interaction terms between attributes and verifying entities because a production practice attribute was never presented to choice experiment participants without a certifying party. In order to determine WTP values for consumers across verification parties and different attributes verified by different verification parties, interaction terms were included. The estimated model specified the systematic portion of utility as:

$$\begin{aligned}(2) \qquad v_j = {} & \beta_1(Cons) + \beta_2(Price) + \beta_3(Private) + \beta_4(Consumer) + \beta_5(USDA) \\ & + \beta_6(Self\_Pasture) + \beta_7(Private\_Pasture) + \beta_8(Consumer\_Pasture) \\ & + \beta_9(USDA\_Pasture) + \beta_{10}(Self\_Indiv) + \beta_{11}(Private\_Indiv) \\ & + \beta_{12}(Consumer\_Indiv) + \beta_{13}(USDA\_Indiv) + \beta_{14}(Self\_Anti) \\ & + \beta_{15}(Private\_Anti) + \beta_{16}(Consumer\_Anti) + \beta_{17}(USDA\_Anti) \\ & + \beta_{18}(Self\_CTruck) + \beta_{19}(Private\_CTruck) \\ & + \beta_{20}(Consumer\_CTruck) + \beta_{21}(USDA\_CTruck)\,,\end{aligned}$$

where *Cons* is a constant included to capture the disutility associated with not having the good (milk or pork chops) in the consumer's choice set ($Cons = 1$ if option C is selected, $Cons = 0$ otherwise), and *Price* is the price of the good in the choice set. *Private*, *Consumer*, and *USDA* are effects-coded dummy variables for verification by a private third party, consumer group, and USDA relative to self-verification. *Self_Pasture*, *Private_Pasture*, *Consumer_Pasture*, and *USDA_Pasture* are effects-coded interaction terms between the verification entity and pasture access. *Self_Indiv*, *Private_Indiv*, *Consumer_Indiv*, and *USDA_Indiv* are effects-coded interaction terms between the verification entity and individual housing in crates or stalls. *Self_Anti*, *Private_Anti*, *Consumer_Anti*, and *USDA_Anti* are effects-coded interaction terms between the verification entity and the use of antibiotics. *Self_CTruck*, *Private_CTruck*, *Consumer_CTruck*, and *USDA_CTruck* are effects-coded interaction terms between the verification entity and the use of certified trucking.

Interaction terms identify the verified attributes in the choice experiment. An example of the interpretation of these interaction terms is that the WTP associated with *Consumer_Anti* can be interpreted as the WTP for consumer group-verified antibiotic-free production, as

[3] Model estimation was conducted in NLOGIT 4.0 using the program's panel data capabilities.

opposed to not having the antibiotic-free production certified by a consumer group. Effects coding was used to avoid confounding effects of attribute levels with the opting-out option presented to consumers.[4]

The β coefficients on all of the explanatory variables except for *Cons* and *Price* were specified to vary normally across consumers. It was possible for consumers to have both positive and negative WTP values for verified animal welfare attributes. The random parameters were assumed to be drawn from a normal distribution, which allowed WTP estimates to be either positive or negative (Tonsor et al., 2005; Lusk, Roosen, and Fox, 2003). The random parameter for alternative j is given by $B_j = \overline{B}_j + \sigma_j * \mu_{ij}$, where $\overline{B}_j$ is the mean estimate across all consumers, σ_j is a diagonal matrix of coefficient standard errors, and μ_{ij} is a vector of independent normal decisions for each individual consumer (Lusk, Roosen, and Fox, 2003; Tonsor et al., 2005).

Coefficients estimated from a random utility model have little interpretive value themselves. Mean WTP estimates for the RPL models are generally calculated by taking the negative ratio of the estimated coefficient on the verified attribute to the price coefficient. The coefficient on the verified attribute k is multiplied by two in the WTP ratio in this analysis due to effects coding (Lusk, Roosen, and Fox, 2003). The WTP for verified attribute k in this analysis was calculated as:

$$WTP_k = -\left(\frac{2 * \beta_k}{\beta_c}\right),$$

where β_k is the coefficient on a verified attribute, and β_c is the coefficient on price.[5] If the standard deviations of the attribute constants are not statistically different from zero, the estimated mean WTP can be interpreted as being representative of the entire surveyed consumer group. In this case, the RPL interpretation reverts to that of the standard multinomial logit, as it is not revealing significant heterogeneity in the group. Evidence of preference heterogeneity exists if standard deviations are statistically significant, in which case mean WTP estimates calculated cannot be interpreted as being representative of the entire sample.

