2005

Consumer Perceptions of Labels and the Willingness to Pay for "Second Generation" Genetically Modified Products

Matthew C. Rousu
Susquehanna University

Daniel C. Monchuk
Iowa State University

Jason F. Shogren
University of Wyoming

Katherine M. Kosa
RTI International

Recommended Citation

Rousu, M. C., Monchuk, D., Shogren, J. F., Kosa, K. (2005). Perceptions of Labels and the Willingness to Pay for Second-Generation Genetically Modified Products. Journal of Agricultural and Applied Economics, 37, 647-657.

Consumer Perceptions of Labels and the Willingness to Pay for "Second Generation" Genetically Modified Products

Matthew Rousu
Research Economist, RTI International

Daniel C. Monchuk
Graduate Student, Department of Economics
Iowa State University

Jason F. Shogren
Stroock Distinguished Professor of Natural Resource
Conservation and Management
Department of Economics and Finance
University of Wyoming

Katherine M. Kosa
Research Analyst, RTI International

15 September 2003

Contact Person:
Matthew Rousu
RTI International*
3040 Cornwallis Road
Research Triangle Park, NC 27709
Phone: (919) 541-3748
Fax: (919) 541-6683
E-mail: mrousu@rti.org

*RTI International is a trade name of Research Triangle Institute.

Consumer Perceptions of Labels and the Willingness to Pay for "Second Generation" Genetically Modified Products

Key Words: auctions, BDM mechanism, cigarettes, field experiment, genetically modified foods, second-generation

Abstract

Environmental and consumer groups have called for mandatory labeling of genetically modified (GM) food products in the United States, stating that consumers have the "right to know." But evidence exists suggesting that consumers often cannot correctly interpret the meaning of scientific labels. Herein we use a nonhypothetical field experiment to examine how well consumers interpret GM labels, focusing on the solitary second-generation GM product currently on the U.S. market—GM cigarettes. Our results suggest that while consumers pay less for GM cigarettes when they are labeled as GM, these labels seem to be misinforming consumers. This evidence implies that consumers could be better off without mandatory GM labeling.

Consumer Perceptions of Labels and the Willingness to Pay for "Second Generation" Genetically Modified Products

INTRODUCTION

Genetic modification remains a controversial issue. Those who oppose genetically modified (GM) food products have successfully publicized potential threats that could result from eating GM foods, such as fears of environmental degradation, consolidated multinational power, and human health threats (e.g., more allergic reactions and uncertain long-term impacts). (See, for example, Greenpeace [2001 a, b, c] and Friends of the Earth.) These concerns have prompted some nations, including the European Union, Australia, and Japan, to require firms to label all GM foods products as such. In contrast, the United States does not require explicit labeling of GM products; rather, labeling in the United States is only required if the product has been modified to alter consumer characteristics. In such cases only the modified attribute needs to be identified.

Only one such altered good currently exists in the United States. A GM cigarette was introduced into the U.S. market in early 2003 and is presently the only product offered in the United States where genetic modification alters a consumer characteristic (i.e., the only second-generation GM product).[1] Genetic modification is used to reduce the level of nicotine, and three versions of these new Quest™ cigarettes are now on the U.S. market (low-nicotine, extra-low nicotine, and nicotine-free).[2] Under current regulations, the U.S. Food and Drug Administration (FDA) required the company to label these new cigarettes—but not as genetically modified, rather just that they are lower in

nicotine. Federal law requires no explanation of the genetic modification, only that the consumption characteristics of the product have changed.[3]

We used experimental auctions to examine adult smokers' willingness to pay for these so-called "second generation" GM products under a 2x2 informational design—(1) with and without a label indicating the cigarettes are GM and (2) with and without supplementary information related to consumer qualities of the GM tobacco. We conducted non-hypothetical field auctions conducted at two grocery stores in the Midwest. To our knowledge, this is the first study to use experimental methods to value the impact of labeling on second generation GM products.

In this paper, we test four hypotheses: (1) overall, bids for GM-labeled cigarettes are identical to bids for non-GM-labeled cigarettes; (2) for less informed consumers, bids for GM-labeled cigarettes are identical to bids for non-GM-labeled cigarettes; (3) for more informed consumers, bids for GM-labeled cigarettes are identical to bids for non-GM-labeled cigarettes; and (4) bids for GM-labeled Quest cigarettes are identical between more informed and less informed participants. We also discuss the merits of labeling versus providing non-labeled information when informing consumers is the goal. In addition, we examine the welfare implications of the FDA's labeling policy of not requiring firms to explicitly label their food products as genetically modified.

Background

Background on GM products

Many countries require GM products to be labeled as such. The countries in the European Union, for instance, require mandatory labeling for all GM products, and the

European Parliament recently voted for a 0.9% threshold, meaning that all products containing more than 0.9% GM material must be labeled as genetically modified. Member countries must first ratify the new rules before they take effect (Cnn.com). Other countries that require mandatory labeling for GM products include Australia, Japan, Korea, Brazil, and Thailand (Shipman; Rousu and Huffman).

In the United States, consumers have shown a preference for non-GM food products. Several studies using experimental auction markets have concluded that, on average, consumers will pay less for GM food products (Lusk et al. 2001a; Rousu et al. 2002; VanWechel et al.). Whereas consumers show a general dislike for GM food products, consumers do not appear to be concerned with the amount of GM content that is present in a product; instead, they seem more concerned with whether GM content is in fact present in the product (Rousu et al. 2004). Studies using surveys and focus groups have found the same general result—U.S. consumers say they will pay less for GM food products (e.g., see Chern et al.; Teisl et al. 2002).

