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Valuing Conflicting Public Information About a New Technology: The Case of Irradiated Foods

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Scientists and advocates can disagree on the value of new products or technologies, such as growth hormones, genetically modified organisms, and food irradiation. Both sides of the debate disseminate information to the public hoping to influence public opinion. This study assesses the economic *value* of both pro and anti public information using food irradiation as a case study. The value of information sources is estimated in isolation and in combination. In isolation, the results indicate each set of information has value. In combination, only the anti-irradiation information is found to have net positive value (persuading some consumers to purchase non-irradiated products). Pro-irradiation information worked to decrease the value of anti-irradiation information by 68% per person.

Key words: experimental auctions, irradiation, value of information

Introduction

Throughout history, some people accept and others reject novel technologies (see, e.g., Landes, 1969; Postrel, 1999). Such controversies extend to food product technologies. In the 1900s, pasteurization was received with mixed support (Pirtle, 1926). Today, people disagree about whether food products should be genetically engineered to increase productivity or treated with irradiation to reduce foodborne pathogen risk.[1] Many individuals hold strong pro or con views toward these controversial products and expend resources disseminating public information in an attempt to influence opinion. Although groups commonly present opposing viewpoints to the general public, to date, scarce research exists that assesses the net *value* of this conflicting information based on how consumers switch their preferences. Understanding the value of information is useful because it indicates to policy makers and the interested parties the net effectiveness of their information.

Using experimental auction data from Fox, Hayes, and Shogren (2002), and Hayes, Fox, and Shogren (2002), this paper estimates the value of conflicting information about

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[1] Irradiation is the process of treating products to a dose of radiation to kill harmful bacteria like *Trichinella* and *Salmonella*.

irradiated food products.[2] This paper specifically contributes to the literature by going beyond the basic comparative static on how new information *affects* bidding behavior—we model and estimate the net *value* of information from pro- and anti-irradiation groups when presented in isolation and in combination. Both sides of the debate believe their information has value if it changes consumer behavior. When presented in isolation, the results suggest both pro- and anti-irradiation information have value. When presented in combination, however, only the anti-irradiation information is found to have net positive value.

Background: Estimating the Value of Information

Several experimental valuation studies have examined the *effects* of information on bidding behavior (see Lusk et al., 2005; Fox, Hayes, and Shogren, 2002). For example, Hayes, Fox, and Shogren (2002) examine "how favorable and unfavorable information about food-irradiation technology affects willingness-to-pay to control" foodborne pathogens. Few studies, however, have assessed the *value* of information as revealed by consumer decisions to switch products. Our study seeks to fill this void by using the unique data developed by Hayes, Fox, and Shogren to estimate explicitly the *value* of information (which they did not do in their original work).[3]

Foster and Just (1989) examined how news of insecticide contamination affects milk consumption in Hawaii. They calculated the value of government information as the difference in rational consumers' choices under incomplete and more complete information, which translated into approximately $10 per person per month. Using the same model, Teisl, Bockstael, and Levy (2001) estimated the value of information on nutrition labels and found that households valued the nutritional information, on average, from $0.096 to $0.542 per product each month.

Huffman et al. (2003) and Rousu et al. (2004 and forthcoming) used the Foster and Just (1989) method as a starting point when they valued information on GM foods using experimental auctions. Investigating how preferences of different groups of consumers varied based on whether they received information, the authors reported that information on GM foods was worth several cents per product to auction participants, resulting in a potentially large social value.

Our approach is similar to Rousu et al. (2004), but with three key differences. First, the participants were initially endowed with a non-irradiated pork sandwich and bid to upgrade to an irradiated pork sandwich. This contrasts with previous research which

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[2] Irradiated foods provide an excellent case study of conflicting information. Pro-irradiation groups contend that irradiation reduces the annual cases of foodborne illness without posing any additional risks (Centers for Disease Control and Prevention, 2005; U.S. Food and Drug Administration, 2005). Anti-irradiation groups argue that irradiation has few additional benefits to warrant the serious health risks arising from irradiating food (Pure-food.com, 2005).

