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Consumer Demand for Mandatory Labeling of Beef from Cattle Administered Growth Hormones or Fed Genetically Modified Corn

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ABSTRACT

This study estimates the value of policies that would mandate labeling of beef from cattle produced with growth hormones or fed genetically modified corn. At no cost, 85 percent of respondents desired mandatory labeling of beef produced with growth hormones and 64 percent of respondents preferred mandatory labeling of beef fed genetically modified corn. Estimates suggest that consumers would be willing to pay 17.0 percent and 10.6 percent higher prices for beef on average to obtain information provided via mandatory labeling about whether the beef is from cattle produced with growth hormones or fed genetically modified corn, respectively.

Key Words: *beef, contingent valuation, genetically modified foods, growth hormones, mandatory labeling.*

Unlike most food products sold in a retail setting, beef is primarily sold as a generic commodity with no brand name. Most consumers are currently unable to identify specific attributes they desire when purchasing beef because of generic marketing strategies. Policy makers, who are interested in assuring that the public has enough information to make an informed choice, and beef packers, retailers, and cattle producers, who are interested in capturing additional profit by branding desirable beef attributes, have turned their attention toward branding and labeling beef products. Of interest in this regard is the role of government intervention in the beef labeling process.

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Caswell and Mojduszka suggest that the costs and benefits of labeling depend on food product attributes, which can generally be categorized as search, experience, or credence. An attribute is considered a search attribute if consumers can identify quality prior to purchase, either through inspection or through research. An experience attribute is one in which consumers can determine quality only after the product is purchased and consumed. In contrast, a credence attribute is one in which quality cannot be assessed even after purchase and consumption. Several beef characteristics can be considered credence attributes. For example, many cattle are produced with anabolic growth hormones and are fed genetically modified (GM) corn. However, consumers have no means of determining which beef products possess the attributes of "growth hormones" or "GM corn" before purchase or even after consumption.

Several conditions arise when a good, such as beef, possesses credence attributes (Darby and Karni). First, consumers never acquire information about the product's quality, even after repeat purchases. This lack of information produces market inefficiencies. Akerlof showed how the presence of an information asymmetry could cause the market to fail by causing low-quality goods to drive high-quality goods out of the market. High-quality goods cannot capture a premium because consumers have incomplete information about the product. Thus low-quality goods prevail in the market. Second, private firms are unable to signal quality through branding because consumers assume the firms will misrepresent the true quality of the product because there is no verification. Consumers will only trust quality signals that can be verified by public certification and governmental involvement.

Two issues motivate this study. First, consumers currently have little information about quality attributes when purchasing beef. This lack of information, or information asymmetry, causes markets to function inefficiently (Antle). Second, consumers are not able to independently judge the quality of several beef attributes before purchase or after consumption. That is, they are credence attributes. As a product attribute moves along the continuum from being a search to experience to credence attribute, labeling can be increasingly beneficial (Caswell and Mojduszka). Because several beef characteristics are credence attributes, labeling can play an important role in increasing efficiency in consumer choice in the beef market.

In this study we evaluate consumer demand for two mandatory labeling programs: a) labeling of beef from cattle administered growth hormones and b) labeling of beef from cattle fed genetically modified corn.[1] The value of increased information provided via mandatory labels is assessed by determining demand for the mandatory labeling programs at varied cost increases. Rather than evaluating the effects of the mandatory labeling program *ex post* with actual market-level data, as described by Caswell and Mojduszka and empirically tested by Teisl, Bockstael, and Levy, we *ex ante* evaluate two potential mandatory labeling programs using contingent valuation (CV) survey methods. To date, little quantitative research has been directed at examining consumer demand for labeling of beef with these particular attributes. Results of this study should be useful to policy makers considering the effects of mandatory labeling policies, beef industry participants interested in revitalizing beef demand, and cattle producers planning for future changes in production practices.