Until recently, the only GM products available on the U.S. market were so called "first-generation" GM products. These products are genetically modified for agronomic purposes. Consumer acceptance of these products has been slow, although some observers have hypothesized that when GM products became available that have direct consumer benefits, i.e., "second-generation" GM products, consumer demand will increase (e.g., see Hoban).

Background on labeling misperceptions

Product labeling is a key tool to help inform consumers. However, only so much information can be put on a relatively small label. Some studies have found that when too much information is added on labels, data overload causes consumers to miss key pieces of information about the product, or they place a disproportionate amount of weight on some of the information (Heroux et al., Jacoby). In making a case for a more comprehensive view of food labels, Caswell and Padberg state: "To avoid overload, consumers choose not to be fully 'informed' on all their purchases" (p. 462).

Another limit to information on labels can also occur, one rarely considered by economists. A technically accurate label can cause consumer misconceptions of the product and decrease consumer welfare. For example, consumers' lack of knowledge about science is evident from an online poll sponsored by the Society for DNA Free Food, which asked respondents to indicate how much they would pay to eliminate DNA from food. While clearly a ridiculous notion, over half of respondents indicated they would pay a 50% premium or more to ensure their food products are DNA-free. Of course, policy makers cannot use this information to set policy since virtually all food products contain DNA.[5] Behavior in such polls suggests that the combination of food products and scientific terms can confuse some consumers. If they do not understand the implications of a food being genetically modified, irradiated, or made from DNA, a short statement indicating the properties of the food product can mislead rather then inform. We explore if a welfare loss arises for our GM product from a short, technical and scientifically accurate label.

Theoretical Model

A perfectly informed consumer maximizes his utility over all products, including new GM cigarettes:

1) $U(cigs, X)$

From the utility function, a demand curve can be derived for cigarettes. Because our experiment is selling one brand of cigarette, we simplify his demand curve to one data point and examine the willingness to pay (WTP) the consumer has for one unit of the product.

2) $WTP^{cigs,\,perfect-\inf} = f(X, Income, \inf^{perfect})$

Most consumers are not perfectly informed, however. For cigarettes, consumers can use the information available on the labels to become informed. Now his WTP for cigarettes differs based on the information he receives on the label and the way he interprets this information. A consumer who receives new GM cigarettes but does not contain a GM label has a WTP for these cigarettes of

3) $WTP^{cigs,no-GM-labels} = f(X, Income, \inf^{no-GM-labels})$.

A consumer bidding on GM cigarettes with a GM-label has a WTP of

4) $WTP^{cigs,GM-labels} = f(X, Income \inf^{GM-labels})$.

To examine which information setting is better, compare the WTP under each partial information setting with the consumers' perfectly informed WTP (i.e., equation 2).

If the (absolute value of the) WTP is farther away from the perfectly informed WTP for one of the two partial-information settings, this suggests the consumer is more misinformed by that label. For example, if

5) $$\left|WTP^{cigs,GM-labels} - WTP^{cigs,perfect-\inf ormed}\right| > \left|WTP^{cigs,no-GM-labels} - WTP^{cigs,perfect-\inf ormed}\right|,$$

then the WTP without a label is closer to the perfectly informed WTP than the WTP with a label. Having no GM label helps consumers act more like they were fully informed than if a GM-label existed. Adding a GM label resulted in a welfare loss for consumers. The opposite case is also possible: labels could help consumers behave as if they were fully informed. We test whether GM labels are welfare improving or not using our experimental auction data. Note since a "perfectly informed consumer" is an unattainable benchmark, our test is with more or less informed participants. We examine how WTP from less informed participants, both participants who bid on products without GM labels and participants who bid on products with GM labels, compares to WTP from participants who were more informed.

Experimental Design

We designed a field experiment employing auctions to examine the effect of GM labeling on products with enhanced consumer attributes. There are tradeoffs when deciding to conduct field experiments instead of laboratory experiments. Field experiments allow the researcher less control over the environment, but allow for a more real-world setting, since many smokers purchase their cigarettes at grocery stores (Lusk et al. 2001b). In addition, we were able to pay a lower participation fee because there was a lower opportunity cost to participants since they were already in the store.

In our experiment, people participated in the experiment either one at a time or in a small group (five or less). Since we often had one participant at a time, we used the Becker-DeGroot-Marschak (BDM) auction, in which each participant's weakly dominant

strategy is to reveal his or her true willingness to pay for different cigarettes.[5] The BDM auction works as follows: (1) each participant places a *bid* on the cigarettes; (2) we randomly select a *market-clearing price* from a uniform distribution on the fixed interval of $0.10 to $6.00, with clearing prices rounded to the nearest dime; and (3) a participant who bids less than the market-clearing price does not "win"; a participant who bids more than the market-clearing price "wins" the auction and purchases the cigarettes at the market-clearing price.

We set up tables at two local grocery stores in Ames, IA (population, 50,000, home to Iowa State University). We created and posted signs inside the grocery store indicating that smokers could earn $10 for 10 to 15 minutes of their time on a research project for Iowa State University.[6] We did not have any trouble recruiting participants.