[3] One can better appreciate our expanded contribution by comparing the tables in Hayes, Fox, and Shogren (2002) and those presented here. In their table 1, Hayes, Fox, and Shogren examine the "effect of information on relative safety estimates," while the approach used in our table 1 is to examine the "percentage of consumers who would switch purchases, and the value of information." Thus, useful new information is provided here about *switching* behavior, which is the key for estimating the value of information. While many consumers would have different willingness to pay for products after receiving information, not all would change their purchasing decisions in a conventional market setting. This change in purchasing decisions, in combination with the bids and the estimates for the market prices, allows us to estimate a value of information—a factor not addressed in previous studies. In further comparison, table 2 in Hayes, Fox, and Shogren assesses the "effect of new information" using an ordered probit model, whereas our table 2 looks at what characteristics would cause a consumer to *switch* purchases in a conventional market setting. Once again, this distinction matters, because the consumers who switch purchases are those who gain value from the information.

valued information in auctions where participants bid on separate products in separate rounds without any initial endowment.[4] Second, participants place bids to upgrade to the non-irradiated pork sandwich both before and after receiving information. This approach allows us to determine the value of information for each participant who gains value, and provides valuable information unobtainable in previous studies that estimated only the number of participants who gained value because different participants received different information treatments. Third, this study is determining the value of conflicting scientific information from multiple sources. Specifically, each source has opposing views on irradiation, but each views a change in behavior by consumers caused by their information as having value to the consumer, and to the group. Thus, the value of conflicting scientific information must be identified amidst this clash of words.

Data

Data for this study are derived from the experimental auctions reported in Fox, Hayes, and Shogren (2002), and Hayes, Fox, and Shogren (2002), who focused on the effects of conflicting information and not the value of information. Their papers provide the complete description of the experimental design, which we briefly summarize here.

Eighty-seven adult participants were recruited from a random sample of 200 households from Ames, Iowa. These participants placed bids in a Vickrey second-price auction (Vickrey, 1961) to exchange a non-irradiated pork sandwich for an irradiated pork sandwich. This was a repeated trial auction, as each participant bid on the sandwich in 10 different rounds.

All participants received baseline information, distributed before the first round of bidding, describing irradiation and *Trichinella*, a foodborne pathogen. After the first five rounds concluded, participants received additional information on irradiation. The exact wording of the two information sets can be found in Fox, Hayes, and Shogren (2002). Pro-irradiation materials were distributed containing information from the American Council on Science and Health. This information stressed how irradiation could be useful in destroying bacteria; noted that the process has been approved by the U.S. Food and Drug Administration, the American Medical Association, and the World Health Organization; and stated that irradiation can save lives. The anti-irradiation information was provided by Food and Water, Inc., a consumer advocacy group. These materials emphasize how products are *dosed* with radiation, how irradiation might cause cancer or decrease nutrient content, how proper cooking eliminates threats from food in the same manner as irradiation, and state that irradiation is controlled by for-profit enterprises.

Eighteen participants received pro-irradiation information only; 19 participants received anti-irradiation information only; and 50 participants received both the pro- and anti-irradiation information. This experimental design is ideal for estimating the value of public information both in isolation and when opposing viewpoints exist simultaneously.

[4] Experimental auctions that endow participants with products have many differences from non-endowment auctions. For an overview of these issues, see Corrigan and Rousu (2006).

Modeling the Value of Information in a Clash of Words

Consider the method used to value information in an exchange auction. We use an ex post approach where the consumers' behavior is examined after receiving information and it is assumed this is their "informed" behavior. Then this behavior is compared to the consumers' uninformed behavior before receiving information to determine whether they behaved differently. Such information can also have an ex ante value if it causes a bid to be raised or lowered by an individual relative to the non-informed bid, even if there was no observable ex post change in behavior.

Examining the difference in consumer surplus to attain the value of information, while potentially useful when examining the introduction of new goods (e.g., see Lusk et al., 2005), does not provide what we define as a "corrective" value of information in our ex post model—i.e., the person made the wrong ex ante choice of good, and, once informed, now makes the "correct" choice of the other good. This is because we assume the post-information behavior is the "correct" behavior; that is, the new information allows individuals to "correct" their previously uninformed choice. Thus, even if consumers have higher consumer surplus when informed, they do not value the information as a "corrective" instrument because they did not purchase a different product. Similarly, information could alter consumers' demand for a product, but if there is no change in purchasing behavior, the information does not have "corrective" value in this model. However, the question of examining ex ante value is beyond the scope of this paper. This value of information is estimated through the eyes of the group providing the information—as any change in behavior would be perceived as valuable to the consumer.