In order to consider statistical variability in estimates of WTP, a 95% confidence interval for mean WTP values was calculated using the delta method. A variety of methods exist to determine confidence intervals on the WTP estimates, including delta, Fieller, Krinsky-Robb, and bootstrap methods; however, these methods have been found to be reasonably accurate and to yield similar results to one another (Hole, 2007). The delta method estimates the variance of a nonlinear function of two or more random variables by taking a first-order Taylor series expansion around the mean value of the variable and calculating the variance on that newly created random variable (Greene, 2003, p. 674). Following Hole, the delta estimate of the variance of a WTP estimate is given by:

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[4] In effects coding, rather than the typical 0, 1 dummy variable coding, the attributes take on a value of 1 when applicable, a value of −1 when the base category applies, and zero otherwise (Tonsor, Olynk, and Wolf, 2009).

[5] In this context, β_k would be, more specifically, the coefficient on the interaction term between an attribute and a verification entity (a verified attribute as defined in the text) or just the verification entity alone. By construction, the attributes themselves were not included in the model without being interacted with a verification entity because for the purposes of this analysis, our primary focus was the verification of the attributes, as opposed to a WTP by consumers for the attributes themselves. Moreover, verification was necessarily included because by the construction of the choice experiment, or by design, it was impossible to have an attribute present without a verification entity verifying that the production process attribute being claimed was actually present. This is consistent with "the real world," as it is unlikely a product could be marketed with the discussed animal welfare claims and not be participating in a verification or certification system as well.

$$\operatorname{var}(W\hat{T}P_k) = \begin{bmatrix} (W\hat{T}P_{\beta_k})^2 \operatorname{var}(\hat{\beta}_k) + (W\hat{T}P_{\beta_c})^2 \operatorname{var}(\hat{\beta}_c) \\ + 2 * W\hat{T}P_{\beta_k} * W\hat{T}P_{\beta_c} * \operatorname{cov}(\hat{\beta}_k \hat{\beta}_c) \end{bmatrix},$$

where $W\hat{T}P_{\beta_k}$ and $W\hat{T}P_{\beta_c}$ are the partial derivates of the estimated WTP for verified attribute k with respect to β_k and β_c, respectively. Once the variance of the WTP estimate is calculated, confidence intervals can be calculated in the standard way.

Results and Discussion

The model was estimated under each of the information treatments (see appendix C), for each product, and separately for direct and indirect questioning treatments. Subsequently, a log-likelihood ratio test was used to determine if the data from the four information treatments could be pooled.[6] Consumer responses were found to be insensitive to the information treatment they received, as we failed to reject the null hypothesis that we could pool observations across consumers receiving the four different information treatments. This finding is similar to those reported by Lusk, Norwood, and Pruitt (2006) and Tonsor, Olynk, and Wolf (2009). Consequently, the models presented throughout this analysis result from pooled models of observations across the information treatments.

To assess whether observations from indirect and direct questioning could be pooled for either livestock product, a log-likelihood ratio test was employed. We rejected the null hypothesis of pooling of data across direct and indirect questioning for both pork chops and milk. Therefore, throughout this analysis, indirect questioning and direct questioning are treated separately and estimates are presented separately for direct questioning versus indirect questioning. Additional log-likelihood tests were employed to determine if data from survey respondents receiving indirect and direct questioning in differing orders could be pooled. We rejected the null hypothesis of pooling across orders of presentation for the direct questioning data for milk. For indirect questioning in milk and pork chops, as well as direct questioning in pork chops, we failed to reject the null hypothesis that we could pool across ordering of presentation (whether indirect questioning first and direct questioning second, or vice versa). Observations were pooled across the order of presentation for indirect questioning in pork chops and milk and for direct questioning in pork chops. As a result of pooling across orders of questioning being rejected for direct questioning in milk, the direct questioning coefficients and WTP estimates for milk are presented for those respondents who saw direct questioning first and indirect questioning second. Observations from respondents who completed indirect questioning first were eliminated from the data set used to analyze direct questioning in milk.

Table 3 reports the parameters estimated in the RPL model for pork chops. Table 4 presents the indirect questioning results for all those survey respondents who completed the survey with respect to milk and the direct questioning results for those survey respondents who completed the direct questioning portion of the choice experiment first. A large number of the estimated means for random pork chop and milk attribute parameters were statistically significant in these models. In random utility models, the interpretation of individual coefficients is generally discouraged (Scarpa and Del Giudice, 2004). The coefficients were used to compute estimates of consumer WTP.

