Journal of Agricultural and Resource Economics 37(3):485–501

Public and Private Preferences for Animal Cloning Policies

Kathleen R. Brooks and Jayson L. Lusk

Data on individuals' private shopping choices are often used to draw conclusions about their desires for food policies. The purpose of this paper is to test this often-implicit assumption using data from a nationwide survey about animal cloning. We find that although individuals' private choices indicate a strong desire to avoid meat and milk from cloned cattle, public choices predict that only 40.29% have a positive WTP for such a ban. The results suggest caution is necessary when inferring public preferences from private choices.

Key words: choice experiment, cloning, contingent valuation, ground beef, milk, policy ban, willingness-to-pay

Introduction

Economists often study consumer choice for the purpose of drawing inferences about the merits of government intervention. Examples include the study of consumer choice to determine the benefits of food-labeling policies (e.g., Dhar and Foltz, 2005; Teisl, Bockstael, and Levy, 2001; Hu, Veeman, and Adamowicz, 2005; Rousu et al., 2007), banning certain technologies or food attributes (e.g., Lusk et al., 2005; Lusk, Norwood, and Pruitt, 2006), and providing safer food (Buzby, Ready, and Skees, 1995; Hayes et al., 1995; Piggott and Marsh, 2004). A key characteristic of such studies is that they use data on consumers' private choices about which products they have purchased to infer the merits of a public policy. Underlying such an approach is an implicit assumption that consumers' preferences for food attributes are stable, in the sense that they would also explain which policies consumers would prefer the government enact. But are people's preferences as reflected in private shopping choices consistent with their preferences for public policies? There are several reasons to suggest that the answer might be no, but there has been little comparison of the differences in preferences for public policies implied by private choices and those implied by direct questioning.

The purpose of this paper is to determine whether individuals' private preferences, as expressed through shopping choices, are consistent with their preferences for public policy. In particular, we ask whether willingness-to-pay (WTP) for a policy to ban the use of cloning technology in meat and milk production can be inferred from meat and milk purchase choices. Animal cloning is of particular interest given the U.S Food and Drug Administration (FDA)'s recent conclusions about on the safety of meat and milk from cloned animals. Although producers have been asked to voluntarily keep cloned animals from entering the food supply chain in the near term, the FDA's announcement marked the beginning of a process that could potentially lead to food from clones, which has not been received well in all quarters. After the announcement, many large food processors and retailers announced their intention to prohibit the sale of products from cloned animals, and other groups called for federal policies to ban cloned products all together.

This paper moves beyond previous research in a number of ways. Previous research on animal cloning has primarily asked consumers whether they intend to purchase products from

Kathleen R. Brooks is an assistant professor of agricultural business and economics in the Department of Agricultural Science at West Texas A&M University and Jayson L. Lusk is professor and Willard Sparks endowed chair in the Department of Agricultural Economics, Oklahoma State University.
The authors are grateful to the USDA-ERS, which provided funding to collect the data involved in this research. The authors would also like to thank three anonymous reviewers and the editor for their helpful comments.

Review coordinated by Gary W. Brester.

cloned animals (International Food Information Council, 2008). The current study aims to estimate consumers' WTP for meat and milk products from cloned animals. This approach allows for a direct comparison between WTP for a policy calculated using consumers' private choices and WTP implied from a direct dichotomous choice question about the policy. This question is important for future policy analysis because it speaks to whether the currently common practice of using private choices in surveys, experiments, and even scanner data (Hu, Veeman, and Adamowicz, 2005; Lusk, Norwood, and Pruitt, 2006; Marette et al., 2008) is useful in projecting citizens' support of public policies.

Conceptual Considerations

There are many possible reasons why private shopping choices might yield different implied preferences for a public policy than those obtained when consumers are asked directly about the policy. Hamilton, Sunding, and Zilberman (2003) argue that even though someone may be unwilling to buy a product, they might be unwilling to vote to ban it because they do not want to constrain their future choices. Voting to ban a product implies giving up the option to change one's mind when more information becomes available. Just as consumers might be unwilling to constrain their own future choices, they might also be unwilling to constrain others' choices, either out of a sense of pluralism or altruism. Consumers may be unwilling to impose their beliefs on others or they may believe that other consumers will be happier if left to make their own choices—even if they are not the ones the individual would make themselves. Regardless of whether motivated by selfish option valuation or by other-regarding preferences, these arguments would suggest that public support for public policies to ban controversial food products is less pronounced than what consumers' private shopping choices would imply.

By contrast, Carlsson, Frykblom, and Lagerkvist (2007) argue that people might be more likely to vote on a product ban than would be implied by their shopping choices because a ban eliminates free riding. Stated differently, if an externality exists, people might be willing to vote to ban a product that they currently purchase; a ban forces people to coordinate their purchases and eliminates the potential for free riding. Some people carry this sort of argument to its extreme, arguing that there are moral reasons for banning the sale of certain products. In such cases, it is argued that policy should prohibit others from buying a product because it "goes against nature" or is not "what God intended."

Both of the preceding arguments accept the premise that consumers' underlying food preferences are stable but assert that people also have preferences that extend beyond their individual food choice, causing them to evaluate public policies differently than their individual purchases. That is, preferences for one's future self, preferences for others, or consideration of externalities can help explain why people might choose one thing in a grocery store and another thing in a voting booth.[1] A different hypothesis is that people's preferences somehow change when they enter the voting booth. Blamey, Common, and Quiggin (1995) argue that we have two selves: a consumer and a citizen. Their argument is that we think about our own private costs and benefits when we are in "consumer mode" but we are more ethical and public-minded when we are in "citizen mode." What we want depends on the role we believe ourselves to be playing. The voting-as-a-citizen hypothesis suggests that people would be more likely to support public policies, such as a product ban, than their private shopping choices would suggest. Nyborg (2000) discusses the potential for an individual's personal preferences to differ from his or her social preferences. Individuals may support public policies more than private shopping choices suggest because of differences in social and personal preferences.

[1] There is, of course, the related problem that sometimes people say they want one thing in a hypothetical survey but then do something else in nonhypothetical experiments. Noussair, Robin, and Ruffieux (2004), for example, used nonhypothetical experiments to test the willingness of French consumers to buy genetically modified foods. Their revealed preferences for purchasing sufficiently discounted GM foods were contrasted with the overwhelmingly negative views found in hypothetical surveys, where many people claimed they would never buy genetically modified foods.