To determine the value of information, we first estimate whether a participant would purchase the irradiated or the non-irradiated product. For simplicity and to follow the structure of the auction market that was used, it is assumed all consumers purchase either the irradiated sandwich or the non-irradiated sandwich, but not both. Participant j would purchase the irradiated sandwich when:

$$BUY\_IR^j = 1 \text{ if } Bid^j - Prem \geq 0. \tag{1}$$

Alternatively, participant j would purchase the non-irradiated sandwich when:

$$BUY\_NON\_IR^j = 1 \text{ if } Bid^j - Prem < 0. \tag{2}$$

As shown by equations (1) and (2), when participant j's bid to exchange the non-irradiated sandwich for the irradiated sandwich is greater than or equal to the premium (*Prem*) for the irradiated sandwich, the participant purchases the irradiated sandwich. The premium is the additional amount the consumer would have to pay for the irradiated sandwich in a conventional market. In this analysis, the market premium for the irradiated sandwich is estimated to be \$0.30 (a 15% premium above a \$2 market price).[5] When participant j's bid to upgrade to the irradiated sandwich is less than the market premium, the irradiated sandwich is not purchased (instead, participant j purchases the

[5] The authors' anecdotal evidence suggests this premium approximates what can be found in grocery stores. For a sensitivity analysis, we also examined the value of information using both bigger and smaller premiums for the irradiated sandwich.

non-irradiated sandwich). Determining what the consumer would purchase is important, because it signals when a consumer would switch purchases. Consumers only gain value from information if their consumption changes after receiving information.

When would information on irradiated food products cause consumer j to switch purchases? There are two ways information influences a consumer to switch. First, information could cause a consumer who was purchasing the non-irradiated sandwich before receiving information to purchase the irradiated sandwich after receiving information, as shown by equation (3):

$$(3) \qquad SWITCH\_IR^{j=1} \text{ if } BUY\_IR^{j}_{pre\text{-}info} = 0, \text{ and } BUY\_IR^{j}_{post\text{-}info} = 1.$$

Consumers would be most likely to switch to the irradiated sandwich if they receive pro-irradiation information. Consumers who receive both pro- and anti-irradiation information, however, might also switch to the irradiated sandwich.

The second scenario under which consumers could switch purchases is if they had chosen to purchase the irradiated sandwich before receiving information, but then decided to purchase the non-irradiated sandwich after receiving information, as shown by equation (4):

$$(4) \qquad SWITCH\_NON\_IR^{j=1} \text{ if } BUY\_IR^{j}_{pre\text{-}info} = 1, \text{ and } BUY\_IR^{j}_{post\text{-}info} = 0.$$

Consumers would be most likely to switch to the non-irradiated sandwich if they receive anti-irradiation information. Consumers who receive both pro- and anti-irradiation information might also switch to the non-irradiated sandwich. If consumer j switches purchases after receiving information, the information has value to the consumer (through the eyes of the scientific group providing the information). To assess the value to consumers, we must establish the difference in consumer surplus yielded from purchasing one product relative to purchasing the other.

Because we obtain the consumer's bid to exchange the non-irradiated sandwich for the irradiated sandwich, the consumer's demand for both the irradiated and non-irradiated sandwich is unknown. The bid represents the consumer's relative preference for the irradiated sandwich [i.e., by how much does the consumer prefer the irradiated (or non-irradiated) sandwich relative to the alternative]. The consumer surplus for each product cannot be determined, as that would require a bid for each product separately. However, by comparing the relative preference for the irradiated sandwich to the market price, the "relative consumer surplus" for these products can be established, which is adequate for determining the value of information. The relative consumer surplus for the irradiated version of a product is a relative consumer "deficit" for the non-irradiated version:

$$(5) \qquad Consumer\_Surplus^{j} = \left| WTP^{j} - Prem \right|.$$

The relative consumer surplus is the absolute difference between consumer j's willingness to pay (WTP) and the premium for the irradiated sandwich. If consumer j would purchase the irradiated sandwich, that individual's WTP is higher than the market price premium. Conversely, if consumer j would purchase the non-irradiated sandwich, then WTP would be lower than the market price premium. While all consumers receive

a nonnegative relative consumer surplus (because they purchase the products they prefer),[6] the surplus only represents the value of information when a consumer switches products.[7]