This experiment had a total of four treatments that differed by the information consumers received, by the presence or absence of a GM label, or both. Figure 1 summarizes the four treatments. Some participants bid on cigarettes that possessed a GM label that said: "This product has been genetically engineered to reduce nicotine." This label was placed to the side of the product. Some consumers were given information on the attributes of the nicotine-free cigarettes before bidding. The four treatments in our 2x2 design were (1) GM label with no information, (2) GM label with additional information, (3) no GM label with no information, and (4) no GM label with additional information.

The information sheet had two bullets of information on the attributes of the Quest brand of cigarettes (see Figure 2). The information synthesized data found on the

manufacturer's website. This treatment is used to test whether a short message on the modified characteristics of these cigarettes would affect consumer demand. Participants were randomly assigned into a treatment group based on what time they participated in the experiment—the experiment monitors switched the treatment at the top of every hour.

Steps in the experiment

Figure 3 summarizes the six key steps in the experiment. In step 1, after a prospective participant indicated interest, we asked him or her to read and sign a consent form and subsequently gave him or her an experimental packet.[7] In step 2, we explained the BDM auction mechanism and answered any questions from participants. In step 3, we conducted a practice round using two candy bars to demonstrate to participants that it was truly in their best interest to bid only their true value for a good in the auction, no more and no less. We also explained that when participants bid on multiple products that only one product would be randomly chosen as binding (valid) to avoid the possibility of participants obtaining multiple products that are similar. When the bidding for the candy bars ended, we determined whether the participant would purchase the candy bar and at what price the candy bar would be purchased.

Following the practice round, we started step 4—the cigarette auctions. Upon commencement of the cigarette auctions, we first had participants indicate the brand of cigarettes they normally smoke (henceforth their "regular brand").[8] This brand of cigarettes was immediately purchased (if their specific brand was not already on hand) and displayed with the three packages of Quest cigarettes (low-nicotine, extra-low nicotine, and nicotine-free) for bidding. We then asked the participant to rank the four

packs from most to least preferred. Once the consumers ranked the cigarettes, we asked them to place their bid for each of the four packs of cigarettes. Before they placed the bids, however, we reiterated that, similar to the candy bar rounds, only one of the four packs of cigarettes would be chosen at random to actually conduct the auction with.

In step 5, the binding (valid) round was determined along with the market-clearing price. In step 6, participants filled out a short post-auction questionnaire and were paid $10 for their participation. The experiment concluded with those who "won" the auction purchasing cigarettes at the selected market-clearing price.

Although we followed standard experimental auction valuation procedures (e.g., Shogren et al. 1994; Fox, Hayes, and Shogren), we made several refinements to our experimental design to better reflect consumer purchases. First, our subjects submitted one bid per product. This backs away from the practice of using multiple rounds of bidding in laboratory experiments, which can cause a "posted-price effect" (e.g., see List and Shogren; Corrigan and Rousu 2003a). Second, we did not endow our subjects with one unit of a product and then ask them to "upgrade" to another item (e.g., Hayes et al.; Lusk et al. 2001b); instead participants bid on different cigarettes in each trial. This avoids the risk of an in-kind endowment effect distorting the participant's bidding behavior (e.g., Lusk and Schroeder; Corrigan and Rousu 2003b). Third, we randomly assigned treatments to the experimental units so estimation of treatment effect is the difference in means across treatments (Wooldridge). Fourth, by using adults in a field experiment, we obtained a more heterogeneous group of auction participants than if we

used college students in a laboratory experiment. Table 1 summarizes the demographic characteristics of the auction participants.

Results

We first discuss the unconditional summary statistics, and then we examine the conditional results based on regression analysis. Table 2 shows the mean bids for the various packs of cigarettes. As would be expected, the highest mean bid, $2.69, is for the participants' regular brand of cigarettes, roughly the average price of a pack of name brand cigarettes in the area. The mean bids for the Quest Low Nicotine, Quest Extra-Low Nicotine, and Quest Nicotine-Free cigarettes are $1.66, $1.59, and $1.45. We created a variable that we call "most preferred Quest cigarettes" because different participants had different preferences for the reduced nicotine-cigarettes (e.g., some participants preferred nicotine-free cigarettes to low-nicotine cigarettes, whereas others had the opposite preference). This variable will allow us to compare the bids for the participants' regular brand of cigarettes to the brand of Quest that participants most preferred. The mean bid for the most preferred brand of Quest cigarettes was $1.84, which was considerably less than the bids for the participants' regular brand.

Table 3 shows the mean bids for the cigarettes under the two different labeling treatments. The bids for the consumers' regular brand of cigarettes are similar, only a 3 cent difference, which is not statistically significant. This is logical because the participants' regular brand of cigarettes is not genetically modified and, thus, should not be affected by the presence of GM labels on the Quest cigarettes. On the other hand, the presence of a GM label on the side of the pack of Quest cigarettes affected consumer

bids. The mean bids for the Quest cigarettes with a GM label are 14% lower, and these differences are statistically significant at the 10% level. Therefore we reject hypothesis 1: bids for GM-labeled cigarettes were less than the non-GM-labeled cigarettes. Some researchers have hypothesized that when GM products became available that had clear consumer benefits instead of just having agronomic benefits that consumer acceptance of GM products would increase (Hoban). Our auction results do not support this view, however, as the percentage discount we find when a GM label is present on these cigarettes, which have clear consumer benefits (lower nicotine), is the same discount Rousu et al. (2002) found using experimental auctions for GM-labeled food products that only had agronomic benefits.