Table 1. Characteristics of Survey Respondents (n=1,787)

Variable	Definition	Mean
Age	Age in years	49.56
Gender	1 if female; 0 if male	0.485
Income1	1 if annual household income <$25,000; 0 otherwise	0.180
Income2	1 if annual household income $25,000 to $99,999; 0 otherwise	0.661
Income3	1 if annual household income ≥ $100,000; 0 otherwise	0.159
Bachelors	1 if Bachelor's degree or higher; 0 otherwise	0.311
Northeast	1 if resides in Northeast U.S Census Region; 0 otherwise	0.174
Midwest	1 if resides in Midwest U.S Census Region; 0 otherwise	0.231
South	1 if resides in South U.S Census Region; 0 otherwise	0.368
West	1 if resides in West U.S Census Region; 0 otherwise	0.227
Primary shopper	1 if primary shopper for household's food products; 0 otherwise	0.681
Some of the meat currently sold in grocery stores is from cloned animals or their offspring	1=strongly disagree; 5=strongly agree[a]	2.790
The average American is willing to eat meat from cloned animals	1=strongly disagree; 5=strongly agree[a]	2.811
I trust the U.S. government to properly regulate the use of animal cloning	1=strongly disagree; 5=strongly agree[a]	2.621
Morals[b]		0.081
Frequency of Meat Purchase[c]	How often meat is purchased per month	3.700
Frequency Milk Purchase[c]	How often milk is purchased per month	3.813

Notes: [a]Response categories were: 1=strongly disagree, 2= somewhat disagree, 3=neither agree nor disagree, 4=somewhat agree, and 5=strongly agree.
[b]Based on relative importance an individual attached to the statement "animal cloning is morally wrong."
[c]1=Never, 2=a few times a year, 3= about once a month, 4=about once a week, 5=every day. The responses were converted to a monthly consumption basis using the following; never purchased=0, a few times a year=1/12, about once a month=1, about once a week=52/12, and daily =30.

Data and Methods

In June 2008, a web-based survey was delivered to participants in the Knowledge Networks (KN) panel. The KN panel consists of individuals recruited using random-digit-dialing techniques and, as such, represents a true probability sample based on the general U.S. population. The panel is comprised of both Internet and non-Internet households. To ensure representativeness, individuals are provided with access to the Internet if the household does not have availability. The survey was sent to 3,222 individuals, 2,256 of whom completed at least a portion of the questions, a response rate of 70%. We restrict our analysis to the 1,825 who completed all choice questions analyzed in this paper. All subjects were provided with information about cloning technology (the exact information statement is provided in the appendix). To help control for a "shock" effect from hearing about a potentially new technology, one half of the sample received the information one week prior to taking the survey and the other half received it only at the time the survey was taken. Because we found virtually identical results across the two treatments, the data is pooled in the analyses reported here.

Table 1 reports the means for selected demographic variables and other variables used in the analysis. A total of 1,787 respondents answered all of the demographic questions. Thus, models that incorporate demographics rely on the subset of 1,787 individuals who provided complete demographic information. Overall, the sample is diverse and representative of the U.S. population. Approximately 49% of respondents were female and the average age was forty-nine years. Approximately 31% of the respondents had a bachelor's degree or higher and over 68% were the primary shopper for their household.

The survey included a number of questions intended to tease out factors that might cause divergence in public and private questions. Three belief questions were administered. Respondents were asked to indicate the extent to which they agreed or disagreed with three statements:

1. "Some of the meat currently sold in grocery stores is from cloned animals or their offspring,"
2. "The average American is willing to eat meat from cloned animals,"
3. "I trust the U.S. government to properly regulate the use of animal cloning."

Participants were asked to respond to each statement on a five-point scale, with 1 indicating strong disagreement and 5 indicating strong agreement. The first question provides information on people's beliefs about the extent of market penetration of cloning and thus relates to beliefs about current consumption and the impacts of a potential ban on products from clones. The second question was included to provide information on people's beliefs about others' preferences; presumably some people might vote differently than their private shopping choices suggest because they do not want to impose their beliefs on others. Finally, the last question aims to determine people's beliefs about the efficacy of government policies, which relates to people's willingness to support regulation.

We also hypothesized that differences in beliefs about the morality of animal cloning might explain differences in public and private choices; those who believe animal cloning is morally wrong are more likely to be willing to enact a ban. To determine consumers' potential objections to cloning on the basis of morality, respondents were asked a series of paired-comparison questions to determine the relative importance of competing objections to animal cloning (including morality). They were asked, "Which of the following two statements best describes your views towards animal cloning? X or Y." A total of eight different issues were included in the survey. Responses were analyzed using a random parameters logit to determine the relative probability of the eight different issues best reflecting people's views on animal cloning. These probabilities are calculated using best-worst choice models (Lusk and Briggeman, 2009). The main advantages of these ratios are that they avoid ordinal scale pitfalls and that there is only one way for the person to respond to each question. Here we focus in on the relative importance an individual attached to the statement "animal cloning is morally wrong." As shown in table 1, the average score for this variable was 0.081, which means that on average there is an 8.1% chance the respondents would chose "animal cloning is morally wrong" as the most important objection in relation to cloning. More details on the construction of this variable are provided in Lusk (2008).

Public WTP for a Ban on Meat and Milk from Clones

To directly determine consumers' public preferences for a ban on meat and milk from cloned animals, they were asked to respond to the following contingent-valuation question:

> Suppose the next time you went to vote, there was a referendum on the ballot that would ban the practice of animal cloning altogether. Would you vote in favor of this policy if the policy would increase the price you would pay for meat and milk products by Z% due to the added enforcement and oversight required by the policy?

Response categories were of the form: "I would vote in favor of a ban and a Z% increase in the price of meat and milk" or "I would vote against the ban and the Z% increase in the price of meat and milk." Each respondent was randomly assigned a value for Z% among the values of 5%, 10%, 15%, 25%, 50%, 75%, or 100%. Answers to this question provide a direct estimate of people's public WTP for that policy to ban animal cloning.

Private WTP for a Ban on Meat and Milk from Clones

The survey contained a series of discrete choice questions asking respondents which milk or ground beef option (or none) they would buy when grocery shopping. In constructing the questions, standard

practices in the choice experiment literature were followed. Each choice option was described by a set of attributes or characteristics. Milk options were described with four different attributes, including price per gallon ($2.99 or $5.99), fat content (whole, 2%, 1%, or skim), use of rbST (no rbST used or rbST used), and use of cloning (milk from noncloned animal, milk from cloned animal, or milk from offspring of cloned animal.) A separate set of questions asked about preferences for buying ground beef, where each option differed by price per pound ($1.99 or $3.99), percentage lean (80% or 90%), percentage saturated fat (5% or 10%), and use of cloning (beef from noncloned animal, beef from cloned animal, or beef from offspring of cloned animal). The purpose of including several additional attributes other than price and cloning was to present consumers with realistic choice options such as those they would encounter in the supermarket and to determine the importance of cloning relative to these other attributes.