It is useful to measure two different welfare gains. The first is the average welfare gain to a person *who gains value* from information (i.e., those who switched purchases):

$$Value\_Switchers = \frac{\sum_{j \in switched} Consumer\_Surplus^{j}}{N^{switchers}}. \tag{6}$$

The average value of information to an individual who gains value is just the total value of information divided by the number of people who gained value from that information.

The second welfare gain to be measured is the average welfare gain to a person in the population (regardless of whether they switched or not):

$$Value\_Person = \frac{\sum_{j \in switched} Consumer\_Surplus^{j}}{N^{population}}. \tag{7}$$

Because this experimental design used repeated trials, we have pre- and post-information bids from each participant, which allows us to determine exactly who gained some value from information.[8]

Results

The Value of Information in Isolation

First, we consider the impact of information when the sources are not competing with each other (i.e., each information source is presented without the dissenting information). Following Fox, Hayes, and Shogren (2002), we used round 5 (bid immediately prior to receiving information) and round 6 (bid immediately after receiving information) for this analysis.

Panel A of table 1 shows the percentage of participants who would purchase the irradiated sandwich in the treatment receiving only pro-irradiation information. Before the pro-irradiation information on irradiation is disseminated, 39% of consumers would purchase the irradiated sandwich. Once pro-irradiation information is disseminated, 17% of the group would switch their purchase to the irradiated sandwich. Our estimates suggest no one who was originally purchasing the irradiated sandwich would switch to the non-irradiated sandwich when only pro-irradiation information was disseminated. In a market without competing information, pro-irradiation information influences consumer decisions.

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[6] Recall, this must hold from the viewpoint of the party providing the information. If information consumers received were viewed by this party as "misinformation," however, a consumer could have a nonnegative surplus.

[7] The minimum a consumer could bid for the irradiated sandwich was zero (i.e., consumers' bids were censored). Consumers who preferred the non-irradiated sandwich were not able to fully express their WTP for the irradiated sandwich. We use a tobit model to account for this design feature in the "results" section when estimating the value of information for those who would switch to the non-irradiated food product. A non-censored model is used to estimate the value of information for consumers who would switch to the irradiated sandwich because their bids were not censored.

[8] While previous experiments assessing the value of information (Rousu et al., 2004; Huffman et al., 2003) could estimate the *percentage* of participants who switched products, they could not determine who would actually switch.

Table 1. Percentage of Consumers Who Would Switch Purchases, and the Value of Information

PANEL A. Consumer Reaction to Pro-irradiation Information (N = 18)		
Description	Number of Participants	Percentage of Participants
▸ Buy irradiated sandwich before information	7	39%
▸ Buy irradiated sandwich after information	10	56%
▸ Switched to irradiated sandwich after information	3	17%
▸ Switched to non-irradiated sandwich after information	0	0%
▸ Value of information per person who switches to irradiated sandwich	$0.65**	
▸ Average value of information for all participants	$0.11**	
PANEL B. Consumer Reaction to Anti-irradiation Information (N = 19)		
Description	Number of Participants	Percentage of Participants
▸ Buy irradiated sandwich before information	5	26%
▸ Buy irradiated sandwich after information	1	5%
▸ Switched to irradiated sandwich after information	0	0%
▸ Switched to non-irradiated sandwich after information	4	21%
▸ Value of information per person who switches to irradiated sandwich	$1.80***	
▸ Average value of information for all participants	$0.38***	
PANEL C. Consumer Reaction to Both Pro-irradiation and Anti-irradiation Information (N = 50)		
Description	Number of Participants	Percentage of Participants
▸ Buy irradiated sandwich before information	19	38%[a]
▸ Buy irradiated sandwich after information	9	18%
▸ Switched to irradiated sandwich after information	0	0%
▸ Switched to non-irradiated sandwich after information	10	20%
▸ Value of information per person who switches to irradiated sandwich	$0.60**[a]	
▸ Average value of information for all participants	$0.12**	

Note: Single, double, and triple asterisks (*) denote statistical significance at the 10%, 5%, and 1% levels, respectively, using a chi-squared test.