The paper proceeds with a review of current beef labeling policies and previous research estimating the value of food product labeling. We then discuss two alternative mandatory beef-labeling programs. A conceptual model for estimating consumer demand for mandatory labeling is then presented. The next section includes a description of the contingent valuation method employed to estimate consumer demand followed by a discussion of survey results. We conclude the paper with a discussion of our findings.

Current Beef Labeling Policies

The USDA has recently made several voluntary labeling programs available to the beef industry. The USDA Agricultural Marketing Service (AMS) administers a certified beef program. Under this program, beef can be given a specific "certified" label if certain breed or quality characteristics are met. Thirty-five such programs are registered with the AMS. The most notable of these certification programs is Certified Angus Beef (CAB). In general, these certified programs are aimed at pro-

[1] We estimate demand for a mandatory labeling program because of the credence nature of the beef attributes of interest. Caswell listed four alternative labeling policies including no labeling allowed, mandatory labeling of all products, voluntary labeling of all products, and voluntary labeling with a government disclaimer about the safety. Consumers mistrust private (or voluntary) attempts to signal quality of credence goods because of the lack of verification. As such, we are interested in determining consumer demand for mandatory labeling.

viding consumers with information about experience attributes. For example, consumers may not be able to tell whether CAB tastes differently than non-CAB before purchase; however, the CAB label provides information about product quality that can only be ascertained after consumption. In theory, this information reduces search costs for consumers and increases market efficiency.

In addition to these programs, the USDA FSIS has instituted provisions to allow beef to be labeled as certified, organic, natural, or no hormones administered if certain requirements are met. These labels are primarily aimed at providing consumers with information about credence attributes. At this point, however, all such programs are voluntary. Although a few firms, such as Coleman's Natural and Laura's Lean, have employed these labels, their products only make up a very small percentage of beef that appears in the market and these products generally only appear in retailers located in affluent neighborhoods. Further, it is uncommon to see these beef products sold in the same meat case with non-branded beef, making it difficult to determine if consumer choice is driven by the meat label or dominated by choice of the particular retailer. Because sales of these products are limited and market data is held by private firms, little is currently known about the impact of these labeling programs.

In addition to these pre-existing programs, other labeling policies have recently been the subject of debate. One labeling regulation, recently the topic of legislative activity, would require labeling of imported fresh beef (Food Safety Inspection Service (FSIS)). Proponents of the mandatory "country-of-origin" labeling claim that the program would allow consumers to make more informed choices when purchasing beef. Because consumers would be able to identify certain levels of quality or consistency with a particular country-of-origin label, consumer demand should be improved (National Cattelman's Beef Association). Another program, also introduced as legislation in the U.S. House of Representatives, would require mandatory nutritional labeling of fresh meat. If passed, nutritional labels similar to those currently on other food products would be required on all fresh beef.

Several studies have examined the value of nutritional labeling programs and mixed results were found. Teisl, Bockstael, and Levy, using scanner data from grocery stores, found that the value of information provided by brand-specific nutritional labels was generally positive and varied by commodity. For example, the value of nutritional information was about $0.50/month/household for milk, about $0.30/month/household for peanut butter, and about $0.09/month/household for mayonnaise. In contrast, Mojduszda and Caswell found that private nutritional labeling was generally ineffective at providing consumers with sufficient information about product quality. They concluded that mandatory nutritional labeling was necessary to appropriately signal quality. Using a different approach, Mojduszda, Caswell, and Harris found that consumer preferences and purchasing patterns did not change significantly after mandatory nutritional labeling was adopted. However, consumers do not necessarily have to increase consumption of healthier foods for a positive value of information to exist (Teisl, Bockstael, and Levy).