Although Table 3 shows that consumers pay less for cigarettes that possess a GM label, this does not indicate that GM labels increase consumer welfare. Research indicates that if a consumer is misinformed and makes a purchase that they would not otherwise make if they were fully informed, a welfare loss results (e.g., see Foster and Just; Teisl et al. 2001; Rousu et al. 2002; Rousu et al. 2004). If a label that indicates a product is genetically modified informs consumers, consumer welfare will increase; but if a label that indicates a product is genetically modified causes misperceptions or misinforms consumers, then consumer welfare will decrease.

One way to test if GM labels are welfare-improving is to examine the bids from participants who saw the GM label but received no information (i.e., participants who were less informed) correspond to bids from participants who received additional information on these cigarettes (i.e., participants who were more informed).[9] Table 4

shows the mean bids for participants segregated by each of the four treatments. Part A shows the bids from participants who did not receive the Quest information. In these treatments, the bids for the Quest cigarettes when GM labels were present are lower than the bids for Quest cigarettes when GM labels were not present.

Part B of Table 4 shows the bids from participants who were given additional information on Quest cigarettes. The bids for Quest cigarettes are quite similar between those who bid on the GM-labeled Quest cigarettes and the non-GM-labeled Quest cigarettes. There is no statistically significant difference for bids in the more informed treatments and the less informed treatment that bid on Quest cigarettes without a GM label. The bids for the GM-labeled Quest cigarettes from those who did not receive the additional information are smaller than the bids for the Quest cigarettes from all of the other treatments, and these differences are statistically significant.

What is striking about these results is the similarity of the bids from the less informed participants who did not see GM labels to the bids from the participants who were more informed (and it did not matter whether GM labels were presented to those who were more informed). Although there are minor differences, they are not statistically significant at any conventional level. This suggests that if it is not feasible for consumers to receive additional information on the properties of these cigarettes, consumers behave similarly to more informed consumers only when a GM label is not present, and consumers behave quite differently from more informed consumers if a GM label is present.

We now consider the conditional results based on regression analysis. The dependent variable in these regressions is the difference in bid prices for the regular name brand cigarettes and the most preferred Quest cigarettes for each participant. We derive this price difference by subtracting one inverse demand equation for a commodity from the other over the two products. The inverse demand equations for the most preferred Quest and regular brand of cigarettes are as follows:

(1) $$P_j^{Quest} = \beta_1^{Quest} + \beta_2^{Quest} X_{j2} + \mu_j^{Quest}$$

and

(2) $$P_j^{regular} = \beta_1^{regular} + \beta_2^{regular} X_{j2} + \mu_j^{regular} .$$

Differencing equations (1) and (2) we can derive the following equation:

(3) $$P_j^{regular} - P_j^{Quest} = \beta_1^{regular} - \beta_1^{Quest} + \left(\beta_2^{regular} - \beta_2^{Quest}\right) X_{j2} + \mu_j^{regular} - \mu_j^{Quest}$$

The coefficients and error terms can be condensed and rewritten as:

(3a) $$P_j^{regular} - P_j^{Quest} = \beta_1^* + \beta_2^* X_{j2} + \mu_j^* .$$

The difference in bid prices is explained by an intercept term β_1^*, a slope term β_2^* that is multiplied by a vector of exogenous characteristics X_{j2}, and a random error term μ_j^*. Differencing the data before model estimation allows us to remove any linear time-invariant individual-specific unobserved effect, and this method leads to unbiased and consistent estimates of information treatment effects on the demand for GM-labeled-cigarettes (Wooldridge, pp. 299-314).[10]

We ran regressions examining what characteristics influenced bids for the Quest cigarettes. The results of these regressions are presented in Table 4. The intercept is

large, positive, and statistically significant in all specifications, indicating that after controlling for independent variables, participants discount Quest cigarettes relative to their usual brand. In these regressions, dummy variables for the information treatments were included in the regression analysis, with the dummy variable for those who bid on GM-labeled products without receiving the additional information being the excluded variable. The coefficients for the dummy variable for those who bid in the treatment that did not receive Quest information and did not bid on the GM-labeled cigarettes is negative and statistically significant, indicating that participants who were less informed bid less for GM-labeled cigarettes than for plain-labeled cigarettes; therefore, we reject hypothesis 2.

The coefficients for the two treatments that received additional information are negative and close in value. Statistical tests indicate that these variables are not statistically different from each other. This indicates that we cannot reject hypothesis 3: those who receive additional information do not bid less for Quest cigarettes when a GM label is present. Because the coefficient for individuals in the treatment that received additional information and bid on cigarettes with a GM label is negative and statistically significant (and the excluded dummy variable is the treatment that bid on Quest cigarettes without receiving additional information), we can reject hypothesis 4: those who are more informed bid differently than those who are less informed on GM-labeled Quest cigarettes.