[a] We cannot reject the null hypothesis that the percentage of participants who switch and the value to participants is identical in panels B and C.

Panel A also shows the value of pro-irradiation information to these consumers. An individual who would switch purchases would gain a value of $0.65 per sandwich from the pro-irradiation information. The average per person value of pro-irradiation scientific information is $0.11 per sandwich. These values are statistically significant at the 5% level using a chi-squared test.

Panel B of table 1 shows the participants who received only anti-irradiation information submitted bids that revealed greater reluctance to purchase the irradiated sandwich. It is estimated that 21% of participants would switch to the non-irradiated sandwich in this treatment, leaving only 5% of participants who would purchase the irradiated sandwich after receiving anti-irradiation information. While the

anti-irradiation (panel B) information is found to influence a similar percentage of participants to switch purchases compared to the pro-irradiation information (panel A), those who would switch after reading the anti-irradiation information find it more valuable. The participants who would switch purchases after receiving anti-irradiation scientific information obtain a value of $1.80 per sandwich from the information, and the average per person value of anti-irradiation scientific information is $0.38 per sandwich. These value estimates are statistically significant at the 1% level.

Similar to pro-irradiation information, when presented in a vacuum, anti-irradiation information influences consumer purchases in the expected direction. Further, both of these information sources have value in the sense that if the information is accurate (which each scientific body believes to be so when they present this information), the consumers who change their behavior are better off after receiving the information (the others have no change in utility). Next, we consider the value when consumers receive both pro- and anti-irradiation information.

The Value of Conflicting Information

When parties with opposing viewpoints present information on a novel technology, consumers' preferences could move either toward or against the irradiated sandwich. Some consumers could be more inclined to purchase the irradiated sandwich, others less inclined. Panel C of table 1 shows the percentage of participants who would switch purchases when they simultaneously receive both pro-irradiation and anti-irradiation information. An estimated 20% of participants would switch their purchase from the irradiated to the non-irradiated sandwich after receiving both pro- and anti-irradiation information. This percentage is similar to the percentage that received only anti-irradiation information (panel B). No participants would switch to the irradiated product.

While the percentage of participants who would switch to the non-irradiated sandwich is similar, the value of anti-irradiation information is affected by the existence of pro-irradiation information. A consumer who would switch gains a value of approximately $0.60 from the anti-irradiation information. This is far less than the $1.80 per person value for anti-irradiation information when presented in a vacuum.[9] We also observe the average value of the anti-irradiation information dropped by 68%—to $0.12 from $0.38 per person.[10]

Why Does Information Influence Consumers to Switch Purchases?

As shown by table 1, information can have value to consumers by causing some consumers to switch purchases. Either pro- or anti-irradiation information from scientists

[9] Recall that the value of information was estimated using different estimates for the premium for the irradiated sandwich. The value of pro-irradiation information when presented alone varies between $0.08 and $0.14 per person; the value of anti-irradiation information when presented alone varies between $0.26 and $0.54 per person, while the value of anti-irradiation information when pro-irradiation is also presented varies between $0.07 and $0.18 per person. Details of these results can be obtained from the authors upon request.

[10] A reviewer pointed out that most value-of-information research assumes only one "most-informed" state and compares everything to that state. Given this experimental design, the most-informed state is the state in which participants receive both pro- and anti-irradiation information. The Fox, Hayes, and Shogren (2002) experimental design did not consider treatments in which participants first bid based on one source of information (either pro- or anti-irradiation) and then bid again after being exposed to both sources of information. Therefore, this type of analysis is impossible given the experimental design, and remains an interesting area for future research.