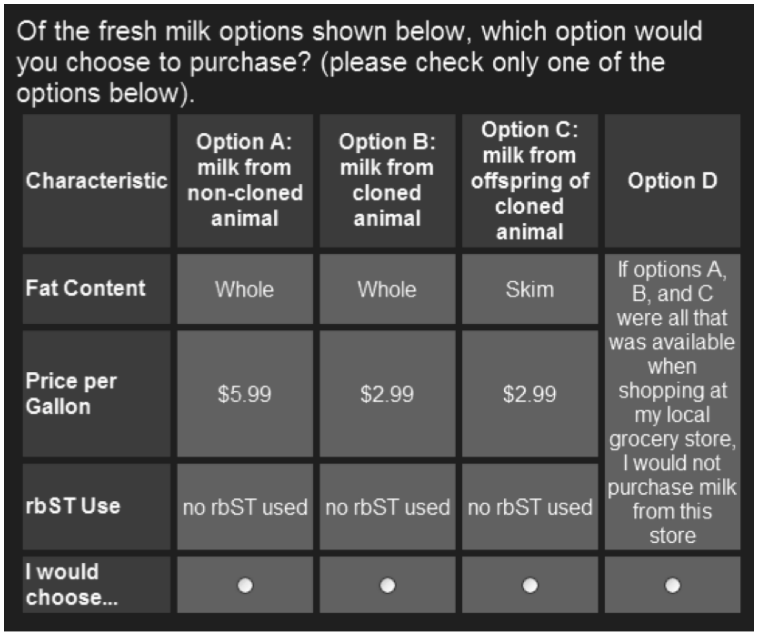
The choice questions were constructed such that the cloning attribute was treated as an alternative-specific attribute; option A was always "milk (meat) from noncloned animal," option B was always "milk (meat) from cloned animal," and option C was always "milk (meat) from offspring of cloned animal." Option D was a "no purchase" option that stated, "If options A, B, and C were all that was available when shopping at my local grocery store, I would not purchase milk (meat) from this store." An orthogonal main effects fractional factorial design was used to determine which milk (meat) options to present to respondents. For the milk questions, price and rBST were varied at two levels each and fat content was varied at four levels, creating sixteen possible combinations of milk options ($2^2 \times 4 = 16$). Because there were three milk options in each choice set, there were 4,096 possible choice sets ($16^3 = 4,096$). From this full factorial, sixteen choice tasks were selected such that the correlations between attributes, both within and across options, were exactly zero. Each respondent answered sixteen milk conjoint choice questions, an example of which is shown in figure 1. For the beef questions, price, percentage lean, and percentage saturated fat were varied at two levels each so there were eight possible combinations of beef options ($2^3 = 8$). Because there were three beef options in each choice set, there were 512 possible choice sets ($8^3 = 512$). From this full factorial, twelve choice tasks were selected such that the correlations between attributes, both within and across options, were exactly zero. Each respondent answered twelve beef conjoint choice questions, an example of which is shown in figure 2. Responses to these choice experiment questions can be used to estimate an attribute-based utility function, which in turn can be used to calculate the private welfare effects of policies such as a ban on cloned milk or ground beef. The exact procedures used to calculate consumer WTP for a ban on meat and milk from clones based on the answers to these choice question are described later in the text.

It should be noted that a potential shortcoming of both our "public" and "private" questions is that they are both hypothetical and thus might lead to inflated WTP values. However, since both sets of questions are hypothetical, this aspect of the design is unlikely to explain differences across the questioning formats. Moreover, the differences across the two question formats are not ones of relative magnitude but rather of sign (the public question suggests a ban is not preferred whereas the private question suggests exactly the opposite). It is unclear how hypothetical bias could explain such a divergence.

Econometric Methods

Public WTP (Contingent-Valuation Question)

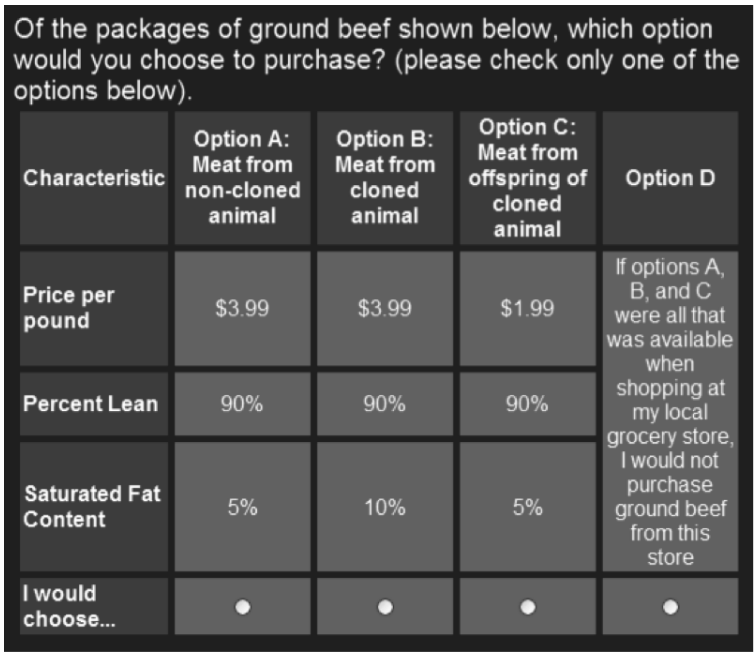
In the contingent-valuation question, participants voted directly either in favor of or against a policy to ban cloning in meat and milk production, assuming that it would increase the price they would pay for meat or milk products by Z%. An interval-censored model is used to estimate mean WTP to ban animal cloning (Cameron and James, 1987; Cameron, 1988). In particular, individual *i*'s public



Of the fresh milk options shown below, which option would you choose to purchase? (please check only one of the options below).

