OPTIMAL ECONOMIC DESIGN OF MAIL SURVEYS: INFLUENCES ON RESPONSE RATES AND THE IMPACT OF RESPONSES TO A SECOND MAILING

by

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B.S., University of Puerto Rico, 1997
M.S., University of Puerto Rico, 2002

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

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Abstract

Mail surveys are used to gather information in order to make inferences about populations. This study examines cost effective methods to maximize response rates to a mail survey. A consumer mail survey was developed and used to study consumer demand for safer foods. In addition, the study will verify if additional responses from follow-up mailings changes econometric analysis results, thus validating follow-up mailing costs. A test was created to maximize response rates and incentives were used in both mailings. An Ordinary Least Square (OLS) model was developed to analyze response rates and mail survey costs while a willingness to pay model and an ordered probit were used for the consumer demand analysis. Results showed that when a consumer survey was sent to a city within the school's state no incentive should be included while if sent to a city outside the school's state an incentive should be included. Moreover, if the outcome from the first mailing resulted in a low response rate a monetary incentive should be included in the follow-up mailing to increase response rates.

Results from the consumer willingness to pay for irradiated salad greens showed that consumers are willing to pay higher prices for irradiated salad greens. Furthermore, results showed that there is no statistical difference between the coefficients, in both the willingness to pay and the ordered probit, from the model using additional observations from follow-up mailing and the model that included only observations from the first mailing. Even though coefficients were not statistically different in the ordered probit, significance of the marginal effects for some variables were different between models.

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Dr. Sean Fox

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ESSAY 1. OPTIMAL ECONOMIC DESIGN OF A MAIL SURVEY

CHAPTER 1.1. - Introduction

Surveys are used to gather information about populations by interviewing limited samples (Dillman, 1991). Mail surveys are more common than face-to-face interviews or telephone interviews, mostly because they cost less and are easier to implement. Mail surveys can elicit responses from people too busy for personal interviews, and can avoid interviewer or respondent bias particularly for topics that are potentially embarrassing in a personal interview situation (Linsky, 1975). In the US and other developed countries the non response rate for mail surveys has been growing over time (Singer, Hoewyk and Maher, 1998). There is substantial literature on how to improve response rates in mail surveys and on factors that influence response rates. Dillman (1991, 2007) provides guidance on survey design and on how to improve response rates, and is probably the most cited reference in the mail survey literature.

Incentives

Respondents to mail surveys do not view monetary incentives as a payment for services; if they did we might expect higher returns with higher inducements (Linsky, 1975). Linsky cited Erdos who stated that "the token (the incentive) nature of the reward should be emphasized rather than a payment for services, since the later would imply a low valuation of the respondent's time." Theoretical support for this view is provided by Gouldner's norm of reciprocity and by cognitive dissonance theory (Linsky, 1975). The norm of reciprocity states that people are more likely to help those who provide favors for them (Linsky, 1975). The act of providing favors (assistance, gifts, etc.) builds a psychological obligation to reciprocate. Jobber and Saunders (1998, a) stated that "it is the paying of an incentive *per se,* rather the amount paid which is the major trigger for

the dissonance and reciprocity which underline its effectiveness". Alternatively, if respondents viewed incentives as a way of paying for their services, incentives would need to be proportional to their wage rate, thus people with higher incomes would require higher incentives.

Singer, Hoewyk and Maher (1998) investigated whether the payment of incentives would increase the expectation of receiving similar incentives in the future. This concern arises from theories, such as expectation state theory, that predict the development of norms (expectations) from perceptions of the existing state of affairs. These theories suggest that the violation of expectations is likely to evoke a negative reaction. Thus, the use of incentives may have a negative impact on response rates in future mail surveys which do not employ incentive payments.

Many studies have shown how monetary incentives increase the response rate in mail surveys (Armstrong, 1975; Jobber and Saunders, 1988, b; James and Bolstein, 1990, and 1992; Armstrong and Yokum, 1994; Wheeler et.al, 1997; and Hager et al., 2003), while others have studied the effects of incentives on the cost of a survey (James and Bolstein, 1990 and 1992; Angur and Nataraajan, 1995). Results from James and Bolstein (1990, 1992) showed that mail survey incentives exhibit diminishing marginal returns, as assumed by Armstrong (1975) and Jobber and Saunders (1988). Thus, as incentives increase response rates increase at a diminishing rate. Diminishing marginal returns can also be found in results from Weeler et. al. (1997).

Incentives and Follow-up Mailings

The number of follow-up mailings influences both the cost of the survey and the length of time required to conduct the survey. The studies listed in Table 1 show the effect of follow-up

mailings on response rates when used with and without monetary incentives. Response rates up to 90% have been obtained in surveys that used as many as four follow-up mailings where monetary incentives were provided in the first mailing. As expected, the results also illustrate diminishing returns to additional mailings, with or without incentives. James and Bolstein (1992) question whether the incentive effect "washes out" with follow up mailings. In their 1990 study the difference in response rates between the third and fourth mailing was only 2% with or without a monetary incentive.

Table 1: Incentives and Follow-up Mailings: Effects on Response Rates.

Number of Mailings	Armtrong and Yokum, 1994		James and Bolstein, 1990			
	No Incentive	Incentive	No Incentive	% Increase	Incentive*	% Increase
First Mailing	43.7%	62.3%	54.2%	-	69.1%	
Second Maliling	-	-	72.0%	17.8%	82.3%	13.2%
Third Mailing	-	-	83.3%	11.3%	88.0%	5.7%
Four Mailing	-	-	88.1%	4.8%	90.2%	2.5%
Overall Response		**66.5%**				**91.0%**

Number of Mailings	James and Bolstein, 1992					
	No Incentive	% Increase	Incentive*	% Increase	Promise to Pay	% Increase
First Mailing	20.7%	-	48.9%	-	23.3%	-
Second Maliling	36.7%	16.0%	61.0%	12.1%	43.3%	20.0%
Third Mailing	46.7%	10.0%	66.3%	5.3%	53.3%	10.0%
Four Mailing	52.0%	5.3%	69.7%	3.4%	56.7%	3.4%
Overall Response						**67.0%**

Number of Mailings	Angur and Nataraajan (1995)				Weeler et. al, 1997 **				Blake (2003)	
	No Incentive	Incentive***	Price Giveaway	Joint Effects	No Incentive	% Increase	Incentive*	% Increase	No Incentive	Incentive
First Mailing	7.0%	15.0%	25.0%	7.3%	36.1%		72.9%		9.8%	19.7%
Second Maliling	-	-	-	-	50.4%	14.3%	88.1%	15.2%	5.6%****	
Third Mailing	-	-	-	-	77.3%	26.9%	94.2%	6.1%		
Four Mailing	-	-	-	-	79.8%	2.5%	95.6%	1.5%		
Overall Response				**13.0%**				**92.5%**		**38.7%**

* These are cumulative percentages. All incentives were add up, where this is the average percent for all incentive groups.

** A post card reminder was sent for the second mailing.

*** One Dollar Incentive.

**** Combined Response Rate.

Incentives and Survey Costs

While several studies have estimated the effect of monetary incentives on response rates, few have examined their impact on survey costs, and none have considered follow-up costs as variable costs. For example James and Bolstein (1990, 1992) included the cost of the monetary incentive in their study but neither study measured the total cost of the survey including costs such as postage, materials, printing, and the cost of follow-ups to non-respondents.

Wheeler et. al. (1997) concluded that while the use of incentives does increase response rates, the marginal cost of a response may be quite high. They provide the following example - a researcher mails 1,000 surveys; and if a $1 incentive increases response rates by 1% (10 additional responses) then the marginal cost of each additional response will be $100.

This brings us to questions such as: what are the costs/benefits of using or not using a monetary incentive? What are the costs/benefits of using or not using two, three or four follow-up mailings either with or without incentives? How can cost per response be minimized when those decisions are taken?

In agricultural economics and economics, mail surveys are commonly used to collect data about consumer behavior and preferences. The sample size and response rate in a mail survey are important, since they determine the ability to make inferences about the population and to make predictions or forecasts. Nederhof (1983) stated that without research on methods that increase response rates, those rates are likely to diminish, thereby affecting the validity of social science findings. Researchers using mail surveys need techniques that can achieve higher response rates, but that also take into consideration their budget so they can optimize their use of available funds.

Objectives

The purpose of this study is to investigate the costs and benefits of alternative elements of design such as incentive payment and re-mailings with the goal of providing recommendations aimed at achieving a more optimal survey design i.e. a design that generates scientifically valid set of responses and inferences at minimal cost. To do so, the study will examine the effects of monetary incentives, follow-up mailings, and survey length on both response rates and on the cost of the survey.

CHAPTER 1.2. - Literature

This section will summarize the work on mail survey response rates. Initially, the work on survey response rates focused on techniques to improve response rates and then progressed in the 1980's to look at the effects of response rates incentives and follow-up mailings. Later studies examined the relationships between cost per response, monetary incentives, and follow-up mailings. This review examines two types of studies: a) those that look for techniques to improve survey response rates and b) those that focused on the effects of monetary incentives and follow-up mailings (summarized in Appendix A). The studies are organized by topic and by year in chronological order.

Techniques to Improve Mail Survey Response Rates

Cox, Anderson, and Fulcher (1974)

Cox, Anderson, and Fulcher (1974) examined consumer evaluations of a financial institution and its service offerings using a two page mail questionnaire. There were four treatments: with and without personalized cover letters and with and without a follow up postcard reminder three days after having received the questionnaire. The overall response rate was 17.8%, and results showed that the personalized cover letter had a statistically significant positive impact on response rate ($\chi^2 = 37.43$). However there was no significant difference attributable to the follow-up treatment ($\chi^2 = 0.83$). Furthermore, the interaction between cover letter and follow-up was not significant ($\chi^2 = 0.27$). They concluded that techniques that increase the response rate may involve significant increases in the cost of the survey.

Linsky (1975)

Linsky (1975) reviewed the literature on techniques that stimulate responses on mail questionnaires. In twelve studies, pre-contacting the respondents appeared to increase the response rates. Follow-up postcards or letters to non respondents was found to have a similar effect on overall response rates. In four out of seven studies, questionnaire length had no impact on response rates. Questionnaire color and use of pre-coded vs. open ended questions also had no significant effect on response rates.

Fox, Crask and Kim (1988)

Fox, Crask and Kim (1998) conducted a meta-analysis of studies examining ten different factors that influence response rates in mailing surveys. The data included studies from 40 different articles. Results showed that pre-notification by letter, follow-up by postcard, stamped postage, stamp return postage, and university sponsorship were statistically significant in terms of increasing response rate.

Yammarino, Skinner, and Childers (1991)

Yammarino, Skinner and Childers (1991) who conducted a meta-analysis on techniques to enhance response rates. One hundred and fifteen journal articles, from 1940 to 1988, were included in the study. The studies provided 184 data points and 17 different variables to predict response rates. Results showed that preliminary notification, follow-ups, sponsorship, return envelope, stamped or metered return postage, personalization, anonymity and length of questionnaire below 4 pages were statistically significant factors influencing reponse rate.