Table 2. Probit Model Examining the Probability Participants Would Switch to Non-irradiated Foods if They Received Anti-irradiation Information (N = 69)

Coefficient	Regression (1)	Regression (2)
α	-1.77	-1.89
	(1.31)	(1.35)
β_{AGE}	-0.10	-0.11
	(0.10)	(0.10)
$\beta_{CONCERN}$	0.54**	0.55**
	(0.25)	(0.25)
β_{GENDER}	0.13	0.16
	(0.44)	(0.45)
$\beta_{EDUCATION}$	-0.32**	-0.33**
	(0.14)	(0.15)
β_{INCOME}	0.23	0.24*
	(0.14)	(0.15)
$\beta_{PRO\text{-}IRRADIATION}$	—	0.19
		(0.45)

Note: Single and double asterisks denote statistical significance at the 10% and 5% levels, respectively, using a two-sided chi-squared test.

would cause consumers to switch purchases and had value to consumers when presented without the competing viewpoint. When presented with competing information, the anti-irradiation information resonated with consumers, although the value consumers received from this information was reduced when competing information was introduced.

We now probe further by examining what characteristics cause consumers to switch to non-irradiated foods if they received anti-irradiation information. A probit model was run to examine this issue, with the dependent variable in the model equal to 1 if the consumer switched to non-irradiated foods, and 0 otherwise. The following covariates are considered: *AGE*, *CONCERN* (about the safety of the food they purchase as indicated in a pre-experiment survey), *GENDER*, *EDUCATION*, *INCOME*, and *PRO-IRRADIATION* (i.e., the consumer also received the pro-irradiation information). Appendix table A1 reports the socioeconomic statistics of these covariates, as provided in Fox, Hayes, and Shogren (2002).

Table 2 shows those who were concerned about the safety of their food were more likely to switch to the non-irradiated product after receiving anti-irradiation information. Faced with different types of risk (risk of foodborne illness or risk of adverse effects from irradiation), consumers chose the more familiar risk. This finding is consistent with the status quo effect, in which participants are more likely to choose the status quo alternative when faced with alternative risky choices (Samuelson and Zeckhauser, 1988). Individuals with more education were less likely to switch to the non-irradiated product; apparently they placed less weight on the anti-irradiation information and more on their prior knowledge. As income increased, some evidence is found that participants were more likely to switch to the non-irradiated product, although this

result is only marginally significant (two-sided p-value = 0.1). We find no evidence to suggest that gender or age affects the consumer's propensity to switch to the non-irradiated version of the sandwich. This finding contrasts with results reported by Cameron (2005) who found both gender and age affected the weight people placed on new information.

Concluding Comments

Data from the experimental auctions detailed in Fox, Hayes, and Shogren (2002), and Hayes, Fox, and Shogren (2002) are used to estimate the *value* of conflicting information provided by two competing groups. The groups disseminate information hoping it has *value* whereby it will induce consumers to change purchasing decisions. For pro-irradiation groups, information has value if it causes consumers to switch to irradiated foods; for anti-irradiation groups, value exists if consumers switch to non-irradiated foods. The results suggest each information set has value when presented in isolation. When both information sets are presented together, however, only the anti-irradiation information has value, although this value is diminished by nearly two-thirds relative to when it was presented in isolation. Whether these findings are case-specific or represent a more general pattern for other controversial goods is unknown. Future research on this topic is warranted.

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References

Cameron, T. A. "Updating Subjective Risks in the Presence of Conflicting Information: An Application to Climate Change." *J. Risk and Uncertainty* 30(2005):63–97.

Centers for Disease Control and Prevention. "Frequently Asked Questions About Food Irradiation." CDC, Atlanta, GA, 2005. Online. Available at http://www.cdc.gov/ncidod/dbmd/diseaseinfo/foodirradiation.htm. [Retrieved May 16, 2005.]

Corrigan, J., and M. C. Rousu. "The Effect of Initial Endowments in Experimental Auctions." *Amer. J. Agr. Econ.* 88(2006):448–457.

Foster, W., and R. E. Just. "Measuring Welfare Effects of Product Contamination with Consumer Uncertainty." *J. Environ. Econ. and Mgmt.* 17(1989):266–283.

Fox, J. A., D. J. Hayes, and J. F. Shogren. "Consumer Preferences for Food Irradiation: How Favorable and Unfavorable Descriptions Affect Preferences for Irradiated Pork in Experimental Auctions." *J. Risk and Uncertainty* 24(2002):75–95.