The impacts of a few beef labeling practices have also been examined. Bureau, Marette, and Schiavina illustrated that the welfare impacts of European beef trade liberalization depend on the feasibility of low-cost labeling and the differences in perceived quality across countries. Whether the European Union's (EU) total welfare would increase should it remove its ban on US hormone treated beef strongly depends on whether imported US beef is labeled and the cost of the labeling. If the labeling were costless, Bureau, Marette, and Schiavina show that the EU could increase total welfare by importing and labeling US beef; however, when labeling costs are positive, the welfare effects of trade liberalization depend on consumers' perceptions of the difference in quality between hormone treated and non-hormone treated beef and are generally ambiguous. Loureiro and McCluskey examined consumer demand for geographically labeled meat in Spain in a hedonic framework. They found

that the geographic label generated a positive price premium for certain levels of meat quality. Latvala and Kola found that 60 percent of Finish consumers were willing to pay a premium for beef labeled as "Finnish Beef." However, the remaining 40 percent of consumers were not willing to pay a premium for the labeled beef primarily because they were satisfied with current labeling practices.

Alternative Beef Mandatory Labeling Programs

Although the USDA allows provisions for voluntary labeling of beef from cattle administered growth hormones, there is no requirement that beef be labeled as such. Some estimates indicate that as much as 95 percent of all cattle in the US are implanted with growth hormones (Kuchler *et al.*). Kenney and Fallert (pg. 23) indicate, "Scientists at the World Health Organization and FDA have concluded that residues from hormones, when properly administered in both dose and method, pose no threat to human health—residues are minuscule compared with the levels of steroid hormones produced naturally in humans." However, not all consumers agree with such statements. For example, a study conducted by the Food Marketing Institute found that, when specifically asked, 50 percent of consumers said hormones were a serious hazard. If consumers are aware that much of the beef on the market came from cattle administered growth hormones and no label is present, consumer purchases of beef may be dampened because they may be uncertain of the attributes of the beef they desire to consume. This lack of information could create market inefficiencies. Even if consumers are currently unaware that most cattle are administered growth hormones, the beef industry must be prepared for increased consumer education. If the beef consumer remains uninformed in the long run, a major backlash may be in store when the public becomes aware of such production practices. For example, the European Union banned the use of growth hormones in livestock production and prohibits imports of beef produced with growth hormones because of perceived consumer concerns regarding hormone use.

A related issue surrounding consumer concern for animal production practices is the use of genetically modified grains as livestock feed. Given the recent press about biotechnology, it is evident that some consumer groups are unwilling to purchase genetically modified foods, despite the fact that no scientific evidence has shown that genetically modified foods are harmful to humans. In Europe, retail products containing GM ingredients must be labeled. This is not currently the case in the U.S., but if consumer trends follow those in Europe, mandatory labeling of GM products may become a reality for U.S. producers. Some research has argued that mandatory labeling of GM foods is needed in the U.S. because of the uncertainty of science and the nature of consumer concerns (Hadfield and Thomson). If consumers are not provided with information identifying whether beef is from cattle GM corn, inefficient purchasing decisions may be made.

A mandatory labeling program for beef produced with growth hormones or fed GM corn has the potential to accomplish three goals: 1) reduce consumer uncertainty regarding the perceived safety attributes of beef, 2) reduce search costs for consumers, and 3) provide more information, via market prices, to cattle producers concerning consumer demand for particular cattle production practices. Given current labeling practices, consumers must make some assumption about the average quality of the beef on the market, as they currently have no other means to infer product quality. This situation produces market inefficacies of the type described by Akerloff or Antle.[2]

Before mandatory labeling of hormone-

[2] An argument could be made that these animal production practices are safe and that introducing mandatory product labels might deceive consumers and may impede technological adoption (Caswell). Whether consumer concerns for issues such as genetically modified foods are rational and efficient is an issue beyond the scope of this study (see Stumo; Smith; Schweikhardt and Batie; and Tweeten for a discussion of this issue).

treated or GM fed beef is seriously considered, several issues require attention. First, there are costs associated with preserving the identity of "hormone-free" or "GM-free" beef from farm to retail levels. Further costs are associated with reduced production efficiencies when producers do not rely of the aid of growth hormones or GM corn in cattle production. There are also costs associated with monitoring a mandatory labeling program. The cost of maintaining a high-quality monitoring entity to ensure labels are truthfully administered could be quite high. Second, consumer demand for these labeling programs must be assessed. If consumers are indifferent about labeling beef produced with growth hormones or GM corn and such a plan is instituted, a sub-optimal situation may arise. However, if consumer demand for the labeling program is increased by an amount larger than the labeling, segregating, and production costs, then mandatory labeling programs may be a beneficial way to increase beef industry welfare. Caswell and Padberg suggested evaluating food labeling policies in this cost/benefit framework.