Greer, Chuchinprakarn and Seshadri (2000)

Greer, Chuchinprakarn and Seshadri (2000) utilized the survey on survey approach to study business respondent's perceptions of mail surveys. They conducted two studies. The first

examined the day of the week the respondent received the questionnaire and the length of questionnaire on the likelihood of responding. The second examined the respondents' preferences about various aspects of the questionnaire and checked perceptions about the use of pre-notification and follow-up. Results for the first study revealed that 51% of respondents did not care about the day of the week they received the survey, 29% said that their likelihood of participating would increase if they received the questionnaire early in the week while 19% said they'd be more likely to respond if they receive it later in the week. Results on questionnaire length showed that respondents preferred questionnaires with fewer pages and questions. Important factors influencing likelihood to respond were content, survey sponsorship and postage paid return envelopes. Privacy/sensitivity of survey questions, cover letter, incentive to respond and setup time to answer were considered less important.

Results from the second study revealed that respondents preferred fixed alternative questions versus open ended questions. Comparative scales were also preferred over non comparative scales. Questions asking for opinions were preferred to those questions asking for facts. Neither the color of the questionnaire paper, nor use of qualitative versus quantitative questions was significant factors for respondents. Results for pre-notification and follow-up showed that these factors also were not significant or had little impact on likelihood of participation.

In summary the literature suggests that pre-contact letters, follow-up letters or postcards, stamped return envelope, university sponsorship, preliminary notification, content of the study, fixed alternative questions, length of the survey, and delivery method affect response rates on mailing surveys.

Effects of Incentives and Follow-up Mailing

This section reviews the literature on the effects of monetary incentives and follow-up mailings in mail surveys. Appendix A provides a summary of the literature in table format.

Armstrong (1975)

Armstrong (1975) analyzed evidence from eighteen studies to show that incentives in mail surveys have a positive impact on response rates. Results indicated that: (1) prepaid monetary incentives yield large increases in response rates, and (2) the larger the monetary incentive, the greater the increase in response rate. However Armstrong noted that when the payment of an incentive is sent in a follow-up mailing it did have an effect, but not quite as strong as when sent in the first mailing. Studies that included a promise of a reward showed that the effect of a promised incentive is small in comparison to that of a prepaid incentive. Because studies were drawn from different time periods incentives were converted into constant dollars. Data from the studies were fitted to a curve showing how the reduction in non-response rate was related to increments in incentives. *A priori* assumptions included: (1) the curve should go through the origin to reflect that no reduction in non response is obtained with no incentive; (2) the curve should approach an asymptote; (3) there should be diminishing marginal returns; (4) the relationship should be simple. From those assumptions he fit the data to the following functional form:

$$Y = a\left(1 - \frac{1}{e^{bM}}\right)$$

where: Y = the reduction in non response rate
a = the asymptote
M = monetary incentive in dollars
b = a parameter to be estimated

The graphical representation for the functional form is shown in Figure 1.

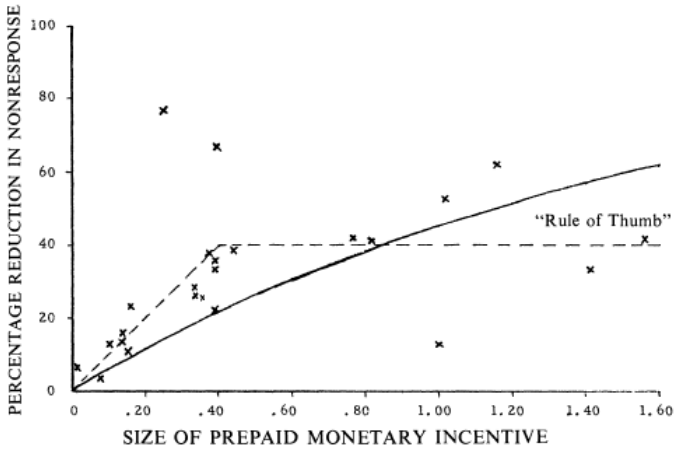

Figure 1: Percentage in Reduction in Non-response vs. Prepaid Monetary Incentive
Source: Armstrong, 1975

The asymptote was assumed to take a value of 100. Regression analysis estimated the value of b to be 0.6. The predictions for this curve, however, were lower than actual mail response reductions by eight percent on average. Consequently an eight percent adjustment improved the predictive performance of the model. Furthermore it was assumed that an incentive of any size would reduce non-response rate by an average of 32%. The resulting rule of thumb was a one percent decrease in the non-response rate for each cent increase in the monetary incentive up to a maximum of 40%. However, Armstrong concluded that it was very difficult to quantify the relationship between incentive size and reduction of non-response rate.

Nederhof (1983)

Nederhof (1983) measured the effect of including a non-monetary incentive in mail surveys. In one study 1093 questionnaires were sent, half of which included an inexpensive ballpoint pen as an incentive. Three follow-up mailings were used. After the first mailing, around 32% of the incentive group responded compared to 20% in the no incentive group. The difference was statistically significant ($\chi^2 = 17.54$). Following the second mailing, the difference

between the groups was 4.6%, which was not significant ($\chi^2 = 2.27$). Following the third and fourth mailings the difference in response rates between the two groups was less than 1%, and not statistically significant. In another study Nederhof surveyed 1002 subjects divided into two groups: one representative of the surveyed population (N = 700) labeled group A, the other group B, randomly selected from the entire population (N = 302). A ballpoint pen was used as an incentive for half the sample in both groups. In group A, following the first mailing, the response rate was 34% for the incentive group and 27% for the no incentive group. The difference was not significant at the 0.05 level but was significant at the 0.10 level ($\chi^2 = 3.58$, p-value = 0.07). In group B, following the first mailing the response rate for the incentive group was 23% versus 22% for the no incentive group. The difference was not significant at any level ($\chi^2 < 1$). Following the second mailing in group A there was a difference of 6.6% between the incentive and no incentive group, ($\chi^2 = 3.5$, p-value < 0.09), while there was no statistically significant difference in group B. No significant differences were found for either sample following the third and fourth mailings. Nederhof's results suggest that incentives may not be necessary or helpful in situations when multiple mailings will be employed.

Jobber and Saunders (1988, b)

Jobber and Saunders (1998) develop a model to illustrate the relationship between prepaid monetary incentives and response rates. They also developed a cost-benefit model of the impact of monetary incentives so that a researcher could judge when the inclusion of a monetary incentive is more effective than increasing the number of mailings in order to achieve a desired sample size. They used data from eighteen different surveys and used Armstrong's (1975) *a priori* assumptions (i.e. to develop their statistical model). Like Armstrong they converted the

incentive size to constant dollars, and estimated the reduction in non-response as a function of the incentive payment and other survey design element.

Results suggested that the effect of an incentive depends on the nil-incentive response rate. The authors estimated that incentives increased response by about 20 percentage points on average. The model also predicted that for surveys with incentive-free returns below 20%, the incentive would more than double the response rate. For surveys achieving over 60% response with no incentive, the return from an incentive remains strong but declines as maximum potential response is approached. Their results support the hypothesis that monetary incentives increase response rates but they found no evidence of a relationship between response rate and the size of the incentive.

James and Bolstein (1990)

James and Bolstein (1990) studied the joint and comparative effects of the use of monetary incentives and follow up mailings in a survey of cable television subscribers in Washington, D.C. They included four groups with monetary incentives ($0.25, $0.50, $1.00, $2.00) and a control group with no incentive and sent three follow-up mailings. The incentive was sent only in the first mailing. The overall response rate was 91% (767 of 844) after four mailings. Results by mailings and incentive size are shown in Table 2.

Table 2: Results from James and Bolstein (1990)

Mailing Number	$0.00 (%)	$0.25 (%)	$0.50 (%)	$1.00 (%)	$2.00 (%)
First Mailing[1]	52.4	62.7	63.1	72.8	77.6
Second Mailing	72.0	74.6	78.0	82.2	88.2
Third Mailing	83.3	82.8	82.7	91.7	94.7
Fourth Mailing	88.1	86.4	86.5	92.9	95.9

The table shows that response rates increase as the incentive amount increases. Since there was no significant difference between the 25 cent and 50 cent groups the authors combined these and compared them with the control group. Following the first mailing there was a significant difference between the 25¢-50¢ group versus the control group ($\chi^2 = 3.57$, p-value $\leq$ 0.05). Similarly for the $1.00 group after the first mailing there was a significant difference ($\chi^2 = 4.90$, p-value ≤ 0.02). They found that there was no significant difference between the $1 and $2 group after the first mailing ($\chi^2 = 1.07$, p-value = 1.5). After the second mailing there was still a significant difference between the $1.00 group and the 25¢-50¢ group ($\chi^2 = 10.06$, p-value=0.01). However there was no difference between the control group and the 25¢-50¢ group, nor between the $1 and $2 group. After the third mailing there was no difference between the 25¢-50¢ group and the control group. The researchers then combined the control group and the 25¢-50¢ group into a single category to compare with the $1.00 and $2.00 incentive groups in to see if there was any statistical difference in the third and fourth mailing. They found that there was significant difference between the groups for both mailings ($\chi^2 = 7.67$, p-value ≤ 0.01 and $\chi^2 = 3.93$, p-value ≤ 0.03 for the third and fourth mailings respectively). Also the $2 group was statistically significantly different from the combined no incentive and 25¢-50¢ cents group for the third and fourth mailing. They concluded that the monetary value of the inducement

[1] $\chi^2=25.69$, p-value=0.001.

plays a major role in increasing response rates. The cost of labor, supplies and mailings were estimated and then divided by the cumulative response rate. Based on the marginal cost per return and the response rates they concluded that the $1.00 incentive would be the best choice after the first mailing.

James and Bolstein (1992)

James and Bolstein (1992) examined the effect of various large monetary incentives among owners of small construction subcontracting companies and conducted a cost benefit analysis on monetary incentives. They divided the sample into eight groups each receiving a different monetary incentive: no incentive, $1 cash, $5 cash, $5 check, $10 check, $20 check, $40 check and an offer of a $50 check to be sent after the questionnaire was returned. Incentives were sent in the first mailing. Three follow-up mailings were sent only to the non respondents every three weeks. The overall response rate was 67 percent. Results are summarized in Table 3.