Hayes, D. J., J. A. Fox, and J. F. Shogren. "Experts and Activists: How Information Affects the Demand for Food Irradiation." *Food Policy* 27(2002):185–193.

Huffman, W. E., M. Rousu, J. F. Shogren, and A. Tegene. "The Public Good Value of Information from Agribusinesses on Genetically Modified Foods." *Amer. J. Agr. Econ.* 85(December 2003):1309–1315.

———. "Consumers' Resistance to Genetically Modified Foods in the U.S.: The Role of Information in an Uncertain Environment." *J. Agr. and Food Industrial Organization* 2(2004). Online. Available at http://www.bepress.com/jafio/vol2/iss2/art8.

Landes, D. *The Unbound Prometheus: Technological Change and Industrial Development in Western Europe from 1750 to the Present.* London/New York: Cambridge University Press, 1969.

Lusk, J. L., W. B. Traill, L. O. House, C. Valli, S. R. Jaeger, M. Moore, and B. Morrow. "Consumer Welfare Effects of Introducing and Labeling Genetically Modified Food." *Econ. Letters* 88(September 2005):382–388.

Pirtle, T. R. *History of the Dairy Industry.* Chicago, IL: Mojonnier Brothers Co., 1926.

Postrel, V. *The Future and Its Enemies: The Growing Conflict over Creativity, Enterprise, and Progress.* New York: The Free Press, 1999.

Pure-food.com. "Food Irradiation Information." 2005. Online at http://www.pure-food.com/food.htm. [Retrieved May 23, 2005.]

Rousu, M., W. E. Huffman, J. F. Shogren, and A. Tegene. "Effects and Value of Verifiable Information in a Controversial Market: Evidence from Lab Auctions of Genetically Modified Food." *Econ. Inquiry* (forthcoming).

———. "Estimating the Public Value of Conflicting Information: The Case of Genetically Modified Foods." *Land Econ.* 80(February 2004):125–135.

Samuelson, W., and R. Zeckhauser. "Status Quo Bias in Decision Making." *J. Risk and Uncertainty* 1(1988):7–59.

Teisl, M. F., N. E. Bockstael, and A. Levy. "Measuring the Welfare Effects of Nutrition Information." *Amer. J. Agr. Econ.* 83(2001):133–149.

U.S. Food and Drug Administration. "Food Irradiation: A Safe Measure." U.S. FDA, Washington, DC, 2005. Online. Available at http://www.fda.gov/opacom/catalog/irradbro.html. [Retrieved February 20, 2005.]

Vickrey, W. "Counterspeculation, Auctions, and Competitive Sealed Tenders." *J. Finance* 16(1961):8–37.

Viscusi, W. K. "Alarmist Decisions with Divergent Risk Information." *Economic J.* 107(November 1997):1657–1670.

Appendix

Table A1. Summary of Socioeconomic Data

Variable	Definition	Mean	Standard Deviation	Median
GENDER	1 if male	0.33	0.49	0.49
AGE	Categorical: 1 = < 20 4 = 30–34 7 = 45–49 2 = 20–24 5 = 35–39 8 = > 49 3 = 25–29 6 = 40–44	5.82	2.83	6
EDUCATION	Categorical: 1 = Grade 8 6 = B.S., B.A. 2 = Grade 9–11 7 = Some grad work 3 = HS graduate 8 = M.S., M.A. 4 = Some tech/trade school 9 = Ph.D., M.D., etc. 5 = Some college/no degree	5.53	1.62	5
INCOME	Categorical: 1 = < $10,000 5 = $40,000–$50,000 2 = $10,000–$20,000 6 = $50,000–$70,000 3 = $20,000–$30,000 7 = $70,000–$100,000 4 = $30,000–$40,000 8 = > $100,000	3.94	1.77	4
PRIOR ATTITUDE	Attitude toward food irradiation prior to the experiment: 1 = Positive (n = 17) 2 = Neutral (n = 60) 3 = Negative (n = 10)	0.08	0.55	0

Source: Fox, Hayes, and Shogren (2002).