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[6] The log-likelihood ratio test, which follows a χ^2 distribution with $K(M - 1)$ degrees of freedom (Wooldridge, 2002) is $-2(LL_j - \Sigma\, LL_i)$, where LL_j is the unrestricted pooled sample log-likelihood value and LL_i denotes the log-likelihood values for each of the information treatment groups. K is the number of parameters in the model and M is the number of information treatments.

Table 3. Parameters (Standard Errors) for Pork Chops from Random Parameters Logit

	Direct Questioning (*N* = 669)		**Indirect Questioning (*N* = 669)**	
Variable	Coefficient Estimates	Std. Dev. Estimates	Coefficient Estimates	Std. Dev. Estimates
Opt Out	−1.5876		−1.6068	
	(1.1046)		(1.0270)	
Price	−0.4960*		−0.4028*	
	(0.1638)		(0.1648)	
Private	0.7030	0.0533	1.5409*	0.0831
	(0.4447)	(0.1416)	(0.4498)	(0.1424)
Consumer	0.3469	0.0635	0.2524	0.0846
	(0.2128)	(0.1434)	(0.2066)	(0.1162)
USDA	−0.8371*	0.8124*	−1.4937*	1.0390*
	(0.2916)	(0.0980)	(0.3020)	(0.0926)
Self-Verified Pasture Access	0.3016*	0.3895*	0.0823	0.3135*
	(0.0930)	(0.0673)	(0.0903)	(0.0697)
Private Party-Verified Pasture Access	−0.3208	1.3943*	−0.6642*	1.2235*
	(0.2083)	(0.0720)	(0.2049)	(0.0720)
Consumer Group-Verified Pasture Access	0.3298*	0.6725*	0.3509*	0.6650*
	(0.1436)	(0.0667)	(0.1422)	(0.0571)
USDA-Verified Pasture Access	0.9514*	0.4935*	1.2687*	0.5134*
	(0.1263)	(0.0593)	(0.1342)	(0.0530)
Self-Verified Individual Crates/Stalls	0.2310*	0.3895*	0.5355*	0.3135*
	(0.1207)	(0.0673)	(0.1235)	(0.0697)
Private Party-Verified Individual Crates/Stalls	0.0737	1.3943*	0.2481	1.2235*
	(0.2114)	(0.0720)	(0.2043)	(0.0720)
Consumer Group-Verified Individual	0.2715*	0.6725*	−0.0074	0.6650*
Crates/Stalls	(0.1583)	(0.0667)	(0.1575)	(0.0571)
USDA-Verified Individual Crates/Stalls	0.4313*	0.4935*	0.5203*	0.5134*
	(0.0853)	(0.0593)	(0.0898)	(0.0530)
Self-Verified Antibiotic Use	−0.0757	0.3895*	0.0798	0.3135*
	(0.1494)	(0.0673)	(0.1524)	(0.0697)
Private Party-Verified Antibiotic Use	−0.3303	1.3943*	−0.6912*	1.2235*
	(0.2470)	(0.0720)	(0.2446)	(0.0720)
Consumer Group-Verified Antibiotic Use	−0.0194	0.6725*	0.0576	0.6650*
	(0.1224)	(0.0667)	(0.1145)	(0.0571)
USDA-Verified Antibiotic Use	0.7228*	0.4935*	0.8596*	0.5134*
	(0.1107)	(0.0593)	(0.1140)	(0.0530)
Self-Verified Certified Trucking/Transport	0.1830*	0.3895*	−0.0500	0.3135*
	(0.0961)	(0.0673)	(0.0956)	(0.0697)
Private Party-Verified Certified Trucking/	−0.9791*	1.3943*	−1.4114*	1.2235*
Transport	(0.3308)	(0.0720)	(0.3235)	(0.0720)
Consumer Group-Verified Certified Trucking/	−0.3845*	0.6725*	−0.2937*	0.6650*
Transport	(0.1383)	(0.0667)	(0.1354)	(0.0571)
USDA-Verified Certified Trucking/Transport	−0.0610	0.4935*	−0.2628*	0.5134*
	(0.1195)	(0.0593)	(0.1247)	(0.0530)

Notes: An asterisk (*) denotes statistical significance at the 0.05 level. Presented models (with log likelihoods of −3,858 and −3,911, respectively) were estimated using NLOGIT 4.0, with Halton draws and 500 replications for simulated probability. Values in parentheses are standard errors.