Table 3: Results for James and Bolstein (1992)

Incentive Size	First Mailing (%)	Second Mailing (%)	Third Mailing (%)	Fourth Mailing (%)
No Incentive	20.7	36.7	46.7	52.0
$1.00	40.7	52.0	61.3	64.0
$5.00 cash	48.7	60.7	66.7	71.3
$5.00 check	52.0	62.7	66.7	67.3
$10.00 check	44.0	56.7	62.0	66.7
$20.00 check	54.0	70.7	75.3	79.3
$40.00 check	54.0	63.3	66.0	69.3
Promise of $50.00	23.3	43.3	53.3	56.7

They found that as the amount of the check increased, the likelihood of being an ineligible participant (people who are no longer in the subcontracting construction business) to the survey also increased. The $5 check and $5 cash responses were combined since both groups did not differ significantly from one another. In the first mailing the response rate increased

significantly as the incentive amount increased from zero to $1 ($p < 0.001$) and from $1 to $5 ($p < 0.05$). Higher incentives did not produce a significantly higher response rate than the $5 incentive, and the promise of $50 did not result in a significant increase in response rate relative to the no incentive group ($p = 0.3$) after the first mailing. After the second mailing the response rate increases significantly as the incentive increases from zero to $1 ($p < 0.01$), from $1 to $5 ($p < 0.05$), and from $5 to $20 ($p < 0.05$). After the third and fourth mailings the response rate increases as the incentive increases from zero to $1 ($p < 0.001$ and $p < 0.05$ respectively), and from $1 to $20 ($p < 0.01$ in both cases). The promise of $50 did not result in a significantly higher response rate over the no incentive group after the 2nd, 3rd and 4th mailings. The response rate for the $20 group was significantly higher than the response rate from the $40 group after the third and fourth mailings. The $10 response rate was lower than the $5 response rate group, where the gap between each group decreases with each mailing, while the $5 group always kept the higher response rate. James and Bolstein estimated the direct costs of the incentives, labor and supplies specifically, per respondent for all incentive groups to see which group was more cost effective. Results showed that the $5 check was more economical than the $5 cash, because not all checks were cashed. They determined that in a one or two wave mailing, a $1 cash or a $5 check was the most cost effective.

Church (1993)

Church (1993) conducted a meta-analysis of 38 experimental and quasi-experimental studies that implemented some kind of mail survey incentive in order to increase response rates. The studies were divided into four groups, two with monetary or non-monetary incentives mailed with the survey, and two with monetary or non-monetary incentives given on the return of the survey. Church found that monetary and non-monetary mailed incentives had a positive effect

on mail survey return rates. Results provided no support for the hypothesis that monetary incentives yielded higher overall responses than non-monetary incentives. One of the major findings was that people respond more favorably to incentives included with the questionnaire rather than to a promise of an incentive after completing the questionnaire. Church concluded that that both monetary and non-monetary incentives mailed with a survey instrument should provide improved return rates worth the investment of time and effort involved in their implementation and that surveyors should avoid the use of a promise of an incentive (either monetary or non-monetary) after completion of the survey.

Armstrong and Yokum (1994)

Armstrong and Yokum (1994) conducted a survey for the International Institute of Forecasters (IIF). The sample population included members, former members, non members, authors of papers on forecasting and people who requested information from the IIF. The sample size was 783 of which 521 were members and 262 were non members. About 50% of both groups received $1.00 as a monetary incentive. The survey was sent by first class mail and contained a personalized signature and self addressed envelope. As expected the response rate from members was higher than that of non members, 52.9% vs. 21.2% respectively. Among non members the incentive resulted in a response rate of 29% vs. 13.7% from those receiving no incentive. The response rate from members receiving the incentive was also higher at 62.3% vs. 43.7% from members who did not receive the incentive.

Angur and Nataraajan (1995)

Angur and Nataraajan (1995) studied the response rates of industrial mail surveys in an international setting. They tested monetary versus non monetary (prize giveaway) incentives. They surveyed 600 Indian companies divided into four groups; control group, dollar incentive,

price giveaway of $250, and joint effects (dollar incentive plus prize giveaway). The corresponding response rates were 7%, 15%, 25% and 7% respectively. They estimated the total cost and the cost per response for the prize giveaway at $556 and $15.44; dollar incentive group $456 and $20.73; control group $306 and $30.6; and joint effect group $314 and $28.75. These results indicated a significant difference between the dollar group and both the no incentive group and joint effect group. There was also a significant difference between the price giveaway and the dollar group. Interestingly there was no significant difference between the joint effect group and the no incentive group. The key finding from the study was that whereas the total cost associated with the prize giveaway was the highest, its cost per respondent was the lowest.

Weeler, Lazo, Heberling, Fisher and Epp (1997)

Weeler, et. al. (1997) performed a survey of people who had an interest in fishing in counties in the Susquehanna River Basin in Pennsylvania. They sent 600 questionnaires and used three follow-up mailings. The first follow-up consisted of 225 cards after a week and a half, the second of 137 follow up questionnaires two weeks later, and a third follow up to 64 people two weeks after. The sample was randomized into five incentive groups: no incentive, $1.00, $2.00, $5.00 and a $10.00 that was send in the first mailing. They had an overall response rate of 92.5% (554 questionnaires). The authors examined optimal incentive levels from a benefit-cost perspective. They set up an equation to describe the net benefit of the survey for the administrator where the net benefit is the total benefit of the survey, which is a function of the responses, minus the total cost of the responses:

Net Benefit = Total Benefit [Response(Incentive)] – Total Cost [Incentive]

The total value of the survey is maximized by choosing the appropriate incentive level. Using the previous equation, the solution is obtained where:

$$\frac{\partial NetBenefit}{\partial Incentive} = \frac{\partial TotalBenefit}{\partial \mathrm{Re}\,sponse} \times \frac{\partial \mathrm{Re}\,sponse}{\partial Incentive} - \frac{\partial TotalCost}{\partial Incentive} = 0$$

Rearranging this equation gives:

$$\frac{\partial TotalBenefit}{\partial \mathrm{Re}\,sponse} = \frac{\partial TotalCost}{\partial Incentive} \div \frac{\partial \mathrm{Re}\,sponse}{\partial Incentive} = \frac{\partial TotalCost}{\partial \mathrm{Re}\,sponse}$$

The marginal cost of a response may be quite high. Thus in a survey with 1,000 questionnaires, if increasing the response rate by 1%, requires the incentive to be $1 larger, the marginal cost of each additional response is $100 just in incentives. In their study the authors found that incentives could affect both response rate and speed of response but the effect of increasing incentives was unclear. They found that at each level of follow-up there was a statistically significant difference between no incentive and some incentive (results were based on a χ^2 test). Regression models, using response rate as the dependent variable and either the amount or presence of an incentive as an explanatory variable, showed that increasing incentives did have an effect on response rates.

Singer, Hoewyk and Maher (1998)

Singer, Hoewyk and Maher (1998) included five extra questions in the 1996 and 1997 surveys of consumer attitudes by the Survey Research Center of the University of Michigan. The five questions were: (1) would you do this interview again? (2) is this survey useful for decision makers? (3) are surveys like this a waste of peoples time? (4) should people get paid for doing surveys? (5) how much should they get paid? Their results showed that there was a significant change, from 29.7% in 1996 to 45.7% in 1997, in the proportion saying that respondents should get paid for doing a survey. Their results also showed that people who had received an incentive were more likely to say that people should get paid than those who had not.

Groves, Singer and Corning (2000)

Groves, Singer and Corning (2000) measured the likelihood of a compositional change in the set of respondents due to a particular design feature when leverages and/or saliencies vary across sub groups. They expected that the effect of an incentive would diminish for those with heightened levels of community involvement. They conducted two surveys, the first a face-to-face survey and the second a mail survey. In the first survey all households were sent an advance letter before been contacted by the interviewer. Two thirds received a $5 incentive and the other one third did not. The purpose of the survey was to measure levels of political and community involvement. After 15 months a mail questionnaire was sent to the same sample in order to see how well the pre-dispositional variables measured in the earlier survey predicted their survey participation a year and a half later. An advance letter was sent, half of which included a $5 incentive. A reminder card was sent to everyone one week later. Results showed that households with high community involvement (58%) were significantly more likely to respond compared to those with low community involvement (43%; $\chi^2 = 7.81$, df = 1, p=0.007). Also as expected, the incentive had a significant effect on response rates for those receiving the $5 incentive (65%) compared to those not receiving the incentive 41.4% ($\chi^2 = 21.339$, df = 1, p=0.000). The effect of the incentive for highly involved respondents was smaller than for those with low community involvement.

Hager, Wilson, Pollak and Rooney (2003)

Hager et al. (2003) surveyed 120 nonprofit organizations about response rates to their surveys. Organizations were randomly assigned to 1 of 12 treatment conditions. The conditions were: length of survey, incentive, and delivery method (regular mail vs. Federal Express). They had three hypotheses: (1) a shorter, less complicated survey will result in higher return rates than

a longer, more complicated survey; (2) a survey delivered to a specific respondent via Federal Express will result in more returns than a survey delivered to a specific respondent via regular mail; (3) a survey package that includes a $5 bill will result in more returns than a survey package that includes no financial incentive. Results showed that using Federal Express had a statistically significant effect while the incentives and length of the survey did not.

Summary

Except for respondent groups who may already be motivated to respond, the literature suggests that surveyors can achieve higher response rates by using incentives. The literature indicates that response rates increase as the incentive amount increases but at a diminishing rate. It also suggests that response rates increase as the number of follow-up mailings increases but also at a diminishing rate for both the incentive and no incentive cases. Dillman (1997) recommended using post payment rather than prepayment of monetary incentives to increase response rates. The recommendation was based on James and Bolstein (1992) and Johnson and McLauglin (1990). In James and Bolstein (1992) 57% responded to the survey when a promise to pay donation of $50 after returning the survey compared to 64% and 71% who were sent $1 and $5 respectively. Results from McLauglin (1990) reported that sending $5 resulted in 83% response compared to 72% who were promised a $10 payment after the questionnaire was returned. Dillman stated that: "a benefit of sending a payment afterwards is that people may provide more complete answers, that is, lower item nonresponse, an effect observed by Johnson and McLaughlin (1990)". He also recommends that a "one dollar bill should be the smallest amount to send" and that a "two dollar incentive was equally effective regardless of whether sent by cash or check". The statement for the one dollar was based on results from James and

Bolstein (1992) and Johnson and McLaughlin (1990). The statement for the 2 dollar amount was based on the study by Lesser, Dillman, Lorenz, Carlson and Brown (1999).

Only one study has examined the effect of incentives used in the second and third mailing of a survey (Huck, an Gleason, 1974). This study will examine how the use of a second incentive in a follow-up mailing influences response rates and survey costs. It will also examine how additional responses from follow-up mailings change the results of the survey - a topic that has not previously been discussed in the literature.

CHAPTER 1.3. - Mail Surveys in Agricultural Economics

This section examines the use of mail surveys in 13 journals in the agricultural economics literature between 2000 and 2006. Due to the lack of volumes for the Journal of Agribusiness, Agricultural and Resource Economics Review, Agricultural and Applied Economics the entire period was not incorporated; only volumes from 2000 to 2004, 2001 to 2004, and 2004 to 2006 were incorporated, respectively. Information on sample size, number of responses, and response rates were gathered. Table 4 shows the number of articles, and their number and percentage of articles that used a mail survey, for the 13 journals. Lowest, highest, and average response rate, were also included[2].

Response rates were calculated by using one of the methods described in Table 5. There are four methods commonly used to estimate and present response rates in the literature. More detailed information is presented in Appendix B, where tables in the Appendix shows the reported response rate (shaded) and response rate as estimated by the other 3 methods if the information was available. The most common method used to report response rate is the "completed/sent" number while the least common is the "usable/sent-undeliverable" number. Table 5 shows the percentage of articles using the different mean of reporting response rate. Six of the sixty eight studies used two different methods to report a response rate. The percentages do not add up to 100 percent since some articles did not report their response rate.