Conceptual Model

To examine the impacts of mandatory labeling of beef from cattle administered growth hormones or fed GM corn, consider an individual's utility function shown in equation 1

$$(1) \qquad u = u(\mathbf{x}, \textit{label}; \mathbf{s})$$

where $\mathbf{x}$ is a vector of consumption goods including beef, *label* indicates the presence of a mandatory label ($\textit{label}_1$ if labeled, $\textit{label}_0$ otherwise) which is fixed exogenously, and $\mathbf{s}$ is a vector of demographic characteristics. In equation 1, it is assumed that the consumer derives utility from the presence or absence of a mandatory label. The consumer maximizes utility subject to a budget constraint: $\mathbf{px} = y$, where $\mathbf{p}$ is a conformable vector of prices and y is income. This maximization problem yields the familiar indirect utility function given by $v(\mathbf{p}, \textit{label}, y; \mathbf{s})$. Of interest here is the value of the mandatory labeling program. Teisl, Bockstael, and Levy and Teisl and Roe discussed a "cost of ignorance" measure to estimate the value of a labeling policy. However, an important distinction must be made between these analyses and the one presented here. Specifically, Teisl, Bockstael, and Levy and Teisl and Roe discuss situations where the value of information had to be separated from the value of a quality change. For example, Teisl, Bockstael, and Levy used secondary data to examine the value of a nutritional label on products in which a change in quality had occurred. In this case, the value of information could not be directly assessed. Here we circumvent this problem by directly eliciting the value of the labeling program. That is, we ask consumers their willingness to pay for a mandatory label, not for "hormone free" or "GM free" beef.[3]

Given current conditions, consumers have no information about hormone or GM feed use. In other words, consumers currently derive the following utility from beef consumption, $v_0 = v(\mathbf{p}, \textit{label}_0, y; \mathbf{s})$. Now suppose a mandatory labeling policy is instituted such that $v_1 = v(\mathbf{p}, \textit{label}_1, y; \mathbf{s})$. Following Hanemann (1991), the compensating variation or maximum willingness to pay (WTP) for this change in labeling policy is

$$(2) \qquad v(\mathbf{p}, \textit{label}_1, y - \text{WTP}; \mathbf{s}) = v(\mathbf{p}, \textit{label}_0, y; \mathbf{s}).$$

The value of the labeling program is equivalently stated in equation 3, which is the dual problem to equation 2.

$$(3) \qquad \text{WTP} = m(\mathbf{p}, \textit{label}_0, v_0; \mathbf{s}) - m(\mathbf{p}, \textit{label}_1, v_0; \mathbf{s})$$

Where m is the expenditure function. If $v_1 >$

[3] In this framework it is important to realize that utility is derived from the presence or absence of a label, not necessarily from the attributes of "hormone use" or "GM feed use." We are not estimating the demand for "hormone-free" or "GM free" beef, rather we are interested in the value of a *label* on these products. Consumer willingness-to-pay for "hormone-free" or "GM free" beef is an issue left unanswered by this research. See Lusk, Roosen, and Fox for estimates of the value "hormone-free" or "GM free" beef when perfect information about product quality is known.

v_0 WTP will be positive. That is, consumers who derive positive utility from the label will be willing to pay a premium for the added information. This WTP estimate, or benefit of the labeling policy, can be compared with costs of the program.