Table 4. Parameters (Standard Errors) for Milk from Random Parameters Logit

	Direct Questioning (N = 332)		**Indirect Questioning (N = 665)**	
Variable	Coefficient Estimates	Std. Dev. Estimates	Coefficient Estimates	Std. Dev. Estimates
Opt Out	−2.5293* (1.1994)		−2.4644* (0.9063)	
Price	−0.2537 (0.1658)		−0.9584* (0.1303)	
Private	0.8250 (0.6004)	0.0819 (0.1580)	1.7760* (0.4745)	0.2330 (0.1569)
Consumer	0.0988 (0.3137)	0.0143 (0.2014)	−0.5370* (0.2231)	0.1578 (0.1761)
USDA	−0.5879 (0.3942)	0.6659* (0.1361)	−1.1811* (0.3062)	0.8700* (0.0939)
Self-Verified Pasture Access	0.5114* (0.1270)	0.3433* (0.1173)	0.0973 (0.0871)	0.2474* (0.0978)
Private Party-Verified Pasture Access	0.1579 (0.2768)	1.1915* (0.0921)	−0.7788* (0.2362)	1.4425* (0.0775)
Consumer Group-Verified Pasture Access	0.7760* (0.2213)	0.6828* (0.0813)	0.5608* (0.1453)	0.6172* (0.0625)
USDA-Verified Pasture Access	1.3089* (0.1822)	0.4993* (0.0746)	1.0268* (0.1399)	0.5495* (0.0543)
Self-Verified Individual Crates/Stalls	0.4369* (0.1663)	0.3433* (0.1173)	0.2392* (0.1244)	0.2474* (0.0978)
Private Party-Verified Individual Crates/Stalls	−0.0438 (0.2746)	1.1915* (0.0921)	−0.2073 (0.2460)	1.4425* (0.0775)
Consumer Group-Verified Individual Crates/Stalls	0.0371 (0.2234)	0.6828* (0.0813)	−0.0373 (0.1619)	0.6172* (0.0625)
USDA-Verified Individual Crates/Stalls	0.3432* (0.1160)	0.4993* (0.0746)	0.4891* (0.0920)	0.5495* (0.0543)
Self-Verified Antibiotic Use	0.2815 (0.2021)	0.3433* (0.1173)	−0.0118 (0.1517)	0.2474* (0.0978)
Private Party-Verified Antibiotic Use	−0.2908 (0.3192)	1.1915* (0.0921)	−1.0151* (0.2689)	1.4425* (0.0775)
Consumer Group-Verified Antibiotic Use	0.2262 (0.1795)	0.6828* (0.0813)	0.2520* (0.1232)	0.6172* (0.0625)
USDA-Verified Antibiotic Use	0.4089* (0.1559)	0.4993* (0.0746)	0.5167* (0.1168)	0.5495* (0.0543)
Self-Verified Certified Trucking/Transport	0.1260 (0.1299)	0.3433* (0.1173)	0.0846 (0.0950)	0.2474* (0.0978)
Private Party-Verified Certified Trucking/Transport	−0.4645 (0.4223)	1.1915* (0.0921)	−1.5351* (0.3454)	1.4425* (0.0775)
Consumer Group-Verified Certified Trucking/Transport	−0.2338 (0.1927)	0.6828* (0.0813)	−0.2010 (0.1428)	0.6172* (0.0625)
USDA-Verified Certified Trucking/Transport	0.0733 (0.1720)	0.4993* (0.0746)	−0.0244 (0.1314)	0.5495* (0.0543)

Notes: An asterisk (*) denotes statistical significance at the 0.05 level. Presented models (with log likelihoods of −2,313 and −3,764, respectively) were estimated using NLOGIT 4.0, with Halton draws and 500 replications for simulated probability. Values in parentheses are standard errors.

In each of the four models estimated, all of the explanatory variables except *Cons* and *Price* were specified to vary normally across consumers. All of the random parameters except *Private* and *Consumer* were estimated to have statistically significant standard deviation parameters in all four of the models estimated, as reported in tables 3 and 4. The statistically significant standard deviation parameters are evidence of preference heterogeneity, in which case the mean WTP estimates calculated cannot be interpreted as being representative of the entire sample.

Willingness to Pay

Mean estimates of consumer WTP were calculated for direct and indirect questioning for pork chops and milk and are presented in table 5 and table 6, respectively. With regard to estimates for WTP for pork through direct and indirect questioning, values were significantly different than zero for the majority of estimates. Looking specifically at direct questioning estimates, the WTP for verification of pasture access indicated consumers had a higher WTP for verification of this attribute by the USDA than for verification by self, private third party, or a consumer group. The same relationship existed for verification of individual stalls/crates for livestock housing and for verification of no antibiotic use, in which consumers had a higher WTP for verification through USDA than for the other verifying entities. Clearly, USDA verification of the attributes included in the analysis (with the exception of certified trucking or transport) had the highest value to the consumer, as estimated through direct questioning, when compared to verifying those same attributes by a different verification entity. When using indirect questioning estimates, WTP for USDA verification was highest for pasture access and antibiotic use, while mean WTP estimates for verified individual crates through indirect questioning were \$2.66/lb. for self-verification and \$2.58/lb. for USDA verification.