The response rate is, of course, sensitive to the method used to report it. For example in a survey with 1,000 mailings, with 100 undeliverable, 400 completed responses and 350 usable responses, the response rate ranges from 44.4% using the completed/(sent-undeliverable) method

[2] The response rates in this table might not be the response rate that were presented in the publication but rather an estimation using one of the methods for calculating response rates.

to 35% using usable/sent method. With more than one method used to report response rates there might be a need to label estimations from Table 5 in order to standardize the terminology. Alexander, Fernandez-Cornejo, and Goodhue (2003) label the first method, completed/sent, as Gross Response Rate while Hwang, Roe, and Teisl (2005); and Shaikh, Sun, and VanKooten (2007) label the third method, usable/sent, as the Effective Response Rate. For the purpose of this study we will use the following names for the response rates described in Table 5: Gross Response Rate (GRR), Net Response Rate (NRR), Gross Effective Response Rate (GERR) and Net Effective Response Rate (NERR).

The average response rate in Table 4 was estimated by using the response rate reported in the publication, if unpublished then the GRR or available response rate was used to calculate the average. Appendix B provides more detailed information about the publications, the authors, sample size, number of responses, response rates, and the references for all 68 studies listed in Table 4. Missing information within the table is due to lack of reporting on response rates or number of questionnaires sent.

Two major findings arrived from Table 4. The first was that less than 5% of the published articles in AgEcon journals had used a mail survey and the second was that the average response rate ranges from 14% in CJAE to 45% in Land Economics. Land Economics and Agricultural Resource Economic Review (ARER) had the highest average response rate, while the Canadian Journal of Agricultural Economics (CJAE) and the Journal of Food Distribution Research (JFD) had the lowest average response rate. The lowest response rate of any articles among all journals was reported in the American Journal of Agricultural Economics (AJAE), with 9.3%, and the highest response rate belonged to Review of Agricultural Economics

(RAE), with 78.3%. The AJAE, Land Economics, and ARER had publications with a response rate greater than as 70%.

Table 4: Use of Mail Surveys in Agricultural Economics Journals, 2000-2006.

Journal	Number of Articles Published	Percentage Using Mail Survey	Reported Lowest Response Rate	Reported Highest Response Rate	Reported Average Response Rate
Review of Agricultural Economics	161	3.7%	12.4%	78.3%	36.5%
American Journal of Agricultural Economics	594	0.8%	9.3%	71.1%	30.8%
Journal of Agricultural and Resource Economics[3]	209	4.8%	22.7%	57.3%	40.2%
Journal of Food Distribution Research	NA	NA	10.0%	22.5%	17.6%
Land Economics	247	3.2%	14.6%	72.0%	45.5%
Agricultural and Resource Economic Review	119	4.2%	14.7%	76.5%	44.6%
Agribusiness	260	1.5%	12.8%	64.0%	31.4%
Journal of Agribusiness	NA	NA	11.3%	65.8%	39.3%
Agricultural and Applied Economics	108	2.8%	18.9%	41.0%	28.9%
Journal of International Food and Agribusiness Marketing	91	1.1%	NR	NR	-
AgBioForum	203	4.9%	14.8%	52.8%	31.2%
Canadian Journal of Agricultural Economics	268	1.9%	11.0%	20.8%	14.3%
Journal of Agricultural Economics[4]	156	0%	-	-	-

NR = Not Reported, NA = Not Available

[3] The number of publications includes only Studies with Applied Analysis.
[4] Volumes for 2001 to 2001 were not available.

Table 5: Methods to Estimate and Present Response Rates in AgEcon Journals, 2000 - 2006.

Method	Response Rate Method	Proportion of Published Articles Using:
1	$\frac{Completed}{Sent}$	40%
2	$\frac{Completed}{(Sent - Undeliverable)}$	12%
3	$\frac{Usable}{Sent}$	20%
4	$\frac{Usable}{(Sent - Undeliverable)}$	6%

CHAPTER 1.4. - Conceptual Model

The literature has shown that response rate (RR) depends on the length of the questionnaire, use of a pre notification postcard, incentive size, location, number of mailings, and other factors. Equation (1) describes the relationship between the response rate and factors that influence that response rate.

$$RR = f(L,PC,I,M) \tag{1}$$

where: L = Length of the survey
PC = Use of a Postcard
I = Incentive size
M = Number of Mailings

In addition, the literature has shown that the response rate exhibits diminishing marginal returns to increases in the size of the monetary incentive (Armstrong, 1975; Jobber and Saunders, 19888, b), thus, we assume

$$\frac{\partial \text{Response Rate}}{\partial \text{Incentive Size}} > 0 \quad \text{and} \quad \frac{\partial^2 \text{Response Rate}}{\partial \text{Incentive Size}^2} < 0$$

Jobber and Saunders (1988,b) presented a graphical description of the relationship between monetary incentives and response rates, Figure 2.

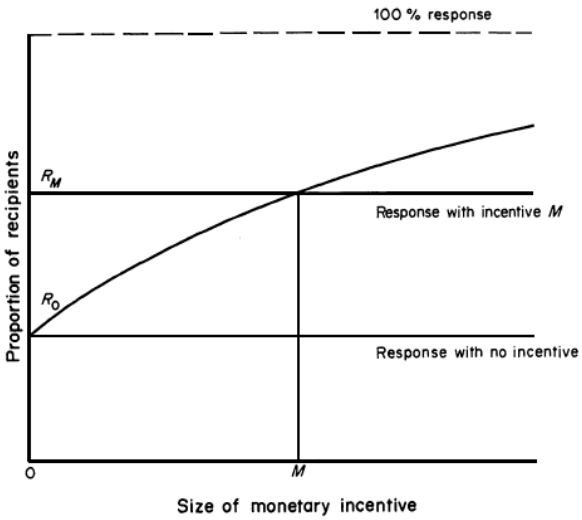

Figure 2: Effect of Incentive on Response Rate
Source: Jobber and Saunders (1988, b)

The following assumptions were made to create a simple model that explains the relationship between response rate and incentives: a) only one mailing would be done, b) property of diminishing marginal returns for incentives is satisfied, c) RR has to be less than or equal to 1, and d) the cost of the survey is less than or equal than the survey's budget.

Consider the case of a researcher conducting a mail survey with a fixed budget, denoted by **y**. The objective is to maximize the number of survey responses, **n**. Choice variables are **N**, the number of surveys mailed, and **I**, the cash incentive included with each survey. Respondents are presumed to be more likely to respond to a survey that includes a cash incentive. Thus, if **a** represents the proportion of those receiving the survey who respond, we have **a = a(I),** and **a'(I) >0**. Furthermore, the literature suggests diminishing marginal returns to increasing levels of the incentive, thus we assume **a''(I) <0**. The number of response obtained is **n = a(I)*N**

The cost of administering the survey is assumed to depend directly on the number of surveys mailed, **N**, and, if used, the incentive, **I**. We make the simplifying assumption, for now, that responses are costless. However the model could be adapted to accommodate such costs or

the situation where the incentive payment is contingent on a response. We further assume no fixed cost so cost are represented as **N*(c + I)**, where **c** is the variable cost of mailing a survey (cost of paper, envelope, postage, etc).

The objective, to maximize the number of responses subject to the research budget, can be represented by

$$\max_{I,N} a(I)N \quad \text{s.t.: } N(c+I) \le y \tag{2}$$

However, since the constraint in this case will always be binding, and thus N = y/(c+I), the objective simplifies to:

$$Max_I a(I)\frac{y}{c+I} \tag{3}$$

The first order condition is:

$$a'(I)(c+I) - a(I) = 0$$

Differentiation, using the implicit function rule, yields

$$\frac{dI^*}{dc} = -\frac{a'(I^*)}{a''(I^*)(c+I^*)} > 0,$$

given $a''(I^*) < 0$ holds. Thus we find that $\frac{dI^*}{dc} > 0$. The intuition for this result is that as the cost of sending one more survey, c, increases, the cost of increasing N increases, but the cost of the monetary incentive I remains the same. This makes the monetary incentive relatively cheaper, and the optimal value of I increases. As a result, N^* falls for two reasons: the price of

each mailing increases (the direct effect), and the expenditures are shifted towards providing monetary incentive (the indirect effect).

CHAPTER 1.5. - Methods and Procedures

This study examines factors that contribute to an efficient survey design, in particular the effect of various monetary incentives, re-mailings, and the length of the survey. The study is based on a mail survey of two thousand households, half in Wichita, Kansas and the other half in Los Angeles, California. Table 6 summarizes the demographics for the U.S. and the two target populations. Both target populations represent proportionally the U.S. for gender, median age, and average household size. Both cities are representative in terms of the proportion of Native Americans. Wichita has 10.8% more whites, 6.6% fewer African American and 5.5% fewer Hispanics than the U.S., while LA has 13.7% fewer whites, 5.5% African American and 34% more Hispanics than the U.S.

Table 6: US, Wichita and Los Angeles Demographics, 2000.

	Sex				Race				Ethnicity
	Male	Female	Median Age	Average Household Size	White	Black African American	Native American, Alaska Native	Asian	Hispanic
US	49.1	50.9	35.3	2.59	75.1	12.3	0.9	3.6	12.5
Los Angeles, CA	49.3	50.7	31.6	2.83	46.9	11.2	0.8	10	46.5
Wichita, KS	49.8	50.2	33.4	2.44	75.2	11.4	1.2	4	9.6

Source: U.S. Census Bureau[5].

[5] Race and Ethnicity do not add to 100% since Ethnicity is considered as a category outside race.

Pretests

Two pre-tests mailings were conducted which resulted in some changes to the survey instrument. One hundred households were surveyed for the first pre-test and ninety six for the second, both to different set of households in Manhattan, Kansas. The first pretest had a response rate of 33%. Following the first pretest two additional choices were added to the willingness to pay (WTP) question for irradiated salad greens. The choices that were added are:

_____ be unsure - I'd need to know more about irradiation, but I think I'd buy the regular non-irradiated salad greens

_____ be unsure - I'd need to know more about irradiation, but I think I'd buy the irradiated salad greens

The order of the choices was changed, with the final order of the choices is shown in the sample instrument, Appendix C. An incentive was used with the second pre-test. One third of the sample were informed that $1 would be contributed to the Red Cross for every response received, one third were informed that $2 would be contributed, while the remaining one third received no incentive. A test of effectiveness of sending a postcard before the survey was conducted in the second pre test with half of the households receiving the port card in advance of the survey. Furthermore, half of the sample included a barcode and the other half included a two letter plus a number code in order to identify households and to seek an efficient way of identifying non-respondents.

The overall response rate for the second pre-test was 49%. The GRR for the postcard group was 27.1% versus 21.9% for the no postcard group. The group with the barcode had a GRR of 28.1% versus 20.8% for the letter plus number identification method. The group with the highest GRR was the no incentive group with 18.8%, followed by the $1 incentive group

with a GRR of 17.7% and the $2 incentive group with a GRR of 12.5%. Following the 2nd pre test two additional questions were added to the final questionnaire, the first about concern about getting ill from Avian Influenza and the second on race and ethnicity.