These results, along with the results in Table 3, also shed some insight into the importance of labeling relative to the importance of non-label information. For the less

informed, the label had a large impact on bids, but these bids were not similar to those who were more informed. Those who were more informed did not vary their bids for the Quest cigarettes based on the presence of a GM label. This provides evidence that non-label information could be far more powerful at influencing consumer decisions. This has several important implications. First, if a policy maker has a decision between disseminating non-label information and changing labels on products, our results indicate that consumer welfare could be higher if non-label information is disseminated. Second, our results help explain some of the promotion methods used by firms. Non-label information helps prevent a potentially negative label from having an impact on demand for the product. If negative labels were mandated for GM products in the United States, one might expect agribusiness firms to start a large public relations campaign to educate the public on the benefits of GM products.[11]

The coefficient on the dummy variable that equals one if the participant is currently in college is positive and statistically significant, indicating that college students will pay less for low nicotine cigarettes than non-college students. This provides evidence that college students are more likely to engage in smoking for the "high" associated with nicotine than other individuals, or that college students are more brand sensitive. The coefficients for females and for income are not statistically significant, indicating that gender and income do not appreciably affect the difference in demand between Quest cigarettes and a smoker's regular brand.[12]

Conclusion and Discussion

Using data from field experimental auctions on new cigarettes genetically modified to reduce nicotine levels, we show when a GM label exists, consumers discount Quest cigarettes by 14% relative to the no label case. This result confirms a general observation in previous studies: GM labels decrease consumer demand. However, consumers are not necessarily better off simply because the GM label changes consumer demand. A label can misinform consumers, especially if it contains scientific terms like genetically modified or genetically engineered. We examine this issue and observe consumers who, with labels, bid similarly to consumers without GM labels. The bids of more informed consumers differed from less informed consumers who were exposed to GM labels. Since these less informed consumers, who were not exposed to GM labels, bid similarly to informed consumers, our results suggest consumer welfare could be higher without GM labeling.

Our results also point to the relative effectiveness of information on labels versus non-label information. Information on labels usually is quite restricted due to space concerns, such that partial information is disseminated. Our results show that those who were only exposed to the GM label bid differently than those with more information. Bidding behavior for people with non-label information were unaffected by whether a GM label was present on the package or not. Our results support the idea that, when possible, non-label information should be disseminated instead of information presented on labels.

Our results do not reject the hypothesis that the current FDA regulations that do not require explicit GM labeling on products is a useful policy if maximizing consumer

welfare is the FDA's goal. If GM labels were required, our results suggest consumer welfare might decrease at this one location. Consumers in other regions of the United States and the world have varying attitudes towards genetic modification than people from the U.S. Midwest (Lusk, Roosen, and Fox). Future research extending and replicated this experiment seems worthwhile. Additional research that quantifies the consumer losses from being misinformed could also be helpful.

Footnotes

1. Flavor Savor Tomatoes, which were genetically modified to increase shelf-life, were on the U.S. market in the 1990s but are no longer sold. Another product, Golden Rice, is genetically modified to increase the amount of vitamin A, but this product is not yet on the market (Lusk).

2. In the past, most reduced-nicotine cigarettes are bleached to remove nicotine resulting in a noticeable difference in taste. In contrast, these GM cigarettes taste similar to leading brand name cigarettes and do not result in a noticeable impact on the quality of the tobacco.

3. The United States does not require any additional labeling for GM foods that are "substantially equivalent" to the non-GM substitute (U.S. Food and Drug Administration). Labeling is only required when, say an absent allergen materializes or when genetic modification alters the end product. Bt-corn is an example of a "substantially equivalent" GM food product. Bt-corn is genetically modified to resist pests but is virtually identical to the non-GM corn consumers would otherwise purchase. Other examples include Monsanto's line of Roundup Ready soybeans, potatoes, and canola.

4. Vegetable oil and sugar are two exceptions.

5. Other popular demand revealing auction mechanisms, such as the 2nd price auction (Vickrey) and the random nth-price auction (Shogren et al. 2001) need multiple participants, which prevented us from using these mechanisms.

6. For legal and ethical reasons, we limited our sample to adults who were 18 years of age or older. The experiment monitors checked the participant's photo identification when the participant looked younger than 28 years old.

7. All experimental materials can be obtained from the authors upon request.

8. Recall that some participants bid on the Quest cigarettes with GM labels on them. Because the regular brands of cigarettes were not genetically modified, we did not place a GM label on these cigarettes.

9. For the more informed consumers, some saw the Quest cigarettes with the GM label, and others did not.

10. We ran these regressions using OLS. Censored regressions were also run, yielding similar results, which makes sense since no participants bid zero for their regular brand of cigarettes and only 3 of the 112 participants bid zero for any of the Quest cigarettes. These results are available from the authors upon request.

11. In Europe, however, mandatory GM labeling has caused the collapse of the market for GM products anywhere, leading to adverse consequences for consumers worldwide (see Huffman et al.).

12. Other demographic characteristics, such as age, were also tested but none were found to be statistically significant.

References

Becker, Gordon M., Morris H. DeGroot, and Jacob Marschak. "Measuring Utility by a Single Response Sequential Method." *Behavioral Science* 9 (July 1964): 226-236.

Caswell, Julie A., and Daniel I. Padberg. "Toward a More Comprehensive Theory of Food Labels." *American Journal of Agricultural Economics* 74 (May 1992): 460-467.

Chern, Wen S., Kyrre Rickertsen, Nobuhiro Tsuboi, and Tsu-Tan Fu. 2002 "Consumer Acceptance and Willingness to pay for Genetically Modifed Vegetable Oil and Salmon: A Multiple-Country Assessment." *Agbioforum* 5: 105-112.