Mean WTP estimates for verified attributes in milk revealed preferences similar to those in pork. When assessing direct questioning, the highest WTP values for verified pasture access and antibiotic use were for USDA verification. The highest value to consumers for verified individual crates was for self-verified individual crates. The mean WTP for self-verified individual crates was \$3.44/gallon versus the \$2.71/gallon estimates for USDA verification. For indirect questioning in milk, consumers reported the highest value for USDA verification of all attributes except certified trucking.

Verification of the use of certified trucking did not follow the pattern of the other four attributes. For direct questioning about pork chops, the mean WTP for self-verification of certified trucking was \$0.74/lb. Verification of certified trucking by USDA had a WTP not statistically different than zero, while verification by private party and consumer group both had negative WTP values for direct questioning. Direct questioning in milk revealed WTP for verification by each of the four entities not statistically different from zero.

Comparing the point estimates in milk and pork chops provided support for the notion that consumer WTP for verification of production process attribute claims was different depending on the livestock product in question. Further, it was apparent that the WTP for verification varied depending on the specific attribute.

Social Desirability Bias

Incorporating both direct and indirect questioning in our choice experiment allowed testing of statistically significant evidence of social desirability bias across livestock products. Evidence of significant social desirability bias was determined by comparing the 95% confidence

Table 5. WTP Based on Direct and Indirect Questioning for Pork Chops ($/pound)

Variable	Willingness to Pay: Direct Questioning ($N = 669$)	Willingness to Pay: Indirect Questioning ($N = 669$)	Evidence of Social Desirability Bias?
Private	2.84*	7.65*	No
Consumer	1.40*	1.25*	No
USDA	−3.38*	−7.42*	No
Self-Verified Pasture Access	1.22*	0.41	No
Private Party-Verified Pasture Access	−1.29*	−3.30*	No
Consumer Group-Verified Pasture Access	1.33*	1.74*	No
USDA-Verified Pasture Access	3.84*	6.30*	No
Self-Verified Individual Crates/Stalls	0.93*	2.66*	No
Private Party-Verified Individual Crates/Stalls	0.30	1.23*	No
Consumer Group-Verified Individual Crates/Stalls	1.09*	−0.04	No
USDA-Verified Individual Crates/Stalls	1.74*	2.58*	No
Self-Verified Antibiotic Use	−0.31	0.40	No
Private Party-Verified Antibiotic Use	−1.33*	−3.43*	No
Consumer Group-Verified Antibiotic Use	−0.08	0.29	No
USDA-Verified Antibiotic Use	2.91*	4.27*	No
Self-Verified Certified Trucking/Transport	0.74*	−0.25	Yes
Private Party-Verified Certified Trucking/Transport	−3.95*	−7.01*	No
Consumer Group-Verified Certified Trucking/Transport	−1.55*	−1.46*	No
USDA-Verified Certified Trucking/Transport	−0.25	−1.30*	No

Notes: An asterisk (*) denotes statistical significance at the 0.05 level. It was determined that there was evidence of social desirability bias if 95% confidence intervals surrounding direct questioning and indirect questioning estimates did not overlap and the absolute value of the direct willingness-to-pay estimate was greater than the absolute value of the indirect willingness-to-pay estimate.

intervals on the direct and indirect WTP estimates for each verified attribute to determine if the confidence intervals overlapped. Evidence of social desirability bias existed if the 95% confidence intervals surrounding the indirect and direct WTP estimates for a given verified attribute did not overlap and the absolute value of the WTP from direct questioning exceeded that of indirect questioning.[7]

For both pork and milk, the sign on the WTP for each attribute was consistent across direct and indirect questioning for WTP point estimates which were statistically different than zero (tables 5 and 6). In the case of pork, statistically significant evidence of social desirability bias was found for only one verified attribute, self-verified use of certified trucking or transport. In the case of milk, however, three verified attributes were found to have significant evidence of social desirability bias, specifically self-, consumer-, and USDA-verified pasture access.

[7] Examination of overlapping 95% confidence intervals is intuitive and allows comparison by visual inspection when confidence intervals are presented. It is acknowledged that comparing of 95% confidence intervals and examining overlap is more conservative than the standard method of significance testing when the null hypothesis is true and falsely fails to reject the null hypothesis more frequently than the standard method when the null hypothesis is false (Schenker and Gentleman, 2001).