Methods and Procedures

To estimate consumer demand for mandatory labeling, a CV mail survey was developed. We used a standard CV approach with design complexity lying between the single-bounded (Hanneman, 1984) and double-bounded dichotomous choice (Hanneman, Loomis, and Kanninen) methods. In the survey, participants were asked, "Would you favor mandatory labeling of beef that has been produced with growth hormones?" As a follow-up question they were asked, "If you responded Yes, would you still prefer the mandatory labeling if it caused a k increase in the price of beef?" The price, k, was varied from 2 percent to 20 percent, and consumers randomly received a survey with one of the following price increases: 2, 5, 10, 15, or 20 percent. Because prices of beef cuts vary considerably, we chose to elicit willingness to pay in terms of percentage rather than absolute dollar amounts. Constructing the questions in this one-and-one-half bound dichotomous framework has been shown to capture most of the efficiency gains in moving from a single-bounded to double-bounded choice format (Cooper, Hanneman, and Signorello). Following this question, consumers were asked to respond to identical questions about beef from an animal fed genetically modified corn. An information sheet was provided to inform consumers about the two production practices.

To analyze the responses to the aforementioned CV questions, we employed a modified version of the interval censored CV model (Cameron, 1988; Cameron and James) that allowed for uncensored values of zero WTP for those respondents who answered No to the initial CV question. Assume that a consumer has a true WTP for the value of the label WTP*. Further assume that

$$(4) \qquad WTP^* = x\beta + \epsilon$$

where x is a vector of socioeconomic explanatory variables, β is a conformable vector of coefficients, and ϵ is an independently and identically distributed normal error with mean zero and variance σ^2. Here, WTP* is a latent variable that it is not actually observed. What is observed from the data is whether a respondent indicated a WTP greater than or less than a particular price, k. In a traditional single-bounded dichotomous framework, respondents are presented with a price increase, k, and are asked if they would pay this amount. The probability of a Yes response is the probability that WTP* > k. Thus if a respondent answers Yes to the CV question, their WTP falls in the range of $[k, \infty]$. Alternatively, a No response to the CV question indicates a WTP in the range of $[-\infty, k]$. The resulting likelihood function is given in Cameron (1988). In the interval-censored model, the mean willingness-to-pay value is simply $E(WTP) = \bar{x}\hat{\beta}$, where $\bar{x}$ is a vector of the sample averages of the independent variables.

By having consumers respond to our initial CV question, WTP estimates can be further refined. Responses to the initial CV question restrict the relevant range of WTP to $[0, \infty]$. That is, WTP for respondents who answer Yes to the initial CV question but No to the follow-up question is bounded by $[0, k]$ rather than $[-\infty, k]$. Further, an individual who responded No to the initial CV question has a WTP = 0, i.e., the range has been collapsed to their exact WTP. One can readily see that this approach increases the accuracy of the WTP estimates.

To operationalize our model we define three groups of respondents: Group D_1 who answered No to the initial WTP question—these individuals have an uncensored WTP = 0, Group D_2 who answered Yes to the initial WTP question and No to the follow-up—these individuals have a WTP from $[0, k]$, and Group D_3 who answered Yes to both questions—these individuals have a WTP from $[k, \infty]$. Given these groups of respondents, the following likelihood function is formulated:

$$(5)\quad \text{Log L} = \sum_{D_1} \log\frac{1}{\sigma}\phi\left(\frac{-x\beta}{\sigma}\right) + \sum_{D_2} \log \Phi\left(\frac{k - x\beta}{\sigma}\right) + \sum_{D_3} \log\left(1 - \Phi\left(\frac{k - x\beta}{\sigma}\right)\right)$$

where ϕ and Φ are the standard normal density and distribution functions, respectively. As Cameron (1988) suggests, the coefficient estimates in (5) can loosely be interpreted as the marginal effect of x_i on WTP. Patterson and Duffield note that the interval-censored formulation is simply a reparameterization of the typical logit or probit models discussed in Hanemann (1984). The advantage to this approach is the ease in which mean WTP estimates and confidence intervals can be calculated. Cameron (1991) showed that the confidence interval for E(WTP) at significance level α is

$$(6)\quad CI_{1-\alpha}[E(WTP)] = \bar{x}\hat{\beta} \pm t_{\alpha/2}\sqrt{\bar{x} \sum \bar{x}'}$$

where Σ is the variance-covariance matrix of the parameter estimates.