Characteristic	Option A: milk from non-cloned animal	Option B: milk from cloned animal	Option C: milk from offspring of cloned animal	Option D
Fat Content	Whole	Whole	Skim	If options A, B, and C were all that was available when shopping at my local grocery store, I would not purchase milk from this store
Price per Gallon	$5.99	$2.99	$2.99	
rbST Use	no rbST used	no rbST used	no rbST used	
I would choose...	○	○	○	○

Figure 1. Example of Milk Choice Question Presented to Survey Respondents



Of the packages of ground beef shown below, which option would you choose to purchase? (please check only one of the options below).

Characteristic	Option A: Meat from non-cloned animal	Option B: Meat from cloned animal	Option C: Meat from offspring of cloned animal	Option D
Price per pound	$3.99	$3.99	$1.99	If options A, B, and C were all that was available when shopping at my local grocery store, I would not purchase ground beef from this store
Percent Lean	90%	90%	90%	
Saturated Fat Content	5%	10%	5%	
I would choose...	○	○	○	○

Figure 2. Example of Beef Choice Question Presented to Survey Respondents

WTP (WTP_i^*) can be written as:

$$WTP_i^* = \boldsymbol{X}_i\boldsymbol{\delta} + u_i, \tag{1}$$

where $\boldsymbol{X}_i$ is the vector of explanatory variables for individual i, $\boldsymbol{\delta}$ is the vector of coefficients, and u_i is an independently and identically normally distributed error term with mean zero and variance σ^2. Each individual was confronted with a randomly chosen percentage increase in price, Z%. The survey responses identify a range on WTP^*. If the individual votes in favor of the ban, then we know that $WTP_i^* > Z_i$, where Z_i is the randomly assigned price increase assigned to individual i. However, if the individual votes against the ban, then $WTP_i^* < Z_i$. Accordingly, the following likelihood functions can be used to estimate the determinants of WTP:

$$\log L = \sum_{i=1}^{n} y_i \log \Phi\left(\frac{\boldsymbol{Z}_i - \boldsymbol{X}_i\boldsymbol{\delta}}{\sigma}\right) + (1 - y_i)\log\left(1 - \Phi\left(\frac{\boldsymbol{Z}_i - \boldsymbol{X}_i\boldsymbol{\delta}}{\sigma}\right)\right), \tag{2}$$

where $y_i = 1$ if the individual voted in favor of the policy at price increase $\boldsymbol{Z}_i$ and 0 otherwise, Φ is the standard normal cumulative distribution function and the coefficient estimates, and $\boldsymbol{\delta}$ can be interpreted as the marginal effect of $\boldsymbol{X}_i$ on WTP_i^* (Cameron, 1988). Mean willingness-to-pay can then be calculated as $E(WTP) = \overline{\boldsymbol{X}}\hat{\boldsymbol{\delta}}$, where $\overline{\boldsymbol{X}}$ is a vector of sample averages of the independent variable. If one is only interested in the location and scale of the willingness-to-pay in the sample, equation (1) can be estimated with only a constant as an explanatory variable. The estimated constant is the mean premium for the policy.

Our question was phrased such that it asked whether people were willing to pay a particular percentage price increase. Thus, estimates from equation (2) are in terms of percentage price increases people are willing to pay. To make a direct comparison to the private choice questions, the percentage WTP needs to be converted to a dollar amount that would make consumers indifferent between banning cloning and not banning cloning. In June 2008, when the survey was conducted, uncooked ground beef was approximately $3.01 per pound (U.S. Bureau of Labor Statistics, 2008) and the retail price for milk was $3.75 per gallon for whole milk (USDA Agricultural Marketing Service, 2008). Thus, we can re-estimate equation (2) and replace Z_i with $P_i = Z_i \times P_0$, where P_0 is the market price of the meat or milk. In this case, the statistic reveals the extra dollar amount people are willing to pay per pound of ground beef or gallon of milk for the ban, assuming the same quantity is consumed after the ban. Although this latter assumption may be somewhat dubious, it is somewhat immaterial given that we find that differences in public and private WTP for a ban are not differences in the magnitude of WTP, but rather of a reversal in preference for the ban.

Private WTP (Choice Experiment Questions)

Responses to the choice-experiment questions regarding which meat or milk option (or none) a consumer would buy when grocery shopping can be used to estimate an attribute-based utility function, which in turn can be used to calculate private preferences for policies such as a ban on cloned milk or ground beef. Responses can be analyzed by using McFadden's (1974) random utility framework. In particular, individual i's utility for choice option j, U_{ij}, is defined by a systematic component (V_{ij}) assumed to depend on the attributes of the choice option (e.g., price, fat content) and a stochastic error term (ε_{ij}) representing consumers' idiosyncrasies unobservable to the analyst:

$$U_{ij} = V_{ij} + \varepsilon_{ij}. \tag{3}$$

If the error terms in equation (3) are independently and identically distributed with a type I extreme-value distribution, then the probability of alternative j being chosen out of a set of J alternatives is the familiar multinomial logit model (MNL):

$$P_{ij} = \text{Prob}(\text{option } j \text{ is chosen}) = \frac{e^{V_{ij}}}{\sum_{k=1}^{J} e^{V_{ik}}} \tag{4}$$

The systematic portion of the utility functions for milk and ground beef is, respectively:

$$V_{ij}^{milk} = \alpha_1(price)_{ij} + \alpha_2(whole)_{ij} + \alpha_3(2\%)_{ij} + \alpha_4(1\%)_{ij} + \alpha_5(rBSTfree)_{ij} + \alpha_6(nonclone)_{ij} + \alpha_7(cloneoffspring)_{ij} + \alpha_8(none)_{ij}, \tag{5}$$

$$V_{ij}^{beef} = \beta_1(price)_{ij} + \beta_2(\%lean)_{ij} + \beta_3(\%saturatedfat)_{ij} + \beta_4(nonclone)_{ij} + \beta_5(cloneoffspring)_{ij} + \beta_6(none)_{ij}, \tag{6}$$

where $(price)_{ij}$, $(\%lean)_{ij}$, and $(\%saturatedfat)_{ij}$ are the price, percentage lean, or percentage saturated fat faced by individual i for alternative j; the α's and β's are the marginal utilities for the milk and beef attributes; and the remaining variables are dummy variables indicating the presence or absence of the characteristic in question. The utility of the "clone" option is normalized to zero for identification purposes; therefore α_6, α_7, and α_8 (β_6, β_7, and β_8) represent the utility of having a gallon of milk (pound of ground beef) from a nonclone, offspring of a cloned animal, or not purchasing at all relative to purchasing milk (ground beef) from a cloned animal on the particular shopping occasion. To facilitate comparison with the results of the "direct" question on WTP for a ban, equations (5) and (6) can be respecified from "preference space" to "WTP space" following the approach in Scarpa, Thiene, and Train (2008). Marginal WTP for an attribute is the attribute's coefficient divided by the negative of the price coefficient. For example, WTP for whole milk relative to skim milk is equal to $\alpha_2/-\alpha_1$. Equations (5) and (6) can be rewritten in WTP space as follows:

$$V_{ij}^{WTPmilk} = \alpha_1(price)_{ij} - \alpha_1\theta_2(whole)_{ij} - \alpha_1\theta_3(2\%)_{ij} + \alpha_1\theta_4(1\%)_{ij} - \alpha_1\theta_5(rBSTfree)_{ij} - \alpha_1\theta_6(nonclone)_{ij} - \alpha_1\theta_7(cloneoffspring)_{ij} - \alpha_1\theta_8(none)_{ij}, \tag{7}$$

$$V_{ij}^{WTPbeef} = \beta_1(price)_{ij} - \beta_1\lambda_2(\%lean)_{ij} - \beta_1\lambda_3(\%saturatedfat)_{ij} - \beta_1\lambda_4(nonclone)_{ij} - \beta_1\lambda_5(cloneoffspring)_{ij} - \beta_1\lambda_6(none)_{ij}, \tag{8}$$

where θ_k and λ_k are consumer WTP for attribute k (that is, $\theta_k = \alpha_k/-\alpha_1$).

Our overall goal is not to estimate the marginal WTP for cloning per se, but rather to calculate consumers' WTP for a ban on animal cloning using the preference functions given in equations (7) and (8), which are determined by private shopping choices. In particular, we can use the estimated utility functions to calculate consumers' expected maximum utility in a world without the ban where there is some chance that consumers might buy ground beef or milk products from cloned animals and compare it to the expected maximum utility in a post-ban world in which there is no chance of buying ground beef or milk products from cloned animals.

To set up the pre-ban scenario, we assume that consumers believe there is currently a 50% chance of purchasing ground beef or milk products from cloned animals when buying ground beef or milk.[2] Our simulation assumes that when purchasing a gallon of milk, consumers have four choices: whole, 2%, 1%, or skim milk (all assumed with no rBST at a price of $3.75 per gallon). When purchasing a pound of ground beef, our simulation assumes consumers have two choices: 80% or 90% lean

[2] Currently there is no way to track meat or milk from cloned animals or their offspring, and thus most consumers cannot determine whether the meat or milk they purchase is from cloned animals. In fact, in the survey we asked respondents whether they thought products from cloned animals were already sold in grocery stores; about 60% indicated they did not know. Such results suggest that in the current market environment, most people are uncertain whether the meat or milk they are purchasing is from cloned animals. Given this level of uncertainty, we assumed in our policy simulations that consumers currently believe they have a 50/50 chance of purchasing meat or milk from a cloned vs. noncloned animal when purchasing meat or milk. Later, we report the sensitivity of the results to this assumption. We also ignore the existence of products from cloned offspring.

(both assumed to have 7.5% saturated fat and cost \$3.01 per pound). Because we assume in the pre-ban world that consumers perceive a 50% chance of purchasing ground beef or milk from a cloned animal, we calculate the expected utility for each meat or milk option as a weighted average of the noncloned utility coefficient shown in equations (7) and (8) (i.e., $0.5\theta_6$ or $0.5\lambda_4$; recall the utility coefficient for cloned animals has been normalized to zero). In effect, we assume that when consumers go to the grocery store to buy ground beef or milk they believe that half is from cloned cattle and the other half is from noncloned cattle, and, not being able to tell which is which, the expected utility of an option is given by the probability of observing cloned multiplied by the utility of getting cloned.

In the post-ban world, consumers can be assured all meat and milk is from noncloned animals. We assume consumers still face the same five choices when purchasing a gallon of milk and the same three choices when purchasing a pound of ground beef as in the pre-ban world; the only difference is that now they know the meat and milk products are from noncloned animal (i.e., $0.5\theta_6$ is replaced with θ_6 and $0.5\lambda_4$ is replaced with λ_4). Consumers' WTP for a ban on animal cloning based on their private meat and milk purchases is calculated by comparing consumers' expected maximum utility in the pre- and post-ban worlds and dividing by the marginal utility of income. In particular, consumers' projected WTP for a ban (per choice of meat or milk option) is:

$$WTP_{Private} = 1/\gamma \left[\ln \left(\sum_{k=1}^{J} e^{V_{ik}^{post-ban}} \right) - \ln \left(\sum_{k=1}^{J} e^{V_{ik}^{pre-ban}} \right) \right], \tag{9}$$

where V_{ik} is defined in equation (7) for milk purchases and equation (8) for beef purchases, and where γ is the marginal utility of income given by $-\alpha_1$ for milk and $-\beta_1$ for beef. For further details on the derivation see Small and Rosen (1981) and Morey (1999).

Results

Table 2 reports the multinomial logit estimates fit to the private-choice-experiment data as well as the interval-censored regressions fit to the public-contingent-valuation data. Looking first at the private choices, the estimates reveal that, as expected, consumers dislike price increases, as indicated by the negative price coefficient. For ground beef, consumers are willing to pay about \$0.048 for each 1% increase in leanness and \$0.152 for each 1% reduction in saturated fat content. For milk, skim is preferred over whole or 1% milk, but 2% is preferred to skim. Consumers also prefer rBST-free milk to milk containing rBST. For both milk and ground beef, products from noncloned animals are strongly preferred over products from cloned animals. For example, consumers are willing to pay a \$3.46 premium for a one-pound package of ground beef and a \$3.40 premium for one gallon of milk from a nonclone as compared to a clone. Consumers do not differentiate much between products from offspring of cloned animals and the clones themselves. The results also indicate that people would rather purchase milk from cloned animals than not purchase it at all, but this is not true for ground beef.

The estimated preference parameters from the private choices can be substituted into equation (9) to determine the implied WTP to ban ground beef or milk from clones. The results indicate that, based on consumers' private shopping choices, consumers are willing to pay \$1.73 per pound more for ground beef and \$1.70 per gallon more for milk each time they purchase in order to ban cloned animal products.[3]

[3] The calculations assume consumers currently believe there is a 50/50 chance of buying cloned versus noncloned meat and milk. If consumers instead believed there was a 60/40 chance of purchasing noncloned versus cloned products, then they would be willing to pay an additional \$1.38 per pound and \$1.36 per gallon each time they purchased meat or milk, respectively, to ban animal cloning. If they believe it is a 40/60 chance of buying noncloned versus cloned products, they would pay an additional \$2.08 per pound for ground beef and \$2.04 per gallon for milk each time they purchased to ban animal cloning. Even if consumers believe there is currently no chance of buying cloned meat or milk, the implied WTP from the private choices is zero, which still remains higher than what is implied from the public voting choices.