Table 6. WTP Based on Direct and Indirect Questioning for Milk ($/gallon)

Variable	Willingness to Pay: Direct Questioning ($N = 332$)	Willingness to Pay: Indirect Questioning ($N = 665$)	Evidence of Social Desirability Bias?
Private	6.50	3.71*	No
Consumer	0.78	−1.12*	No
USDA	−4.63	−2.46*	No
Self-Verified Pasture Access	4.03*	0.20*	Yes
Private Party-Verified Pasture Access	1.24	−1.63*	No
Consumer Group-Verified Pasture Access	6.12*	1.17*	Yes
USDA-Verified Pasture Access	10.32*	2.14*	Yes
Self-Verified Individual Crates/Stalls	3.44*	0.50*	No
Private Party-Verified Individual Crates/Stalls	−0.35	−0.43	No
Consumer Group-Verified Individual Crates/Stalls	0.29	−0.08	No
USDA-Verified Individual Crates/Stalls	2.71*	1.02*	No
Self-Verified Antibiotic Use	2.22	−0.02	No
Private Party-Verified Antibiotic Use	−2.29	−2.12*	No
Consumer Group-Verified Antibiotic Use	1.78	0.53*	No
USDA-Verified Antibiotic Use	3.22*	1.08*	No
Self-Verified Certified Trucking/Transport	0.99	0.18	No
Private Party-Verified Certified Trucking/Transport	−3.66	−3.20*	No
Consumer Group-Verified Certified Trucking/Transport	−1.84	−0.42*	No
USDA-Verified Certified Trucking/Transport	0.58	−0.05	No

Notes: An asterisk (*) denotes statistical significance at the 0.05 level. It was determined that there was evidence of social desirability bias if 95% confidence intervals surrounding direct questioning and indirect questioning estimates did not overlap and the absolute value of the direct willingness-to-pay estimate was greater than the absolute value of the indirect willingness-to-pay estimate.

All three cases of significant social desirability bias evidence for milk were for verified pasture access. One potential explanation for this finding revolves around consumer sentiment for and familiarity with the attributes investigated. Lusk and Norwood (2009a) found that people indicated their own WTP values were higher than those they predicted for other people when goods had relatively high normative consequences. We hypothesize that pasture access was the most normative of attributes included in this analysis, leading to this significant evidence of social desirability bias in verified pasture access, while significant evidence was not found in the other investigated verified attributes.

We found large differences in WTP for pasture access in milk purchases assessed using direct and indirect questioning. The difference in WTP for direct and indirect questioning for self-verified pasture access was $3.83, while the differences for consumer and USDA verified were $4.95 and $8.18, respectively. For the attributes in which statistically significant social desirability was found, the magnitudes of social desirability bias were large. In particular, the ratio of direct to indirect milk WTP estimates in this analysis for consumer and USDA verification of pasture access was approximately 5 to 1, while self-verified pasture access was 20 to 1. Lusk and Norwood (2009a) noted that differences in WTP estimates can be quite large (including cases in which the difference across self- and inferred valuation exceeded self-valuation) in situations where normative consequences were relatively high and own versus other people's WTP values differ.

While the degree of bias present when looking at individual attributes differed by product, there was evidence against pooling of observations from direct and indirect questioning for both livestock products through likelihood-ratio testing. A number of factors likely determine the degree to which bias is present for specific products. For pork chops relative to milk, we hypothesize that factors such as consumers' association with cows versus pigs or the distinction between milk as a livestock product versus pork chops as a meat product may play a role in the evidence of bias which was found. The amount of consumers' exposure to the livestock species or consumer sentiment for a specific species may potentially influence social desirability bias surrounding products from certain species. Widespread consumer exposure to campaigns for milk and dairy products, for example, could result in closer consumer association with or sentiment for dairy cows. Other potentially relevant factors include the increased likelihood of consumers seeing cows on pasture versus pigs on pasture, increased perceived familiarity with milk production versus swine production, or different emotional attachment to animals which produce food products versus those raised primarily to slaughter for meat. In light of our results, it is possible that consumers, through exposure to campaigns or the species, have higher emotional attachment to cows.

Conclusions

Consumers are increasingly interested in how their food is produced. A growing body of literature has reviewed consumer preferences for certain production practice attributes and welfare attributes associated with livestock used for food production. This analysis assessed consumer value for the verification of those production practices. Estimates of consumer WTP for verification of four different livestock production process claims across two livestock products were obtained. Consumer WTP estimates differed across verifying entity as well as attributes verified. For example, verification of access to pasture by the USDA had the highest WTP for both pork chops and milk of any entity verifying access to pasture.