Results

Before administration of the full survey, a preliminary mailing was conducted to pretest the initial survey. Slight modifications were made based on these responses and 2500 surveys were mailed in February 2000 to consumers in the 48 continental United States. Two hundred sixty six surveys were returned due to undeliverable addresses and 648 usable surveys were completed and returned resulting in a 29-percent usable response rate.[4] Summary statistics of the survey respondents are presented in Table 1. A little over half the respondents were female. The average respondent was 52 years of age with 15 years of education and a household income between $50,000 and $59,999 per year. Table 2 compares summary statistics of our survey sample with the U.S. population. The sample of consumers that responded to our survey had slightly higher incomes and education as compared to the national statistics. However, our sample of respondents had roughly the same age, household size, and number of women as does the U.S. population. Any differences that exist between our sample and the U.S. population should be taken into consideration if generalizations are to be made about policy changes. In the following analysis our model estimates control for socioeconomic factors that could readily be manipulated to adjust for difference between our sample and the U.S. population.

As indicated in Table 1, 85 percent of respondents indicated a preference for mandatory labeling of beef administered growth hormones. However, only 68 percent desired labeling after a price increase. Demand for labeling of beef from cattle fed GM corn was lower than that for growth hormones. Only 64 percent of respondents preferred labeling of beef from cattle fed GM corn at no price increase. This number reduced to 52 percent when a cost was associated with the mandatory labeling program.

Figure 1 shows the percentage of respondents who preferred mandatory labeling at six price levels. As expected, more consumers preferred the mandatory labeling programs at no cost as opposed to a price increase. Further, demand for labeling generally declined as the price of the labeling increased. At every cost, demand for labeling of beef produced with growth hormones was higher than demand for labeling of beef from cattle fed GM corn.

To quantify the influence of consumer demographics on demand for labeling, equation 5 was estimated for each labeling program using survival model procedures in SAS. Table 3 reports two models for each labeling program, Model 1 that includes all socioeconomic factors and Model 2 that only includes a constant term (which, by construction of the like-

[4] The mailing list was purchased from a reputable private company that randomly drew addresses from telephone white pages. One dollar was included in the surveys to encourage participation. Sending follow-up notices to nonrespondents would likely have increased the response rate; however, monetary and logistical constraints prevented such a procedure.

Table 1. Summary Statistics of Survey Respondents

Variable	Definition	Mean[a]	Std. Dev.
Gender	1 if female; 0 if male	0.534	0.499
Age	age of respondent in years	51.491	15.149
Education	years of education 8 = less than 12th grade; 12 = high school diploma; 14 = some college; 14 = technical school; 15 = associate's degree; 17 = bachelor's degree; 20 = master's degree; 23 = juris doctorate; 24 = doctorate	15.189	3.246
Income	household income level 1 = less than $10,000; 2 = $10,000 to 19,999 . . . 19 = $180,000 to $189,999; 20 = more than $190,000	6.410	3.726
Child	1 = children in the household; 0 = otherwise	0.231	0.422
Beef	number of times per month respondent consumes beef	9.392	6.291
Hormone concern	1 = not at all concerned; 5 = very concerned	4.074	1.152
GM concern	1 = not at all concerned; 5 = very concerned	3.890	1.270
Hormone Label	1 = desire labeling of beef produced with hormones; 0 otherwise	0.850	0.357
Hormone Paylabel	1 = desire labeling of beef produced with hormones if it the labeling caused an k price increase in the price of beef[b]; 0 otherwise	0.687	0.464
GM Label	1 = desire labeling of beef from cattle fed genetically modified corn; 0 otherwise	0.642	0.480
GM Paylabel	1 = desire labeling of beef from cattle fed genetically modified corn if it the labeling caused an k price increase in the price of beef[b]; 0 otherwise	0.518	0.500