Table 2. Comparison of WTP for a Ban on Ground Beef and Milk from Clones from Private and Public Choices

	Ground Beef			Milk		
	Private Choices		Public Vote	Private Choices		Public Vote
Variable	Preference Space	WTP Space	Policy Ban	Preference Space	WTP Space	Policy Ban
Price	−0.65**	−0.65**		−0.42**	−0.42**	
	(0.01)	(0.01)		(0.01)	(0.01)	
Leanness	0.03**	0.05**				
	(0.002)	(0.004)				
Saturated fat content	−0.10**	−0.15**				
	(0.004)	(0.01)				
Whole vs. skim				−0.20**	−0.48**	
				(0.03)	(0.06)	
1% vs. skim				−0.14**	−0.32**	
				(0.03)	(0.06)	
2% vs. skim				0.28**	0.70**	
				(0.03)	(0.06)	
rBST Free				0.63**	1.49**	
				(0.02)	(0.05)	
Noncloned vs. cloned	2.23**	3.46**		1.43**	3.40**	
	(0.01)	(0.07)		(0.02)	(0.07)	
Cloned offspring	0.32**	0.50**		−0.14**	−0.34**	
vs. cloned	(0.03)	(0.05)		(0.03)	(0.06)	
None vs. cloned	0.51**	0.80**		−1.03**	−2.45**	
	(0.20)	(0.32)		(0.04)	(0.07)	
Intercept			−0.78**			−0.98**
			(0.39)			(0.49)
Scale			5.90**			7.35**
			(1.05)			(1.31)
WTP for ban ($/Choice)		$1.73[a]	−$0.78[b]		$1.701[c]	−$0.98[d]
		(0.03)	(0.39)		(0.033)	(0.49)
LLF	-20080.50	-20080.50	-1185.92	-32820.00	-32820.00	-1185.92
# of Choices	21,900	21,900	1,825	29,200	29,200	1,825
# Respondents	1,825	1,825	1,825	1,825	1,825	1,825

Notes: Public Choices are estimated from multinomial logit model fit to the conjoint-choice data and Public Vote is estimated from interval censored regression model fit to the contingent-valuation choice data. Numbers in parentheses are standard errors. Double asterisks (**) indicate statistical significance at the 5% level or lower.
[a]95% confidence interval for the mean WTP determined by parametric bootstrapping is [1.662, 1.790].
[b]95% confidence interval for the mean WTP is [-1.563, -0.003].
[c]95% confidence interval for the mean WTP determined by parametric bootstrapping is [1.635, 1.765].
[d]95% confidence interval for the mean WTP determined by parametric bootstrapping is [-1.948, -0.004].

Table 2 also reports the results from the interval censored regression fit to the contingent-valuation question in which consumers were directly asked about their WTP to ban meat and milk from clones. The results reveal that consumers are not willing to pay for a ban on cloned products. In fact, the data indicates that ground beef prices would have to fall by $0.78 per pound and milk prices would have to fall by $0.98 per gallon for people to be indifferent to the ban.[4] Our results

[4] It is important to note that the negative WTP amounts are projections and are outside the range of prices in the valuation question (the lowest price was a 5% price increase). Still, we can be relatively confident that consumers are willing to pay no more than 5% higher prices, on average, for a ban, and are most likely willing to pay something less.

indicate a reversal in analysts' projections of consumer desires: people's private choices imply they want one thing whereas their public voting preferences imply they want another.

The question now is why people exhibit differences in preferences when making private versus public choices. Given the direction of the reversal (people were less supportive of the ban in the public voting question than in their private choices), we can rule out two possible explanations mentioned previously. First, consumers apparently do not believe there is an externality or public good that would cause higher support for a ban than private choices would imply. Secondly, consumers are apparently not voting as citizens.[5]

To delve into this issue more deeply, we re-ran the regressions reported in table 2 to investigate how demographics and beliefs affected WTP for a ban on cloned products. For the public-preference contingent-valuation questions, this task is easily accomplished by adding demographic variables linearly into the interval-censored regression. For the private-choice questions, we modified equations (7) and (8) and specified the "noncloned versus cloned" variable as a function of demographic and attitudinal variables. In particular, the coefficients from equations (7) and (8), θ_6 and λ_4, then become: $\theta_6 = (\boldsymbol{X}_i\boldsymbol{\tau})$ and $\lambda_6 = (\boldsymbol{X}_i\boldsymbol{\omega})$, where $\boldsymbol{X}_i$ is a vector of demographic, belief, and attitudinal question variables for individual i and $\boldsymbol{\tau}$ and $\boldsymbol{\omega}$ are the vectors of parameters. The demographic variables included age, gender, income level, education level, region, and whether or not they were the primary shopper for their household's food purchases. Four belief questions, previously described, were included in the regression along with variables indicating how often the respondent purchased meat or milk.

Models incorporating demographics and beliefs are reported in table 3. Results reveal that females are willing to pay \$0.32 more to avoid ground beef from cloned animals compared to males, but males are willing to pay \$0.20 more to avoid milk from cloned animals. Results from the contingent-valuation data reveal that females are willing to pay \$1.18 and \$1.47 more than males for beef and milk, respectively, for a ban on animal cloning than are males.

Consumers who agree that meat from cloned animals is currently sold in grocery stores are willing to pay about \$0.13 less for ground beef and \$0.27 less for milk from cloned animals than those who do not believe the statement. However, agreement with this statement has no significant effect on their willingness to pay for a ban. Agreement with the statements that "the average American is willing to eat meat from cloned animals" and "I trust the U.S. government to properly regulate the use of animal cloning" significantly affects private and public WTP, but the magnitudes of the effects are much higher for the willingness to pay for the ban. A one-unit increase (on a scale of 1 to 5) in agreement with the statements reduces WTP between \$1.63 and \$2.03 for the ban but only \$0.35 and \$0.34 for purchases of meat or milk, respectively, from a noncloned animal. Consumers who believe that animal cloning is morally wrong are willing to pay significantly more for products from noncloned animals and to ban animal cloning. Again, a one-unit change in the morality variable has a much more pronounced effect on WTP for a ban as compared to WTP for products from noncloned animals relative to cloned animals. These estimates suggest that certain demographics and beliefs affect the differences between private and public preferences.