Survey Design

Three main versions of the questionnaire were used. Within version 1, there were eight different sub-versions, while versions 2 and 3 each had sixteen sub-versions for a total of forty different questionnaire sub-versions. Twenty five questionnaires were sent for each sub version, a total of 2,000 questionnaires.

Table **7** summarizes the different versions, and how they differ depending on irradiation technology, use of a postcard, response incentives and WTP price treatments for the question on irradiated salad greens. Versions with an odd number after the decimal (e.g. 1.1, 2.3) asked the respondent about gamma ray irradiation treatment while those with an even number (e.g. 1.2, 3.6) ask about E-beam irradiation. All of the questionnaires from the second version (i.e. 2.1, 2.2, 2.3, etc.) included all questions from version 1 and additional questions about consumption of poultry products, and the potential impact of a case of Avian Influenza (AI) in the US. Half of the Version 2 surveys, those denoted a), included extra information about AI while the other half, those denoted b), did not (see Table 8). The additional information read as follows:

> "According to food safety professionals, proper cooking kills the bird flu virus and would protect consumers if the disease was found in U.S. poultry."

Version 3 included all questions from version 2 with additional questions about the use of antibiotics in animal feed and a question about willingness to pay for meat without antibiotics if a ban on antibiotics on animal feed took place. Four different price premiums for the "antibiotic free" steak were used in different versions of the survey - $1, $2, $3, and $4 (see Table 8).

To assess the effect of survey length on response rate version 1 contained five pages, version 2 six pages, and version 3 seven pages. A postcard was send before the survey to half of the sample for each version: V.1 to V.4 included the postcard and V.5 to V.8 did not, where V represents the version number Table 7. Two mailings were done, each with different incentive sizes and types of incentives. The first mailing included four groups, three groups with incentives and a control group with no incentive. Two hundred and fifty surveys were sent for each group in each city. The incentive groups included a promise of a donation to the Red Cross of $1, $3, or $5. A second incentive was introduced in the second mailing, where for each group

in the first mailing there were three sub-groups with different incentives in the second mailing. The second mailing included 2 groups with monetary incentives and one as a control group. Twenty five percent of the non respondents received a $1 bill, another twenty five percent received $2 and fifty percent of the non respondents did not receive any incentive with the 2nd mailing. A total of 1,554 questionnaires were mailed for the second mailing, 835 to the non incentive group, 362 with $1, and 357 with $2. Versions V.1 to V.4 were preceded by a postcard while V.5 to V.8 were not. The postcard was sent two days prior to the questionnaire to half of the households in the sample in each location five hundred to Wichita and five hundred to Los Angeles.

The following standard techniques that have been shown to improve response rates in mail surveys were also employed: a return envelope, a personalized cover letter, and an assurance of confidentiality. Since the results for the pre-test showed that barcodes increased response rate compared to the two letter code, all households were identified with a barcode containing a unique number on the back of the return envelope in order to identify non respondents and thus reduce the costs of the follow-up mailing.

Table 7: Questionnaire Versions*

Version	Sample Size	Post Card	First Mailing Incentive	Second Mailing Incentive	Irradiation Technology and WTP Price
Version 1.1 Version 2.1) a) Version 2.1) b) Version 3.1) a) Version 3.1) b)	25 each	Yes	$0	$0 $1 $2	Gamma Rays 10¢
Version 1.2 Version 2.2) a) Version 2.2) b) Version 3.2) a) Version 3.2) b)	25 each	Yes	$1	$0 $1 $2	E-beam 10¢
Version 1.3 Version 2.3) a) Version 2.3) b) Version 3.3) a) Version 3.3) b)	25 each	Yes	$3	$0 $1 $2	Gamma Rays 25¢
Version 1.4 Version 2.4) a) Version 2.4) b) Version 3.4) a) Version 3.4) b)	25 each	Yes	$5	$0 $1 $2	E-beam 25¢
Version 1.5 Version 2.5) a) Version 2.5) b) Version 3.5) a) Version 3.5) b)	25 each	No	$0	$0 $1 $2	Gamma Rays 35¢
Version 1.6 Version 2.6) a) Version 2.6) b) Version 3.6) a) Version 3.6) b)	25 each	No	$1	$0 $1 $2	E-beam 35¢
Version 1.7 Version 2.7) a) Version 2.7) b) Version 3.7) a) Version 3.7) b)	25 each	No	$3	$0 $1 $2	Gamma Rays 50¢
Version 1.8 Version 2.8) a) Version 2.8) b) Version 3.8) a) Version 3.8) b)	25 each	No	$5	$0 $1 $2	E-beam 50¢

* 40

*versions shown are for 1 city. Repeated for the 2nd city.

Table 8: Additional Questions in Versions 2 and 3

Version	Irradiation Technology	Case of Wild Bird with Avian Influenza Additional Information	Total
Version 2.1) a)	Gamma Rays 10¢	Yes	25
Version 2.2) a)	E-beam 10¢	Yes	25
Version 2.3) a)	Gamma Rays 25¢	Yes	25
Version 2.4) a)	E-beam 25¢	Yes	25
Version 2.5) a)	Gamma Rays 35¢	Yes	25
Version 2.6) a)	E-beam 35¢	Yes	25
Version 2.7) a)	Gamma Rays 50¢	Yes	25
Version 2.8) a)	E-beam 50¢	Yes	25
Version 2.1) b)	Gamma Rays 10¢	No	25
Version 2.2) b)	E-beam 10¢	No	25
Version 2.3) b)	Gamma Rays 25¢	No	25
Version 2.4) b)	E-beam 25¢	No	25
Version 2.5) b)	Gamma Rays 35¢	No	25
Version 2.6) b)	E-beam 35¢	No	25
Version 2.7) b)	Gamma Rays 50¢	No	25
Version 2.8) b)	E-beam 50¢	No	25

Version	Irradiation Technology	Case of Wild Bird with Avian Influenza Additional Information	Antibiotics WTP Price	Total
Version 3.1) a)	Gamma Rays 10¢	Yes	$4	25
Version 3.2) a)	E-beam 10¢	Yes	$4	25
Version 3.3) a)	Gamma Rays 25¢	Yes	$3	25
Version 3.4) a)	E-beam 25¢	Yes	$3	25
Version 3.5) a)	Gamma Rays 35¢	Yes	$2	25
Version 3.6) a)	E-beam 35¢	Yes	$2	25
Version 3.7) a)	Gamma Rays 50¢	Yes	$1	25
Version 3.8) a)	E-beam 50¢	Yes	$1	25
Version 3.1) b)	Gamma Rays 10¢	No	$4	25
Version 3.2) b)	E-beam 10¢	No	$4	25
Version 3.3) b)	Gamma Rays 25¢	No	$3	25
Version 3.4) b)	E-beam 25¢	No	$3	25
Version 3.5) b)	Gamma Rays 35¢	No	$2	25
Version 3.6) b)	E-beam 35¢	No	$2	25
Version 3.7) b)	Gamma Rays 50¢	No	$1	25
Version 3.8) b)	E-beam 50¢	No	$1	25

CHAPTER 1.6. - Data

Estimation of Responses to the Initial Mailing

The 2000 mailed surveys can be divided into 80 different versions according to: a) location – Wichita and LA, b) length of the survey (3 different lengths) and the presence or absence of information about bird flu in the two longer versions – thus giving 5 separate versions based on length and information, c) type of irradiation technology – gamma ray or e-beam, d) the price premium used in the willingness to pay for irradiated salad greens – four different price premium levels, and e) the price premium used in the question about willingness to pay for antibiotic free meat – four different premium levels. In total then, we had 80 different versions of the instrument, each going to a sample of 25 households. Surveys were also differentiated from each other along two additional dimensions – i.e., i) whether or not the respondents received a postcard in advance of the survey, and ii) the level of incentive provided with the initial mailing – a promise to pay either \$0, \$1, \$3, or \$5 to the Red Cross for each survey completed. Thus, Version 1.1 was 5 pages long, with gamma rays technology information, a 10¢ price premium for the willingness to pay for irradiated salad greens, with a \$0 incentive and a postcard. Similarly Version 2.2b was 6 pages long, with e-beam technology information, a 10¢ price premium for irradiated salad greens, \$1 promise donation to the Red Cross, no postcard, and no additional information about bird flu. Table 7 and Table 8 describe the characteristics of the different survey versions, while Table 9 below provides response rates for four of the 80 different survey versions. Thus, for version 1.1, 8 of the 25 mailed surveys were completed giving a response rate of 32% for the first mailing. The estimation model assumes that this

response rate depends on the location, the level of incentive, the length of the survey instrument, and the use of the initial postcard.

Table 9: Response Rate for the First Mailing, an example.

Version	Sent First Mailing	Incentive Group	Completed	Non Respondents	Gross Response Rate
1.1	25	$0	8	17	32.0%
1.2	25	$1	9	16	36.0%
1.3	25	$3	8	17	32.0%
1.4	25	$5	8	17	32.0%

Estimation of Responses for the Second Mailing

For the 2nd mailing, non-respondents in each of the 80 different treatment categories from the first mailing were further divided into three separate treatment sub-groups. Within each of the 80 categories, approximately 50% of non-respondents received no incentive with the 2nd mailing, approximately 25% received a $1 bill with the 2nd mailing, and approximately 25% received $2 (see Table 10). Thus, with the 2nd mailing we have 240 separate groups, for each of which a response rate to the 2nd mailing can be computed.

That response rate to the 2nd mailing is provided in the final column of table 2. Thus, within version 1.1 of the survey, we have three separate response rates of 22.2%, 50%, and 25% for the three separate incentive provided with the 2nd mailing. The estimation model assumes that this response rate depends on the incentive - $0, $1 or $2, the location, and the length of the survey.

Table 10: Response Rate for the Second Mailing, an example.

Version	Non Respondents	Sent Second Mailing	Incentive Group	Completed	Gross Response Rate
1.1	17	9	$0	2	22.2%
		4	$1	2	50.0%
		4	$2	1	25.0%
1.2	16	9	$0	2	22.2%
		4	$1	0	0.0%
		4	$2	1	25.0%
1.3	17	10	$0	2	20.0%
		4	$1	1	25.0%
		4	$2	2	50.0%
1.4	17	10	$0	1	10.0%
		3	$1	1	33.3%
		4	$2	1	25.0%

Estimation of Overall Response Rate

When we consider the 240 different sub-groups resulting from different treatments and different levels of incentive with the 2nd mailing, we can, for each of those subgroups, compute a response rate that takes into consideration the responses received to both the first and second mailings. Thus,

$$Total\ Completed = Completed\ FM + Completed\ SM$$

where: FM = First Mailing, SM = Second Mailing

For example, consider survey version 1.1 as described below in Table 11. Eight responses were received from the first mailing, and of the 17 non-respondents, nine received no incentive with the 2nd mailing, four received $1, and four received $2. Two of the nine receiving a zero incentive responded to the 2nd mailing. Given that response rate, we can compute what the

response rate would have been, had the same incentive, i.e $0, been provided to all 17 non respondents to version 1.1. In this case, the response rate to the 2nd mailing is 22.22% - i.e. 2 divided by 9. Had we achieved that same response rate for all 17 of the initial non-respondents to version 1.1, we would have obtained 17*(2/9) = 3.77 responses. Thus, for version 1.1, the response rate using a zero incentive for non respondents would have been (8 + 3.77)/25 = 47.08%. This we consider the overall response rate which is assumed to be a function of the incentives provided with both the first and second mailing, in addition to other characteristics of the survey – location, length etc.