Analysis of the WTP estimates for milk from the direct and indirect questioning provides support for the notion that when questioned directly, people have a tendency to represent themselves in a way which is socially acceptable. Consistent with Lusk and Norwood (2009a), it is likely that the indirect WTP estimates, for the case in which evidence of social desirability bias can be found, are a more accurate reflection of people's actual WTP than the direct questioning WTP estimates. Evidence for social desirability bias differed across livestock product, with milk yielding more evidence than pork chops. Therefore, evidence of social desirability bias in WTP for credence attributes of production processes differed depending on the livestock species in question.

Future work may consider verification by specific parties, rather than across the broad and general categories of private third-party and consumer groups, for example. Additional livestock products should be evaluated to further analyze the differences in consumer WTP and social desirability bias across livestock species and products. The incorporation of different production process attributes may yield additional insights into the attribute types for which consumers have higher WTP for verification through a given party.

Future work related to assessing social desirability bias could include analysis of increased numbers of livestock products. Evidence of social desirability bias was found in this analysis, which used online survey techniques for data collection, but further work is necessary regarding the degree of bias present depending on data collection method employed. We suspect the degree of social desirability bias would be higher for phone interviews and higher still for in-person interviews. The impact of data collection method employed on evidence for social desirability bias is left to future analyses.

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Appendix A: Choice Experiment Definitions

Individual Crates/Stalls refers to the use of practices individually confining animals where:

- *Not Permitted* means the animal was raised on an operation certified to *not* confine animals in individual crates, stalls, or cages;
- *Permitted* indicates that no claims regarding confinement of animals in individual crates, stalls, or cages are being made.

Pasture Access refers to the ability of animals to access grass pasture (when weather permits) and not be confined solely to indoor production facilities:

- *Required* means the animal was raised on an operation certified to provide animals with access to grass pasture (when weather permits);
- *Not Required* indicates that no claims regarding access to grass pasture are being made.

Antibiotic Use refers to the use of antibiotics on animals where:

- *Not Permitted* means the animal was raised on an operation certified to *not* administer antibiotics to animals;
- *Permitted* indicates that no claims regarding use of antibiotics are being made.

Certified Trucking/Transport refers to the use of certified trucking and transportation methods that enhance the care and welfare of animals during transport:

- *Required* means the animal was raised on an operation using certified trucking and transportation methods;
- *Not Required* indicates that no claims regarding trucking and transportation methods are being made.

Certification Entity refers to the process used in verifying animal welfare and handling claims made on the product label where:

- *USDA-PVP* means the label is backed by a producer's participation in a certification and process verification program (PVP) managed by the United States Department of Agriculture (USDA);
- *Self-Certification* means the label is backed by a producer's participation in a certification and verification program managed by the industry itself;
- *Private, Third Party* means the label is backed by a producer's participation in a certification and verification program managed by a private, third-party company that is neither associated with the livestock industry nor any consumer groups;
- *Consumer Group* means the label is backed by a producer's participation in a certification and verification program managed by a consumer group interested in animal welfare and handling issues.

Appendix B: Example Choice Set Scenario for Pork Chops

EXAMPLE DIRECT QUESTIONING SCENARIO:

Pork Chop Attribute	Option A	Option B	Option C
Price ($/lb.)	$3.24	$3.99	*I choose not to purchase either of these two products.*
Individual Crates/Stalls	Not permitted	Permitted	
Pasture Access	Not required	Required	
Antibiotic Use	Not permitted	Permitted	
Certified Trucking/Transport	Required	Not required	
Certification Entity	Self-Certification	USDA-PVP	
I choose …			

EXAMPLE INDIRECT QUESTIONING SCENARIO:

Pork Chop Attribute	Option A	Option B	Option C
Price ($/lb.)	$3.24	$3.99	*I choose not to purchase either of these two products.*
Individual Crates/Stalls	Not permitted	Permitted	
Pasture Access	Not required	Required	
Antibiotic Use	Not permitted	Permitted	
Certified Trucking/Transport	Required	Not required	
Certification Entity	Self-Certification	USDA-PVP	
Average American would choose …			

Appendix C: Information Shocks

(1) Base Information

Use of Gestation Crates in Pork Production
Gestation crates (also called gestation stalls) refer to metal crates (approximately 7 feet long and 2 feet wide) that house female breeding stock in individually confined areas during an animal's approximately four-month pregnancy.