[a] Number of respondents = 648.
[b] Participants randomly received a survey where k = 2 percent, 5 percent, 10 percent, 15 percent, or 20 percent.

lihood function, is the expected WTP). Estimates suggest that consumers with higher income are willing to pay a greater amount for mandatory labeling of beef produced with growth hormones than are lower-income consumers. Further, consumers that express a greater concern for the safety of hormone use (on a scale of 1 to 5) are willing to pay more for mandatory labeling than are consumers with lesser concern. Although many of the demographic variables are statistically insignificant, the WTP estimates are statistically different from zero. The expected WTP value for mandatory hormone labeling is about 17 percent, which implies that the "average" consumer is willing to pay 17-percent higher prices for beef to acquire information about hormone production practices. The point esti-

Table 2. Comparison of Survey Sample to U.S. Population

Statistic	Survey Sample	US Population[a]
Median Household Income	$40,000 to $49,999	$38,885
Percent with College Degree	37%	22%
Average Age	51	46
Number of People in Household	2.63	2.63
Percentage of Women	53	51

[a] U.S. Census Bureau, 1998 statistics.

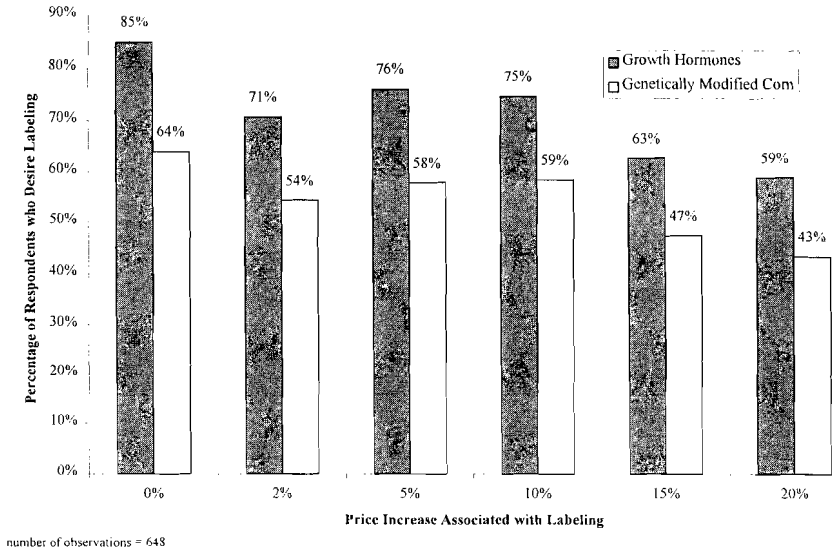

Figure 1. Consumer preference for mandatory labeling of beef from cattle fed genetically modified corn and produced with growth hormones at various price increases

mate is robust to inclusion or exclusion of the demographic variables as indicated by the Model 2 WTP estimate. Ninety-five percent confidence intervals, calculated using equation 6, imply that WTP may range from 19.2 percent to 14.8 percent.

Consumer demand for mandatory labeling of beef from cattle fed GM corn is less than that for hormone use. Estimates indicate that older and higher-educated consumers have higher WTP for mandatory GM labeling than younger and less-educated consumers. Further, those consumers with greater concern about the safety of GM feed use express a greater WTP than those with lesser concern. WTP point estimates from both Models 1 and 2 imply that consumers are willing to pay a 10.6-percent higher price for beef such that information is provided about animal feeding practices. Confidence intervals indicate that the WTP estimates are statistically different from zero and range from 12.8 percent to 8.5 percent for the full model.