Table 11: Total Number of Completed Questionnaires Estimation, an example.

Version	Sent	Completed FM	Non Respondents	Sent Second Mailing	Completed Second Mailing	GRR	Total Responses	Completed FM + GRRSM * Non Respondents	Total Response Rate
				9	2	22.2%	10	**8 + (0.222*17) = 11.77**	**0.47**
1.1	25	8	17	4	2	50.0%	10	**8 + (0.500*17) = 16.50**	**0.66**
				4	1	25.0%	9	**8 + (0.250*17) = 12.25**	**0.49**
				9	2	22.2%	11	**9 + (0.222*16) = 12.55**	**0.50**
1.2	25	9	16	4	0	0.0%	9	**9 + (0.000*00) = 9.00**	**0.36**
				4	1	25.0%	10	**9 + (0.250*16) = 13.00**	**0.52**
				10	2	20.0%	10	**8 + (0.200*17) = 11.40**	**0.46**
1.3	25	8	17	4	1	25.0%	9	**8 + (0.250*17) = 12.25**	**0.49**
				4	2	50.0%	10	**8 + (0.500*17) = 16.50**	**0.66**
				10	1	10.0%	9	**8 + (0.100*17) = 9.70**	**0.39**
1.4	25	8	17	3	1	33.3%	9	**8 + (0.333*17) = 13.66**	**0.55**
				4	1	25.0%	9	**8 + (0.250*17) = 12.25**	**0.49**

Overall Response Rate Results

Table 12 shows total response rates and response rates for the first and second mailings for both cities. Gross Response Rate (GRR) after both mailings for this study was 31.1% while the Net Response Rate (NRR), accounting for 112 undeliverable surveys was 32.9%. The GRR for the first mailing was 20.1%, and 14.2% for the second mailing. More detailed data on the response rate is on Appendix D.

Version 1, 2, and 3 differed from each other in terms of questionnaire length and their respective GRR were 31.3%, 31.9%, and 30.3%. Thus questionnaire length appeared to have little or no effect on the response rates.

Table 12: Gross Response Rates for First and Second Mailing for Both Cities.

GRR	Wichita	Los Angeles	Both
First Mailing	31.2%	9.0%	20.1%
Second Mailing	19.2%	10.2%	14.2%
Both Mailings	44.3%	17.9%	31.1%

Response Rates for Wichita and Los Angeles

The GRR for Wichita for both mailings was 44.3% compared to 17.9% for Los Angeles (Table 12). Response rates for the first and second mailings for Wichita were 31.2% and 19.2%, and for LA was 9.0% and 10.2% for Los Angeles. The data suggests that home state residents respond at a significantly higher rate compared to out of state residents.

Effect of Postcard on Response Rate

Table 13 shows the GRR for subsamples that either received or did not receive a postcard prior to receiving the questionnaire. Overall the GRR with the postcard was 34.7% compared to 27.5% without. In Wichita the GRR with postcard was 48.8% compared to 39.8% without, while in Los Angeles the corresponding for the postcard group was 20.6% and 15.2% for the no postcard group. More detailed results on the effect of postcard on response rates by questionnaire version are presented in Appendix D.

Table 13: Gross Response Rates for Postcard Treatment for Both Cities.

Treatment	Wichita	Los Angeles	Both Cities
Postcard	48.8%	20.6%	34.7%
No Postcard	39.8%	15.2%	27.5%

Effect of the Incentive on Response Rate for the First Mailing

Table 14 summarizes results for the different incentives used in the first mailing, and the effect of the incentive on the first mailing response rate by city. More detailed information can be found in Appendix D. Overall, the provision of the incentive and varying the level of the incentive appeared to have little effect on the response rate. The GRR in the first mailing with no incentive was 21% with the $1 promised donation to the Red Cross 19.4% with $3, 18.6% and with $5, 21.4%. In Wichita the highest GRR in the first mailing was for the no incentive group at 35.6%, followed by $5 promise group at 32%. The $1 and $3 groups had GRR's of 30% and 27.2% respectively. Thus in Wichita the presence or level of the incentive seemed to have no effect on response rates. In LA the pattern of responses was completely different and

corresponded to the finding, in most of the published literature, that incentives have a positive effect on the response rate. The highest GRR was the $5 promise to pay group with 10.8%, followed by the $3 group at 10%, and the $1 group and no incentive groups with 8.8% and 6.4% respectively. The different pattern of response rates suggests that the effect of the incentive depends on the location of the respondent relative to the researcher.

Table 14: First Mailing Gross Response Rates By Incentive Size and City.

Incentive	Wichita	Los Angeles	Both Cities
$0 Group	35.6%	6.4%	21.0%
$1 Donation to the Red Cross	30.0%	8.8%	19.4%
$3 Donation to the Red Cross	27.2%	10.0%	18.6%
$5 Donation to the Red Cross	32.0%	10.8%	21.4%

Effect of Incentive on Response Rates for the Second Mailing

A total of 1556 questionnaires were sent in the second mailing to the non respondents from the first mailing. The incentives in the 2nd mailing were as follows: 50%-no incentive, 25%-$1 cash incentive, and 25%-$2 cash incentive. Table 15 shows the results for the second mailing by incentive with more detailed results in Appendix D. The highest GRR was found with the $2 incentive at 24.6%, followed by the $1 incentive at 18.8%, while the no incentive generated a GRR of only 7.9%. In Wichita, the highest GRR in the second mailing was 30.6% with the $2 incentive, followed by the $1 group at 25.9%, and the no incentive group at 11.5%. In LA the highest GRR of the second mailing was also for the $2 group with 20%, followed by the $1 group with 13.2%, and 4.7% for no incentive group. The pattern in response rates suggests that including a monetary incentive in the second mailing has a positive effect on response rates.

Table 15: Second Mailing Gross Response Rates by Incentive Size by City

Incentive	Wichita	Los Angeles	Both Cities
$0	11.5%	4.7%	7.7%
$1	25.9%	13.2%	18.8%
$2	30.6%	20.0%	24.6%

Survey Costs

The first mailing for this study contained 2,000 and the second contained 1,554 questionnaires. The first mailing included four incentive groups while the second mailing three incentive groups, Table 7. Appendix E presents the data on the cost of the survey. The following equation was used to estimate total costs:

$$TC = \sum_{i=1}^{4} I_{1i} \times RE + \sum_{j=1}^{3} I_{2j} \times MAI + \sum_{M=1}^{2} PO_M \times MAI_M + \sum_{M=1}^{2} MAT_M \times MAI_M \qquad (4)$$

where: $i = i$th incentive for the First Mailing
$j = j$th incentive for the Second Mailing
$M = M$ mailing
RE = Number of questionnaires completed (received) in the first mailing
MAI = Number of questionnaires mailed in the second mailing
PO = Postage Costs
MAT = Material Costs

The total cost for the study was $7,916, which given the 622 responses results in an average cost per response of $12.73. The cost was also estimated if households could not be identified, that is if the follow-up mailing was sent to all 2,000 households in the sample. Households were identified using a barcode system, which produced $1,149 in savings. For both mailings, incentive costs were $1,953, which is 24.7% of the total cost. The largest cost of the survey was postage, which represented 43.5% of the total cost. A total of $34 dollars was returned: $16

from undeliverable questionnaires and $18 from people who mailed back the incentive along with the answered questionnaire or returned the questionnaire unanswered.

Cost Per Response

Cost per response (CPR) was estimated by dividing total cost and number of respondents. Cost and cost per response[6] for each of the 80 groups in the first mailing were estimated. The average cost per response for the first mailing was $17.74, with $9.87 for Wichita and $26.24 in LA, Table 16. Cost and cost per response[7] for each of the 240 sub groups in the second mailing were also estimated. The average cost per response in the second mailing was $11.97, with $10.29 for Wichita and $14.28 in LA. The overall cost per response was estimated by using the following equation:

$$\text{CPR} = \frac{\text{Total Cost}}{\text{Total Number of Responses}}$$

where the total number of responses for each subgroup was estimated by using the method as described in Table 11. Overall average cost per response was $22.50, with $11.08 in Wichita and $34.31 in LA. Postcard cost per response was estimated by dividing postcard cost by total number of respondents. The average postcard cost per response was $1.77, with $0.80 in Wichita and $1.77 in LA.

[6] Three observations were not included since they had zero respondents.
[7] Ninety seven observations were not included since they had zero respondents.

Table 16: Average Cost Per Response.

	Wichita	LA	Both Cities
First Mailing	$9.87	$26.24	$17.74
Second Mailing	$10.29	$14.26	$11.97
Overall	$11.08	$34.31	$22.50
Postcard	$0.80	$2.74	$1.77

Respondent Characteristics

Respondents' characteristics are summarized in Table 17. As expected more females responded to the survey since the survey asked for the person most responsible for the households grocery shopping. Three interesting observations about the sample are: (a) that 61.3% of the respondents are 50 years or older, (b) that 66.2% of respondents' live in households with one or two people, and (c) that 77.6% of respondents have some college education or more. The median age for the US population is 35.3 and the average age for the respondents in this study was 55.4 years. Because the study focuses on adults we expect the average age to exceed that of the entire population. Average household size is 2.59 in the US, 2.83 and 2.44 in LA and Wichita respectively, thus the sample appears to be reasonably representative. The sample also appears reasonably balance with regard to ethnicity but is under representative of the Hispanic group, which maybe due to a language barrier[8]. In addition, the sample also appears to be reasonably balance regarding household income.

[8] A Hispanic household called the Department of Agricultural Economics asking about the purpose of the letter, this household thought that the letter was from US Immigration Service and was a deportation notification.

Table 17: Respondents Characteristics

Characteristic	Description	Number of Respondents	Percentage within group
Gender	Male	230	37.8%
	Female	379	62.2%
Age	Less than 21	2	0.3%
	21-30	33	5.6%
	31-40	85	14.4%
	41-50	108	18.3%
	51-60	146	24.7%
	More than 60	216	36.6%
Race Ethnicity	White	475	78.6%
	Black, African American	51	8.4%
	Native American	10	1.7%
	Hispanic	40	6.6%
	Asian	19	3.1%
	Other	9	1.5%
Education	Some high school	27	4.5%
	High school graduate	108	17.9%
	Some college	166	27.5%
	College graduate	180	29.9%
	Post graduate	122	20.2%
Household Size	1	168	27.3%
	2	239	38.9%
	3	91	14.8%
	4	70	11.4%
	5	31	5.0%
	More than 6	16	2.6%
Income	Less than $20,000	69	12.1%
	$20,000 up to $30,000	62	10.8%
	$30,000 up to $40,000	75	13.1%
	$40,000 up to $50,000	64	11.2%
	$50,000 up to 70,000	91	15.9%
	$70,000 up to 100,000	88	15.4%
	$100,000 up to 150,000	79	13.8%
	more than $150,000	44	7.7%

CHAPTER 1.7. - Analysis of Response Rates

Two thousand questionnaires were mailed, half in Wichita Kansas and the other half in Los Angeles, California. The incentive in the first mailing consisted of a promise to pay a donation to the Red Cross. A cash incentive was used in the second mailing. Using SAS 9.1., OLS regressions were run to estimate the effects of various factors on the response rate for the first and second mailings.