To illustrate the relationship between public WTP for a ban and private WTP to avoid cloned products, figure 3 plots each consumer's predicted WTP resulting from the regression equations in table 3.[6] Based on private shopping choices, a majority of people are willing to pay to avoid cloned products, with only four consumers projected to favor cloned products. The figure clearly shows that the two preferences (public and private) are positively correlated, but the line is shifted downward and is steeper than what would be implied by a forty-five-degree line coming from the origin.

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[5] The voting-as-a-citizen hypothesis suggests people would be more likely to support public policies, such as a product ban, than their private shopping choices would suggest (Blamey, Common, and Quiggin, 1995). Voting as a citizen would tend to cause someone to be more likely to vote in favor of public policies than their private choices would suggest, which is exactly the opposite of what we found.

[6] This graph shows the results for ground beef; the figure for milk is virtually identical.

Table 3. Comparison of the Effects of Individual-Specific Attitudes and Characteristics on WTP for Noncloned versus Cloned Ground Beef and Milk from Private and Public Choices

	Ground Beef		Milk	
	Private Choices	Public Vote	Private Choices	Public Vote
Variable	WTP Space ($)	Policy Ban ($)	WTP Space ($)	Policy Ban ($)
Price	−0.68**		−0.43**	
	(0.01)		(0.01)	
Leanness	0.05**			
	(0.004)			
Saturated fat content	−0.15**			
	(0.01)			
Whole vs. skim			−0.46**	
			(0.06)	
1% vs. skim			−0.30**	
			(0.06)	
2% vs. skim			0.70**	
			(0.06)	
rBST free			−1.50**	
			(0.05)	
Cloned offspring vs. cloned	0.47**		−0.34**	
	(0.05)		(0.06)	
None vs. cloned	0.60**		−2.46 ∗ ∗	
	(0.31)		(0.07)	
Determinants of Preferences for Noncloned vs. Clones				
Intercept (Noncloned vs. cloned)	5.47**	6.33**	5.41**	7.89**
	(0.17)	(1.35)	(0.21)	(1.68)
Age in years	−0.003	0.001	−0.004**	0.0001
	(0.002)	(0.01)	(0.002)	(0.01)
Female vs. male	0.32**	1.18**	−0.20**	1.47**
	(0.05)	(0.41)	(0.07)	(0.52)
Inc1 (<25,000) vs. Inc3 (>100,000)	−0.16	1.45**	−0.24**	1.80**
	(0.09)	(0.67)	(0.11)	(0.83)
Inc2 (25,000 to 100,000) vs. Inc3 (>1000,000)	0.01	1.04**	−0.07	1.29**
	(0.07)	(0.54)	(0.09)	(0.67)
Bachelor or higher vs. less than Bachelor degree	−0.36**	−0.30	−0.58**	−0.38
	(0.05)	(0.39)	(0.07)	(0.49)
Northeast vs. West	0.23**	0.46	0.27**	0.57
	(0.08)	(0.54)	(0.10)	(0.67)
Midwest vs. West	0.04	−0.24	0.28**	−0.29
	(0.07)	(0.50)	(0.09)	(0.63)
South vs. West	0.24**	0.35	0.52**	0.43
	(0.06)	(0.45)	(0.08)	(0.57)
Primary Shopper	−0.17**	−0.14	0.03	−0.17
	(0.06)	(0.40)	(0.07)	(0.50)
Agree "Some of the meat currently sold in grocery stores is from cloned animals or their offspring"	−0.13**	−0.15	−0.27**	−0.19

(continued on next page…)

Table 3. – continued from previous page

	Ground Beef		Milk	
Variable	Private Choices WTP Space ($)	Public Vote Policy Ban ($)	Private Choices WTP Space ($)	Public Vote Policy Ban ($)
	(0.03)	(0.21)	(0.04)	(0.27)
Agree "The average American is willing to eat meat from cloned animals"	−0.35**	−1.63**	−0.34**	−2.03**
	(0.03)	(0.34)	(0.04)	(0.42)
Agree "I trust the U.S. government to properly regulate the use of animal cloning"	−0.34**	−1.59**	−0.12**	−1.99**
	(0.02)	(0.31)	(0.03)	(0.39)
Morals	2.21**	8.31**	2.47**	10.35**
	(0.20)	(1.777)	(0.23)	(2.20)
How often purchase meat	0.01	−0.09**	−0.01	−0.11**
	(0.01)	(0.04)	(0.01)	(0.05)
How often purchase milk	0.02**	0.04	0.01**	0.05
	(0.01)	(0.04)	(0.01)	(0.05)
Scale		5.02		6.26
		(0.85)		(1.05)
# of Choices	21,444	1,787	28,592	1,787
# of Respondents	1,787	1,787	1,787	1,787

Notes: Public Choices are estimated from multinomial logit model fit to the conjoint-choice data with the "noncloned versus cloned" variable a function of demographic and attitudinal variables and Public Vote is estimated from interval censored regression model fit to the contingent-valuation choice data with demographic variables added linearly. Numbers in parentheses are standard errors. Double asterisks (**) indicate statistical significance at the 5% level or lower.

One interesting question that arises is whether there are significant differences between the type of people that reverse projected preferences and those that do not. Based on figure 3, individuals with contradicting preferences are below the horizontal axis and those who do not have contradicting preferences are above the horizontal axis. Recall that the private choices predicted that practically everyone (all but four people) would vote in favor of a ban. However, the public choices indicated that only 40.29% would vote in favor (i.e., their predicted WTP is greater than zero) and 59.71% would vote against (i.e., their predicted WTP is less than zero). Table 4 compares consumers with and without contradicting preferences. A majority of females (63%) were consistent in their preferences and did not have contradicting preferences; by contrast, most men (61%) voted against the cloning ban when their private shopping choices implied they would prefer it. People with contradicting preferences were more likely to agree that the average American is willing to eat meat from cloned animals compared to those who vote for the ban (3.29 versus 2.09, respectively), suggesting people's votes are sensitive to how they believe they will affect others. Individuals with conflicting preferences were also more likely to trust the government to regulate the use of animal cloning (3.24 versus 1.69) and purchased meat and milk more often than those who voted for the ban based on public choices (4.15 versus 3.05 and 3.92 versus 3.65, respectively). People who were consistent in their private and public choices were much more likely to believe morality is a concern with cloning than were those who voted against.