CNN.com. "EU Passes Tough New GM Rules." <http://www.cnn.com/2003/WORLD/europe/07/02/eu.gm.crops/index.html>. July 2, 2003.

Corrigan, Jay R., and Matthew Rousu. "Posted Prices, Affiliated Values, and the Top-Dog Effect: Evidence from Experimental Auctions." RTI Working paper, 2003a.

Corrigan, Jay R., and Matthew Rousu. "The Endowment Effect in the Absence of Loss Aversion." RTI Working Paper, 2003b.

Foster, William, and Richard E Just. "Measuring Welfare Effects of Product Contamination with Consumer Uncertainty." *Journal of Environmental Economics and Management* 17 (1989): 266-83.

Fox, John A., Dermot J. Hayes, and Jason F. Shogren. "Consumer Preferences for Food Irradiation: How Favorable and Unfavorable Descriptions Affect Preferences for

Irradiated Pork in Experimental Auctions." *Journal of Risk and Uncertainty* 24(2002): 75-95.

Friends of the Earth. "The Need for Labeling Genetically Engineered Foods." Online. Available at <http://www.foe.org/safefood/factshtgelabel.htm>. March 2001.

Greenpeace International. "We Want Natural Food!" <http://www.greenpeace.org/~geneng/>. March 2001a.

Greenpeace International. "7. Public Concern." <http://www.greenpeace.org/%7Egeneng/reports/food/intrfo07.htm>. March 2001b.

Greenpeace International. "11. The Potential for Allergic Reactions." <http://www.greenpeace.org/%7Egeneng/reports/food/intrfo11.htm>. March 2001c.

Hayes, Dermot J., Jason F. Shogren, Seung Youll Shin, and James B. Kliebenstein. "Valuing Food Safety in Experimental Auction Markets." *American Journal of Agricultural Economics* 77 (February 1995): 40-53.

Heroux, Lise, Michel Laroache, and K. Lee McGown. "Consumer Product Label Processing: An Experiment Involving Time Pressure and Distraction." *Journal of Economic Psychology* 9 (1988): 195-214.

Hoban, Thomas J. "Trends in Consumer Attitudes about Agricultural Biotechnology." *Agbioforum* 1 (1998): 3-7.

Huffman, Wallace E., Matthew Rousu, Jason F. Shogren, and Abebayehu Tegene. "Consumers' Resistance to Genetically Modified Foods in High Income Countries: The Role of Information in an Uncertain Environment." Paper

presented at the International Consortium of Agricultural Biotechnology Researchers, Ravello, Italy, June 29-July 2, 2003.

Jacoby, Jacob. "Information Load and Decision Quality: Some Contested Issues." *Journal of Marketing Research* 14 (November 1977): 269-573.

List, John A., and Jason F. Shogren. "Price Information and Bidding Behavior in Repeated Second-price Auctions." *American Journal of Agricultural Economics* 81 (November 1999): 942-949.

Lusk, Jayson L., and Ted C. Schroeder. "An Alternative Test for the Endowment Effect." Starkville, MS: Working Paper Mississippi State University, Department of Agricultural Economics, May 2002.

Lusk, J., M.S. Daniel, D. Mark, and C. Lusk. "Alternative Calibration and Auction Institutions for Predicting Consumer Willingness to Pay of Nongenetically Modified Corn Chips." *Journal of Agricultural and Resource Economics* 26 (July 2001a): 40-57.

Lusk, Jayson L., John A. Fox, Ted C. Schroeder, James Mintert, and Mohammad Koohmaraie. "In Store Valuation of Steak Tenderness." *American Journal of Agricultural Economics* 83 (August 2001b): 539-550.

Lusk, Jayson L., Jutta Roosen, and John A. Fox. "Demand for Beef from Cattle Administered Growth Hormones or Fed Genetically Modified Corn: A Comparison of Consumers in France, Germany, the United Kingdom, and the United States." *American Journal of Agricultural Economics* 85 (February 2003): 16-29.

Lusk, Jayson L. "Effects of Cheap Talk on Consumer Willingness-to-Pay for Golden Rice." *American Journal of Agricultural Economics*, forthcoming, 2003.

Rousu, Matthew, and Wallace E. Huffman. "GM Food Labeling Policies of the U.S. and Its Trading Partners." Ames, IA: Iowa State Department of Economics Staff Paper, Number 344, September 2001.

Rousu, Matthew, Wallace E. Huffman, Jason F. Shogren, and Abebayehu Tegene. "Estimating the Public Value of Conflicting Information: The Case of Genetically Modified Foods." *Land Economics*, forthcoming, 2004.

Rousu, M., W.E. Huffman, J.F. Shogren, and A. Tegene. "The Value of Verifiable Information in a Controversial Market: Evidence from Lab Auctions of Genetically Modified Foods." Staff Working Paper, Iowa State University, Department of Economics Series, Paper #3, 2002.

Shipman, David R. "Marketing of Grains in Today's Evolving Markets." Paper presented at the meeting "Strategies for Coexistence of GMO, Non-GMO, and Organic Crop Production," Minneapolis, MN, November 28, 2001.

Shogren, Jason F., Seung Y. Shin, Dermot J. Hayes, and James B. Kliebenstein. "Resolving Differences in Willingness to Pay and Willingness to Accept." *The American Economic Review* 84 (March 1994): 255-270.