First Mailing Response Rate

The dependent variable for the following models is the response rate for the first mailing, for each of the 80 categories or groups as described in Table 7

. The following regression was used to model response rate in the first mailing for each city, Wichita and Los Angeles (LA):

$$RR1_i = b_0 + b_1\,PC + b_2\,DRC1 + b_3\,DRC3 + b_4\,DRC5 + b_5\,PAGES + e \quad (5)$$

where: $RR1_i$ = First Mailing Response Rate for the *i*th city
DRC1 = Promise to pay donation to the Red Cross of $1
DRC3 = Promise to pay donation to the Red Cross of $3
DRC5 = Promise to pay donation to the Red Cross of $5
PAGES = Number of Pages

Table 18 presents the descriptions of the independent variables used in the regression models. A model that included both cities and the interaction between the incentives, postcard, and the number of pages with the dummy variable for Wichita is as follows:

$$RR1 = b_0 + b_1\,PC + b_2\,WICHITA + b_3\,DRC1 + b_4\,DRC3 + b_5\,DRC5 + b_6\,PAGES + b_7\,WICHCARD + b_8\,WICHRC1 + b_9\,WICHRC1 + b_{10}\,WICHRC5 + b_{11}\,WICHPGS + e \quad (6)$$

where: RR1 = First Mailing Response Rate
WICHCARD = Interaction between Wichita and postcard
WICHCRC1 = Interaction between Wichita and $1 donation to the Red Cross
WICHCRC3 = Interaction between Wichita and $3 donation to the Red Cross
WICHCRC5 = Interaction between Wichita and $5 donation to the Red Cross
WICHCPGS = Interaction between Wichita and number of pages

Table 18: Variable Description for Response Rates Regression Analysis

Variable	Variable Description
PC	Postcard Dummy 1 = Sent a postcard prior to the survey 0 = No postcard was sent
DRC1	Promise to pay donation to the Red Cross of $1 1 = if donation was included 0 = otherwise
DRC3	Promise to pay donation to the Red Cross of $3 1 = if donation was included 0 = otherwise
DRC5	Promise to pay donation to the Red Cross of $5 1 = if donation was included 0 = otherwise
PAGES	Number of Pages (5, 6, or 7)
WICHITA	Dummy Variable for Wichita 1 = Wichita 0 = Los Angeles
ONEDOLLAR	Second Mailing Incentive of $1 1 = if $1 bill was included 0 = otherwise
TWODOLLARS	Second Mailing Incentive of $2 1 = if $2 were included 0 = otherwise
WICHCARD	Interaction between Postcard and Wichita
$WICHRCP_j$	Interaction between Wichita and j th promise to pay donation to the Red Cross j = 1,3, and 5 dollar donation
WICHPGS	Interaction between number of pages and Wichita
WICHONE	Interaction between one dollar and Wichita
WICHTWO	Interaction between two dollars and Wichita

Individual Models

Results for regressions from equation (5) and (6) are shown in Table 19. The R^2 for the Wichita and LA regression models were 35.0% and 20.3% respectively.

Incentives

Results showed that for Wichita the incentive had a negative effect on the response rate while in Los Angles it had a positive effect. Results for Wichita are not in accordance with the literature while results for LA are in accordance with Church (1993), and Angur and Nataraanjan (1995) who found a positive effect of monetary incentives and response rates. In Wichita, for example, response rate for the zero incentive groups was, in some cases, higher than that for the groups that received incentives. Incentive cost effectiveness will be discussed later in the cost section.

In the Wichita model, the only statistically significant coefficient was the promise to pay a donation to the Red Cross of $3 (a negative effect) while the $5 promise to pay donation to the Red Cross was the only significant incentive in Los Angeles. The promise to pay a donation of $3 in Wichita is predicted to decrease response rate by 8.4%. In LA response rates are predicted to increase by 2.4%, 3.6%, and 4.4% for promises to pay $1, $3, and $5 to the Red Cross.

Postcard and Number of Pages

The inclusion of a postcard prior to the survey had a positive and statistically significant effect on response rate for both cities. Thus, use of a postcard increases the response rate by 9.6% in Wichita and 3.2% in Los Angeles, *ceteris paribus*. There results are in accordance with Lynsky (1975); Fox, Crash, and Kim (1988); Yammarino, Skinner, and Childers (1991) who found that

sending a postcard prior to the survey had a positive effect on response rates. Analysis of the cost effectiveness of a postcard would be discuss later in the cost section.

The length of the questionnaire did not have a statistically significant effect on the response rate for either city but the negative effect is in accordance with Yammarino, Skinner, and Childers (1991); Greer, Chuchinprakarn, and Seshadri (2000); and Hager, Wilson, Pollak and Rooney (2003) who found that there is a negative relationship between questionnaire length and response rates. The coefficient suggest that as the number of pages increases by one response rates would decrease by 1.3% and 0.5% in Wichita and LA respectively, *ceteris paribus*.

Table 19: First Mailing Regression Results[9]

Variable	By City		Joint[10]
	Wichita	Los Angeles	
Intercept	0.390***	0.081	0.081
	(0.116)	(0.068)	(0.095)
WICHITA	-	-	0.309**
	-	-	(0.134)
PC	0.096***	0.032*	0.032
	(0.027)	(0.016)	(0.022)
DRC1	-0.056	0.024	0.024
	(0.038)	(0.022)	(0.031)
DRC3	-0.084**	0.036	0.036
	(0.038)	(0.022)	(0.031)
DRC5	-0.036	0.044*	0.044
	(0.038)	(0.022)	(0.031)
PAGES	-0.013	-0.005	-0.005
	(0.018)	(0.011)	(0.015)
WICHCARD	-	-	0.064**
	-	-	(0.031)
WICHRC1	-	-	-0.080*
	-	-	(0.044)
WICHRC3	-	-	-0.120***
	-	-	(0.044)
WICHRC5	-	-	-0.080*
	-	-	(0.044)
WICHPGS	-	-	-0.008
	-	-	(0.021)
R^2	0.3546	0.2035	0.7736
Adj. R-Sq	0.2372	0.0587	0.7369
F Value	3.0200**	1.4100	21.120***

Standard Errors are in parenthesis
*, **, and *** are significant at the 10%, 5%, and 1% respectively.

[9] To keep response rates bounded between zero and one, a logit regression was ran, and marginal effects were also estimated, Appendix F. Neither coefficients nor marginal effects were significant. The intercept and WICHPAGES had different signs from the OLS estimates. All marginal effects were different from the OLS estimates.
[10] RR1 hat was estimated for each observation, RR1 hat $\in (0, 1)$.

Joint Model

The model containing the responses from LA and Wichita had a R^2 of 77.4%. The dummy variable representing Wichita was positive and statistically significant indicating a 30.9% higher response rate for Wichita compared to LA in the first mailing, *ceteris paribus*.

Incentives

The interaction effect between location and incentive indicated how the effect of the incentive differs between the two locations. Thus, results showed that the difference between Wichita and LA for the $1 and $5 dollar donations was 8% and a 12% for the $3 donation.

Postcard and Number of Pages

The interaction variable between postcard and Wichita was significant and positive, indicating the highest level of effectiveness of the post card for the in state versus out of state respondents. The interaction variable between length of the questionnaire and Wichita was not significant indicating no significant differences between the two locations in terms of the effect of survey length.

Second Mailing Response Rate

Approximately three weeks after the initial mailing of the survey instrument, the instrument was re-mailed to the non respondents. As described in Table 7, cash incentives were included in the second mailing, with twenty five percent of non respondents receiving a $1 bill, another twenty five percent receiving $2, and fifty percent of the non respondents not receiving any incentive. A total of 1,554 questionnaires were mailed for the second mailing.

The dependent variable for this model is response rate for the second mailing, i.e. completed questionnaires divided by questionnaires sent (GRR), as described in Table 10. The independent variables used to explain the dependent variable are described in Table 18. There were 240 observations given that every incentive group from the first mailing was divided into three categories, no incentive, one dollar, and two dollars. The following regression was used to model the second mailing response rate for each city:

$$RR2_i = b_0 + b_1\,PC + b_2\,ONEDOLLAR + b_3\,TWODOLLARS + b_4 PAGES + e \qquad (7)$$

where: $RR2_i$ = Second Mailing Response Rate for *i*th city

Similar to the analysis done for the initial mailing, response rate models were estimated separately for each city, then jointly. Results are shown in Table 20.

Individual Models

The R^2 value is similar for both cities 13.6% for Wichita and 13.3% for LA. As with the first mailing, individuals in Wichita responded a higher rate than those in LA. The difference, however, was not statistically significant.

Incentives

The cash incentives had a positive and significant effect on the response rate in both cities. In Wichita the $1 incentive increased the response rate by 16.1%, and the $2 incentive increased the response rate by 18.5% compared to the baseline, zero incentive. In LA, the corresponding increases were 8.1% and 14.9% respectively. To our knowledge this is the first study that examines the effect of an incentive with a second mailing, thus these results cannot be compared with previous studies. However, the positive effect on response rates is consistent with results in

the literature (e.g., (Armstrong (1975); Jobber and Saunders (1988); James and Bolstein (1990, 1992); Church (1993); Armstrong and Yokum (1994); and Weeler, Lazo, Heberling, Fisher, and Epp (1997)).

Postcard and Number of Pages

The inclusion of a postcard before the first mailing of the survey and the number of pages of the questionnaire was positive and not statistically significant for the second mailing response rate of both cities. The insignificant effect of the postcard is not surprising since the postcard was sent before the first mailing.

The length of the questionnaire did not have a significant effect for either city, having in Wichita, a negative effect while in LA a positive effect. Wichita's negative effect is in accordance with Yammarino, Skinner, and Childers (1991); Greer, Chuchinprakarn, and Seshadri (2000); and Hager, Wilson, Pollak and Rooney (2003) who found that there is a negative relationship between questionnaire length and response rates. As the number of pages increases in Wichita the response rate is predicted to decrease by 1.7% while in LA it is predicted to increase by 0.9%, *ceteris paribus*.

Joint Model

The joint model containing second mailing response rates for both LA and Wichita had a R^2 of 18.7%. In this model only the incentive variables were significant, $1 at the 10% significance level and $2 at 5% significance level. Interaction terms were insignificant indicating no significant differences between the two locations. Sending an incentive of $1 to Wichita will increase response rates by 16.0% and 8.1% in LA, *ceteris paribus*. In addition, sending $2 incentive will increase response rates by 18.5% and 14.9% for Wichita and La respectively.