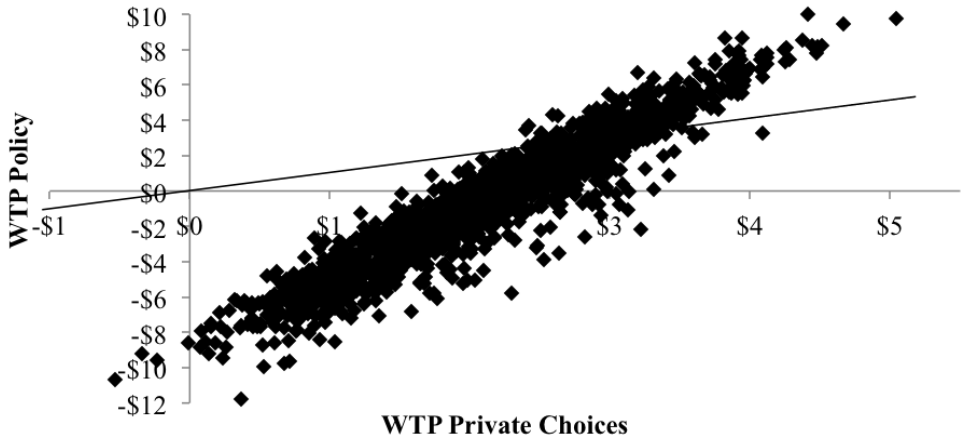

Figure 3. Private versus Public WTP for Ban on Animal Cloning

Table 4. Comparison of Predicted Votes (Based on Private Choices) and Actual Votes to Ban on Ground Beef and Milk from Clones

	Consistent	Inconsistent	P-value
Percent predicted to vote in favor based on public choices	40.3%	59.5%	
Mean age	49.6	49.5	0.886
Female	62.9%	39.0%	< 0.001
Male	37.1%	61.1%	
Income < $25,000	22.4%	15.1%	
Income $25,000 to $100,000	67.4%	65.3%	< 0.001
Income > $100,000	10.3%	19.7%	
Less than bachelor's degree	76.3%	64.2%	< 0.001
Bachelor's degree or higher	23.8%	35.8%	
Northeast region	16.9%	17.7%	
Midwest region	21.8%	23.9%	0.424
South region	39.2%	35.4%	
West region	22.1%	23.1%	
Primary shopper	70.6%	66.3%	0.060
Agree: "Some of the meat currently sold in grocery stores is from cloned animals or their offspring."	2.5	3.0	< 0.001
Agree: "The average American is willing to eat meat from cloned animals"	2.1	3.3	< 0.001
Agree: "I trust the U.S. government to properly regulate the use of animal cloning."	1.7	3.2	< 0.001
Morals	0.1	0.1	< 0.001
How often purchase meat	3.1	4.2	< 0.001
How often purchase milk	3.7	3.9	0.204
N	720	1063	< 0.001

Notes: N = 1,787, but 4 observations are not included, because they opposed both the ban implied from the private choices and from the policy question. Consistent refers to those people who we predicted, based on their private choices, would vote on a ban in the same way that they actually voted on the ban in their public choice. Inconsistent refers to those people who we predicted, based on their private choices, would vote against a ban based but who actually voted in favor of the ban in their public choices. P-value comes from χ^2 test of independence for categorical variables, for continuous variables p-value is from *t*-test.

Conclusions

This study sought to determine whether individuals' private preferences, as expressed through shopping choices, are consistent with their preferences for public policy. Choice experiments regarding which meat or milk option (or none) a consumer would buy when grocery shopping were used to measure private preferences, and a contingent-valuation question focused on a ban on the practice of animal cloning was used to measure public preferences. The current study found contradicting results: while private shopping choices indicate people are willing to pay to avoid cloned meat and milk, when asked directly most people would demand compensation were a ban enacted. Private choices implied that practically everyone would favor a ban, but public choices predict that only 40.29% have a positive WTP for the ban.

The results reveal an inadequacy in the conceptual approach used to translate preferences expressed in private shopping situations into preferences for public policy. In particular, people apparently have beliefs and preferences about the policy itself that need be taken into consideration. Some consumers may want to avoid cloning in their private decisions but not enact a nationwide ban due to the desire to publicly fund research on cloned animals or a reluctance to have the government meddle with private markets. Our results are not supportive of the notion that differences in public and private choices are a result of people "voting like a citizen" in contingent-valuation questions, nor do they support the notion that people believe there to be large externalities associated with cloning technology. The results are more consistent with the hypothesis that people are sensitive to the impacts on other consumers when evaluating the merits of public policy and want to have the option to adjust their beliefs as more information becomes available. In addition, beliefs about the morality of cloning appear to play a significant role in explaining differences in public and private preferences.

[Received February 2012; final revision received July 2012.]

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Appendix A: Information Given to Respondents about Cloning

Animal cloning is a process in which scientists can copy the genetic or inherited traits of an animal. Clones are similar to identical twins only born at different times. Similar to in vitro fertilization, cloned animals begin in a laboratory, but then are born to surrogate mothers in the usual way and grow up just like other animals.

This reproductive breeding technique is appealing to some ranchers and farmers because it enables them to create "identical twins" of their best breeding stock—allowing them to more quickly breed desirable traits into herds. The technique is also appealing to some consumers because it has the potential to lower the price and increase the quality of meat and milk.

This reproductive breeding technique is opposed by some people on moral and ethical grounds. Other people are opposed to animal cloning because, given current technology, only a small percentage of attempts at cloning are successful and many of the clones die during all stages of gestation and birth and the procedures may carry risks for the mother. Although these symptoms are a downside to cloning, they are not necessarily unique to cloning in comparison to other reproductive techniques.

In January 2008, after years of detailed study and analysis, the U.S. Food and Drug Administration (FDA) concluded that, "meat and milk from clones of cattle, swine, and goats, and the offspring of clones from any species traditionally consumed as food, are as safe to eat as food from conventionally bred animals." The FDA's science-based risk assessment, which was peer-reviewed by a group of independent scientific experts in cloning and animal health, concluded:

1. Cloning poses no unique risks to animal health compared to the risks found with other reproduction methods including natural mating.
2. The composition of food products from cattle, swine, and goat clones, or the offspring of any animal clones, is no different from that of conventionally bred animals.
3. Because of the preceding two conclusions, there are no additional risks to people eating food from cattle, swine, and goat clones or the offspring of any animal clones traditionally consumed as food.

A copy of the FDA's report can be found at: http://www.fda.gov/cvm/cloning.htm.