Summary and Conclusions

Several beef labeling programs are currently being employed as a way to differentiate a market that has historically been dominated by sales of generic commodity products. Because several beef characteristics can be considered credence attributes, a role for government involvement in the labeling process exists. However, before federal action is taken the benefits of any particular labeling policy must be weighted against the costs. Critical in this assessment is the value of a labeling policy. This study provides direct estimates of the value of two potential mandatory labeling programs by utilizing responses to a contingent valuation mail survey. Specifically, we estimated the demand for two mandatory labeling strategies: labeling of beef from cattle a) produced with growth hormones and b) fed genetically modified (GM) corn.

In a survey of U.S. consumers we found that more respondents prefer labeling of beef produced with growth hormones than labeling of beef from cattle fed GM corn (85 percent versus 64 percent). Demand for both mandatory labeling programs was sensitive to increases in the price of beef associated with labeling, segregation, and monitoring costs. Because of the price sensitivity of the demand for labeling, it is important to consider costs of the mandatory labeling programs. Estimation results indicate that consumers will prefer mandatory labeling of beef produced with

Table 3. Interval Censored Estimates of Consumer Demand for Mandatory Labeling of Beef from Animals Administered Growth Hormones and Fed Genetically Modified Corn

	Hormone Labeling		GM Labeling	
Variable	Model 1	Model 2	Model 1	Model 2
Constant	−9.545***	17.043***	−14.218***	10.609***
	(4.463)[a]	(0.800)	(3.503)	(0.533)
Gender	0.920	—	0.234	—
	(1.145)		(0.873)	
Age	−0.002	—	0.047*	—
	(0.040)		(0.032)	
Income	0.258*	—	0.055	—
	(0.634)		(0.126)	
Child	0.124	—	−0.168	—
	(1.460)		(1.105)	
Education	0.178	—	0.371***	—
	(0.189)		(0.151)	
Beef	0.093	—	0.056	—
	(0.090)		(0.068)	
Hormone Concern	5.143***	—	—	—
	(0.492)			
GM Concern	—	—	4.077***	—
			(0.351)	
Sigma	10.650***	12.373***	9.244***	10.664***
	(0.579)	(0.678)	(0.407)	(0.472)
WTP Point Estimate[b]	17.02%[c]	17.04%	10.64%[c]	10.61%
95% Confidence Interval	[19.23, 14.81][c]	[18.61, 15.48]	[12.80, 8.46][c]	[11.65, 9.57]

Log likelihood = −707, −770, −1,145, and −1,220 for hormone models 1 and 2 and GM models 1 and 2, respectively. *, **, and *** represent 15 percent, 10 percent, and 5 percent levels of statistical significance, respectively. Number of observations = 648.

[a] Numbers in parentheses are standard errors.

[b] WTP is the percentage increase in the price of beef respondents are willing to pay for a mandatory label.

[c] Calculated at the mean values of the independent variables.

growth hormones only if labeling costs cause beef prices to rise no more than 17 percent. Further, consumers will prefer mandatory labeling of beef from cattle fed GM corn if labeling costs increase beef prices no more than 10.6 percent.

Results of the analysis indicate that significant demand exists for a mandatory labeling program for beef administered growth hormones. However, several issues require attention before such a program is strongly considered. First, the costs of cattle segregation, lost production efficiencies, packaging, and program monitoring must be estimated to compare with the estimate value of the labeling program. If estimated costs increases are greater than 17 percent, our results indicate that beef consumption will suffer. Second, the estimated benefits of the labeling program should be studied in a non-hypothetical setting. Research has shown that consumers respond differently when answering hypothetical survey questions that when making actual non-hypothetical comments (Fox et al). Further, the short-run impacts of such a program need to be assessed. Because the vast majority of beef is currently produced with added growth hormones, and it is likely that consumers are unaware of this fact, short-run demand may fall until price signals from consumers at the retail level can be relayed to cattle producers. Finally, an interesting extension to this study would be to compare consumer demand for alternative labeling policies with varying degrees of government involvement. Theoretically, consumers are assumed to distrust pri-

vate attempts to signal quality of credence attributes. However, many food manufacturers regularly advertise quality credence attributes through private labels, which indicates that this assumption may be able to be relaxed in some circumstances.

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