Shogren, Jason F., M., Margolis, C. Koo, and John A List. "A Random *n*th-Price Auction." *Journal of Economic Behavior and Organization* 46 (December 2001): 97-109.

Society for DNA Free Food – Survey Results. <http://www.netspeed.com.au/ttguy/>. Retrieved April 21, 2003.

Teisl, M., L. Halverson, K. O'Brien, B. Roe, N. Ross, and M. Vayda. "Focus Group Reactions to Genetically Modified Food Labels." *Agbioforum* 5 (2002): 6-9.

Teisl, Mario F., Nancy E. Bockstael, and Alan Levy. "Measuring the Welfare Effects of Nutrition Information." *American Journal of Agricultural Economics* 83 (February 2001): 133-49.

U.S. Food and Drug Administration. "Guidance for Industry: Voluntary Labeling Indicating Whether Foods Have or Have Not Been Developed Using Bioengineering." <http://vm.cfsan.fda.gov/~dms/biolabgu.html>. January 2001.

VanWechel, Tamara, Cheryl J. Wachenheim, Eric Schuck, and David K. Lambert. "Consumer Valuation of Genetically Modified Foods and the Effect of Information Bias." North Dakota State University Agribusiness and Applied Economics Report No. 513, 2003.

Vickrey, William. "Counterspeculation, Auctions, and Competitive Sealed Tenders." *Journal of Finance* 16 (March 1961): 8-37.

Wooldridge, J. M. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press, 2002.

Figure 1. The 4 treatments in the experiment

Treatment	Number of Participants	Quest Cigarettes possessed a GM-label	Participants received additional information on Quest cigarettes before bidding
1	29	No	No
2	29	Yes	No
3	30	No	Yes
4	24	Yes	Yes

Figure 2. The information on Quest cigarettes that was disseminated to some participants

---

Quest

Information about
a new brand of cigarettes

- **Quest** is a brand of cigarettes with **low** or **no nicotine**.
- Although Quest cigarettes have less nicotine, **they look, smoke, and burn the same** as conventional cigarettes and offer the same smoking enjoyment.