Access to Grass Pasture in Milk Production
Dairy cow housing systems vary from confinement operations with cows housed in barns and fed at bunks to grazing dairies that do not confine cows. The typical U.S. dairy has some of both systems, with grazing

occurring when climate is favorable and housing available in inclement weather. Organic production requires access to pasture when weather permits.

(2) Industry Information

Use of Gestation Crates in Pork Production
Gestation crates (also called gestation stalls) refer to metal crates (approximately 7 feet long and 2 feet wide) that house female breeding stock in individually confined areas during an animal's approximately four-month pregnancy.

The American Veterinary Medical Association (AVMA) supports the use of sow housing that "minimizes aggression and competition between sows; protects sows from detrimental effects associated with environmental extremes, particularly temperature extremes; reduces exposure to hazards that result in injuries; provides every animal with daily access to appropriate food and water; and facilitates observation by caretakers of individual sow appetites, respiratory rates, urination and defecation and reproductive status." The National Pork Producers Council (NPPC) supports this position of AVMA.

Access to Grass Pasture in Milk Production
Dairy cow housing systems vary from confinement operations with cows housed in barns and fed at bunks to grazing dairies that do not confine cows. The typical U.S. dairy has some of both systems, with grazing occurring when climate is favorable and housing available in inclement weather. Organic production requires access to pasture when weather permits.

The National Milk Producer's Federation supports access to pasture as part of the National Organic Program provided it is "size neutral."

(3) Consumer Group Information

Use of Gestation Crates in Pork Production
Gestation crates (also called gestation stalls) refer to metal crates (approximately 7 feet long and 2 feet wide) that house female breeding stock in individually confined areas during an animal's approximately four-month pregnancy.

The Humane Society of the U.S. (HSUS) states that gestation crates are "individual metal enclosures so restrictive that the pigs cannot turn around." Moreover, HSUS states, "Crated sows suffer a number of significant welfare problems, including elevated risk of urinary tract infections, weakened bones, overgrown hooves, lameness, behavioral restriction, and stereotypes. Due to concerns for the welfare of intensively confined sows, legislative, industry, and corporate policies are increasingly phasing out the use of gestation crates."

Access to Grass Pasture in Milk Production
Dairy cow housing systems vary from confinement operations with cows housed in barns and fed at bunks to grazing dairies that do not confine cows. The typical U.S. dairy has some of both systems, with grazing occurring when climate is favorable and housing available in inclement weather. Organic production requires access to pasture when weather permits.

The Humane Society of the U.S. (HSUS) states that cows confined to cement-floored barns have a higher incidence of lameness. HSUS further states that cows prefer lying and resting on soft surfaces like wood chips or straw rather than hard surfaces like concrete or gravel.

(4) Industry and Consumer Group Information

Use of Gestation Crates in Pork Production
Gestation crates (also called gestation stalls) refer to metal crates (approximately 7 feet long and 2 feet wide) that house female breeding stock in individually confined areas during an animal's approximately four-month pregnancy.

The American Veterinary Medical Association (AVMA) supports the use of sow housing that "minimizes aggression and competition between sows; protects sows from detrimental effects associated with environmental extremes, particularly temperature extremes; reduces exposure to hazards that result in injuries; provides every animal with daily access to appropriate food and water; and facilitates observation by caretakers of individual sow appetites, respiratory rates, urination and defecation and reproductive status." The National Pork Producers Council (NPPC) supports this position of AVMA.

The Humane Society of the U.S. (HSUS) states that gestation crates are "individual metal enclosures so restrictive that the pigs cannot turn around." Moreover, HSUS states, "Crated sows suffer a number of significant welfare problems, including elevated risk of urinary tract infections, weakened bones, overgrown hooves, lameness, behavioral restriction, and stereotypes. Due to concerns for the welfare of intensively confined sows, legislative, industry, and corporate policies are increasingly phasing out the use of gestation crates."

Access to Grass Pasture in Milk Production

Dairy cow housing systems vary from confinement operations with cows housed in barns and fed at bunks to grazing dairies that do not confine cows. The typical U.S. dairy has some of both systems, with grazing occurring when climate is favorable and housing available in inclement weather. Organic production requires access to pasture when weather permits.

The National Milk Producer's Federation supports access to pasture as part of the National Organic Program provided it is "size neutral."

The Humane Society of the U.S. (HSUS) states that cows confined to cement-floored barns have a higher incidence of lameness. HSUS further states that cows prefer lying and resting on soft surfaces like wood chips or straw rather than hard surfaces like concrete or gravel.