Figure 3. Steps in the experiment

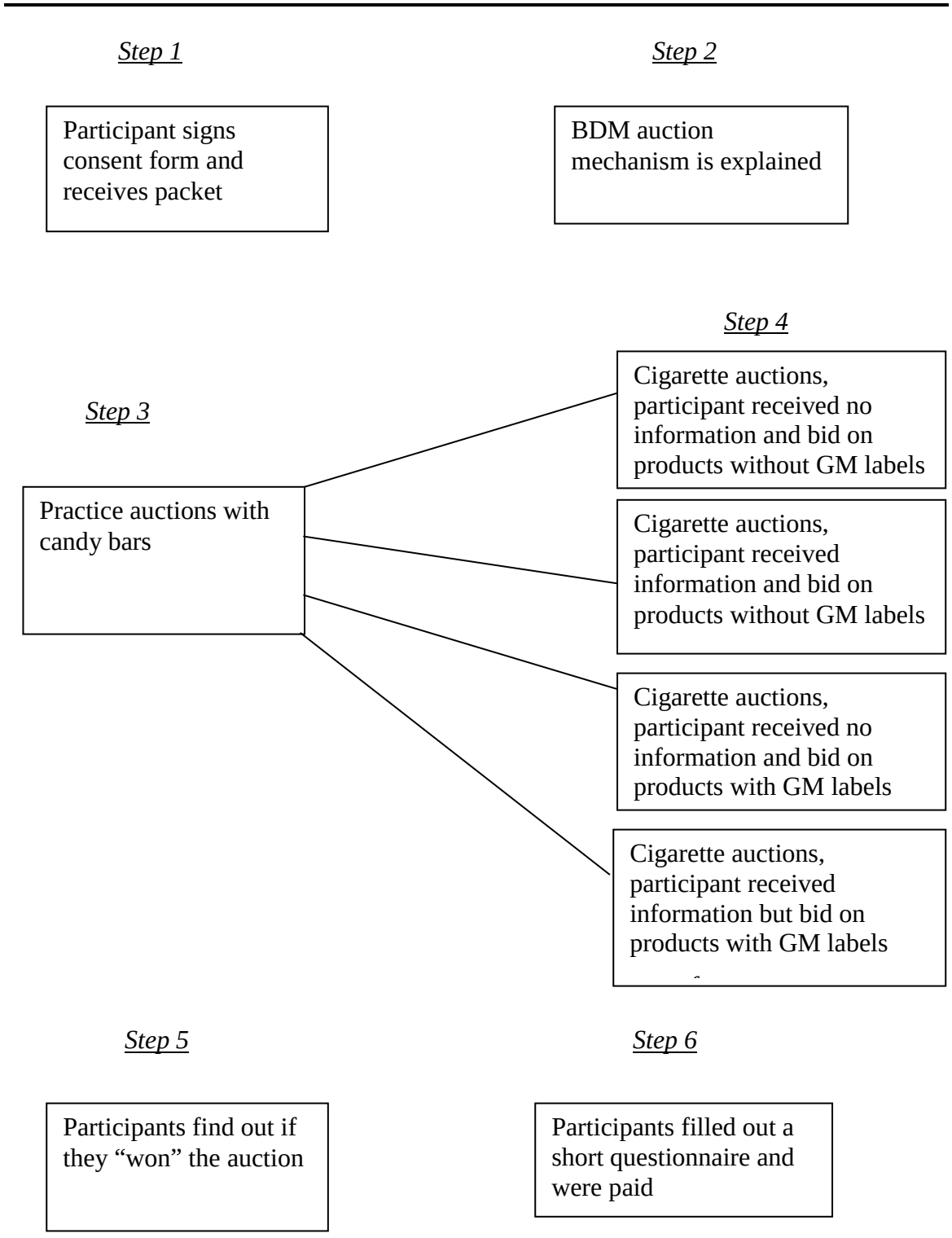

Table 1. Characteristics of the auction participants

Variable	Definition	Mean	St. Dev.
Gender	1 if female	0.38	0.49
Age	The participant's age	28.9	12.1
College-now	The participant is currently enrolled in college	0.43	0.50
Income	The households income level (in thousands)	25.9	26.5
Quit-recent	The participant is either currently trying to quit smoking, or has attempted to quit smoking within the past 6 months	0.38	0.49
Light	1 if the participants usual brand of cigarettes were light cigarettes	0.51	0.50
Marlboro	1 if the participant smoked Marlboro cigarettes	0.72	0.45

Table 2. Mean bids for cigarettes (N = 112)

	Mean	**Median**	**Std. Deviation**	**Minimum**	**Maximum**
Name Brand Cigarettes	2.69	2.75	0.85	0.50	5.00
Quest Low Nicotine	1.66	1.75	0.77	0	4.00
Quest Extra-Low Nicotine	1.59	1.50	0.80	0	4.00
Quest Nicotine-Free	1.45	1.50	1.11	0	6.00
Most Preferred Quest Cigarette	1.84	1.85	1.01	0	6.00

Table 3. How did mean bids differ when GM labels were presented? (Standard deviations in parenthesis)

	Bids from consumers who saw Quest cigarettes that did not have a GM label (N = 59)	Bids from consumers who saw Quest cigarettes that had a GM label (N = 53)
Name Brand Cigarettes	2.68	2.71
	(0.69)	(1.01)
Quest Low Nicotine *	1.77	1.54
	(0.73)	(0.80)
Quest Extra-Low Nicotine	1.65	1.53
	(0.76)	(0.83)
Quest Nicotine-Free	1.52	1.37
	(1.20)	(1.02)
Most Preferred Quest Cigarette *	1.97	1.70
	(1.01)	(1.00)

*Differences in bids are statistically significant at the 10% level between those who bid on GM-labeled and non-GM-labeled versions of these cigarettes.

Table 4. How did bids differ in each of the 4 information treatments

Part A: Bids for those who did not receive additional information on Quest cigarettes

	Bid on cigarettes with GM labels (N = 29)	**Bid on cigarettes without GM labels (N = 29)**
Name Brand Cigarettes	2.57	2.71
	(1.11)	(0.61)
Quest Low Nicotine	1.21 ***	1.83
	(0.84)	(0.80)
Quest Extra-Low Nicotine	1.22 ***	1.66
	(0.85)	(0.74)
Quest Nicotine-Free	0.99 ***	1.58
	(0.86)	(1.07)
Most Preferred Quest Cigarette	1.32 ***	2.01
	(0.90)	(0.93)

Part B: Bids for participants who received the additional information on Quest cigarettes

	Bid on cigarettes with GM labels (N = 24)	**Bid on cigarettes without GM labels (N = 30)**
Name Brand Cigarettes	2.88	2.65
	(0.86)	(0.76)
Quest Low Nicotine	1.94	1.71
	(0.52)	(0.67)
Quest Extra-Low Nicotine	1.89	1.63
	(0.66)	(0.80)
Quest Nicotine-Free	1.84	1.46
	(1.01)	(1.33)
Most Preferred Quest Cigarette	2.17	1.94
	(0.92)	(1.09)

***Difference between these bids and corresponding bids in the other treatments are statistically significant at the 1% level.

Table 5: Regression model explaining the difference between the participants regular brand of cigarettes and their most preferred brand of Quest cigarettes (N = 112)

Regressors	(1)	(2)	(3)	(4)	(5)
Intercept	1.25***	1.45 ***	1.37 ***	1.39 ***	1.36 ***
	(0.20)	(0.18)	(0.21)	(0.24)	(0.22)
GM label and received information	-0.54 *	-0.52 *	-0.56 *	-0.56 *	-0.56 *
	(0.29)	(0.29)	(0.28)	(0.29)	(0.29)
No GM label and received information	-0.54 *	-0.64 **	-0.73 ***	-0.73 ***	-0.73 ***
	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)
No GM label and received no information	-0.55 *	-0.52 *	-0.64 **	-0.64 **	-0.65 **
	(0.28)	(0.27)	(0.28)	(0.28)	(0.28)
Quit-recent		-0.47 **	-0.55 ***	-0.55 ***	-0.55 ***
		(0.21)	(0.21)	(0.21)	(0.21)
College now			0.40 *	0.40 *	0.40 *
			(0.21)	(0.21)	(0.21)
Female				0.05	
				(0.21)	
Income					-0.00
					(0.00)

R-Squared	0.05	0.09	0.12	0.13	0.13

***Coefficient is statistically significant at the 1% level.

**Coefficient is statistically significant at the 5% level.

*Coefficient is statistically significant at the 10% level.