Table 20: Second Mailing Regression Results[11]

Variable	By City		Joint[12]
	Wichita	Los Angeles	
Intercept	0.199	-0.020	-0.020
	(0.170)	(0.127)	(0.150)
WICHITA	-	-	0.219
			(0.212)
PC	0.034	0.024	0.024
	(0.040)	(0.030)	(0.035)
ONEDOLLAR	0.161***	0.081*	0.081*
	(0.049)	(0.036)	(0.043)
TWODOLLARS	0.185***	0.149***	0.149***
	(0.049)	(0.036)	(0.043)
NPP	-0.017	0.009	0.009
	(0.027)	(0.020)	(0.024)
WICHCARD	-	-	0.011
			(0.050)
WICHONE	-	-	0.080
			(0.061)
WICHTWO	-	-	0.036
			(0.061)
WICHPGS	-	-	-0.026
			(0.033)
R^2	0.1359	0.1331	0.1869
Adj. R-Sq	0.1059	0.1029	0.1551
F Value	4.5200***	4.4100***	5.8700***

Standard Errors are in parenthesis
*, **, and *** are significant at the 10%, 5%, and 1% respectively.

[11] To keep response rates bounded between zero and one, a logit regression was ran, and marginal effects were also estimated, Appendix F. The only significant variable was TWODOLLARS for both coefficient and marginal effect. In addition, the variables WITWO and WICHPC had different signs from the OLS. All marginal effects were different from the OLS estimates.

[12] RR2 hat was estimated for each observation, RR2 hat $\in (0, 1)$.

Total Response Rate

OLS regressions were run to estimate the effects of both incentives on total response rate. The dependent variable is the total response rate as estimated in the final column of Table 11. The following equation was used to model total response rate:

$$\begin{aligned} TRR = {} & b_0 + b_1\, ZO + b_2\, ZT + b_3\, OZ + b_4\, OO + b_5\, OT + b_6\, THZ + b_7\, THO + \\ & b_8\, THT + b_9\, FZ + b_{10}\, FO + b_{11}\, FT + b_{12}\, NPP + b_{13}\, PC + \\ & b_{14}\, WICHITA + e \end{aligned} \qquad (8)$$

Table 18 presents the description of the independent variables used in the regression model. Regression results for equation (8) are shown in Table 22. The R^2 was 51% and the model has a significant F value at the 1% level with a value of 16.72.

Incentives

Results showed that combinations of incentives had a positive effect on response rates. Only two cases in the model had a negative effects, \$1-\$0 and \$3-\$0[13]. Thus, if the \$1-\$0 incentive combination is used then total response rate will decrease by 1.1% and 1.7% if \$3-\$0 is used, *ceteris paribus*. Five incentive combinations were significant, three at the 5% level and 2 at the 1% level. The \$1-\$2 and \$5-\$2 incentive combinations were statistically significant at the 1% level, and \$0-\$1, \$0-\$2, and \$5-\$1 at the 5% level. Compared to the baseline, \$0-\$0 incentive, if the \$1-\$2 combination is used then total response rate will increase by 13%, and 18.8% if \$5-\$2 is used, *ceteris paribus*. Furthermore, compared to the baseline, \$0-\$0 combination, if \$0-\$1 combination is used the total response rate will increase by 9.6%, 9% for \$0-\$2, and 11.3% for \$5-\$1 combinations, *ceteris paribus*.

[13] Note that the first mailing incentive was a promise to pay donation to the Red Cross.

Postcard and Number of Pages

The postcard and Wichita variables were also significant at the 1% level. For example if a consumer survey of 5 pages, with a postcard sent prior to the survey, in Wichita will result in a total response rate of 54.4%, 53.8%, 57.8%, 56.1%, and 63.6% for the $0-$1, $0-$2, $1-$2, $5-$1, and $5-$2 incentive combinations respectively. For LA if a consumer survey of 5 pages, with a postcard sent prior to the survey will result in a total response rate of 27.8%, 27.2%, 31.1%, 29.4%, and 37.0% for the $0-$1, $0-$2, $1-$2, $5-$1, and $5-$2 incentive combinations respectively. Those response rates will decrease by 1% if the number of pages increases by one, *ceteris paribus*. Higher response rates will result if a postcard is sent before the survey with an increase of 7.2%, *ceteris paribus*.

Table 21: Variables and Variable Description in the Total Response Rate Model

Variable	Description
ZO, $0-$1	1 = If First Mailing Incentive of $0 and Second Mailing Incentive of $1 0 = otherwise
ZT, $0-$2	1 = If First Mailing Incentive of $0 and Second Mailing Incentive of $2 0 = otherwise
OZ, $1,-$0	1 = If First Mailing Incentive of $1 RC and Second Mailing Incentive of $0 0 = otherwise
OO, $1-$1	1 = If First Mailing Incentive of $1 RC and Second Mailing Incentive of $1 0 = otherwise
OT, $1-$2	1 = If First Mailing Incentive of $1 RC and Second Mailing Incentive of $2 0 = otherwise
THZ, $3-$0	1 = If First Mailing Incentive of $3 RC and Second Mailing Incentive of $0 0 = otherwise
THO, $3-$1	1 = If First Mailing Incentive of $3 RC and Second Mailing Incentive of $1 0 = otherwise
THT, $3-$2	1 = If First Mailing Incentive of $3 RC and Second Mailing Incentive of $2 0 = otherwise
FZ, $5-$0	1 = If First Mailing Incentive of $5 RC and Second Mailing Incentive of $0 0 = otherwise
FO, $5-$1	1 = If First Mailing Incentive of $5 RC and Second Mailing Incentive of $1 0 = otherwise
FT, $5-$2	1 = If First Mailing Incentive of $5 RC and Second Mailing Incentive of $2 0 = otherwise

Table 22: Total Response Rate Results.

Variable	Coefficient	Standard Error	t-value
Intercept	0.161*	(0.090)	1.789
ZO, $0-$1	0.096**	(0.048)	2.000
ZT, $0-$2	0.090*	(0.048)	2.250
OZ, $1,$0	-0.011	(0.048)	-0.229
OO, $1-$1	0.046	(0.048)	0.833
OT, $1-$2	0.130***	(0.048)	2.708
THZ, $3-$0	-0.017	(0.048)	-0.354
THO, $3,-$1	0.074	(0.048)	1.542
THT, $3-$2	0.079	(0.048)	1.646
FZ, $5-$0	0.007	(0.048)	0.146
FO, $5-$1	0.113**	(0.048)	2.354
FT, $5-$2	0.188***	(0.048)	3.917
NPP	-0.010	(0.013)	-0.769
PC	0.072***	(0.020)	3.600
WICHITA	0.267***	(0.020)	13.350
R^2	0.510		
Adj. R-Sq	0.480		
F Value	16.72***		

*, **, and *** are significant at the 10%, 5%, and 1% respectively.

This model shows the response rate achieved by alternative combinations of incentives. Given that researchers have limited resources one must look how to maximize response rates given the budget for the survey. The following section examines which incentive in the first mailing achieves the lowest cost per response.

CHAPTER 1.8. - Analysis of Survey Costs

Results from the first mailing showed that the highest response rate for Wichita was associated with the no incentive group. In LA, the highest response rate was achieved using the $5 promise to pay donation to the Red Cross. Now we must ask the question: is this incentive within the researcher's budget? Thus, we need to determine which is the most cost/effective incentive or the incentive that would result with higher response rates at lowest cost and within the researcher's budget.

An OLS regression was run to estimate the effect of various factors on cost per response (CPR) in the first mailing[14]. The dependent variable for the model was CPR for the first mailing. The independent variables used in the model are described in Table 21. The following regression was used to model CPR for the first mailing:

$$\begin{aligned} CPR = {} & b_0 + b_1\,PC + b_2\,WICHITA + b_3\,DRC1 + b_4\,DRC3 + b_5\,DRC5 + \\ & b_6\,PAGES + b_7\,WICHCARD + b_8\,WICHRC1 + b_9\,WICHRC1 + \\ & b_{10}\,WICHRC5 + b_{11}\,WICHPGS + e \end{aligned} \qquad (9)$$

Results for equation (9) are presented in Table 23. The R^2 for this model was 50% and a significant F-test at the 1% level. None of the variables were statistically significant. Results showed that in Wichita the CPR is predicted to decrease by $12.14 while in LA is predicted to increase by $17.93.

[14] Three observations were not included in the model since the group had no respondents.

Incentives

Results showed the interaction terms for all incentives were insignificant, which indicates that there is no significant difference between the locations. Results also showed that when using a promise to pay donation to the Red Cross of $3 the cost per response in LA is predicted to decrease by $2.52 compared to the non incentive group. However in Wichita, the promise to pay donation predicted an increase cost per response by $5.48. The promise to pay donation of $1 and $5 to the Red Cross predicted an increase cost per response for both cities.

Table 23: First Mailing Cost Per Response Regression Results.

Variable	Coefficient	Standard Error	t-value
Intercept	17.931	13.650	1.31
WICHITA	-12.138	18.651	-0.65
PC	-3.207	3.089	-1.04
DRC1	0.637	4.623	0.14
DRC3	-2.524	4.623	-0.55
DRC5	0.837	4.623	0.18
PAGES	1.655	2.115	0.78
WICHCARD	0.339	4.279	0.08
WICHRC1	4.929	6.238	0.79
WICHRC3	8.004	6.238	1.28
WICHRC5	4.518	6.238	0.72
WICHPGS	-1.427	2.896	-0.49
R^2	0.499		
Adj. R-Sq	0.414		
F Value	5.89***		

*, **, and *** are significant at the 10%, 5%, and 1% respectively.

Postcard and Number of Pages

The interaction terms between location and both postcard and pages were insignificant, thus no significant difference between the two locations. Results showed that when a postcard is sent prior to the survey, there is a negative effect on CPR for both cities. However, the CPR is predicted to decrease by $2.87 in Wichita and $3.21 in LA. The number of pages had a positive effect on CPR. Therefore, if the number of pages increases by one, then the CPR is predicted to increase by $0.23 in Wichita and $1.66 in LA.

CHAPTER 1.9. - Conclusion

This study examined how a consumer mail survey can be optimized by obtaining a valid set of responses and inferences at a minimal cost. A consumer mail survey was sent to two thousand households half to Wichita, Kansas and the other half to Los Angeles, California. Two mailings were conducted, the first included four different incentives: no incentive, and a promise to pay donation to the Red Cross of $1, $3, and $5. The second mailing included three different incentives: no incentive, one dollar bill and two dollars.

Results showed that response rates for mail surveys can be optimized by choosing different types and size of incentives while satisfying the budget. A positive effect on response rates and a negative effect on cost per response were achieved from sending a postcard a few days prior to the survey. Thus, we suggest sending a postcard prior to the survey given that our results indicate that response rates will increase and CPR will decrease. Results showed that response rates were higher for Wichita than for LA. One explanation for this may be due to the fact that Wichita residents might identify themselves with Kansas State University. These results suggest that there might a local effect to response rates, that is the city within the school state resulted in a higher response rate than the out of state city. Further research should be done to examine if this local effect does exist.

In addition, incentives in the first mailing, a promise to pay donation, had a negative effect on response rates in Wichita and a positive effect in LA. Thus, this result suggests that the local effect might washout the effect of the incentive. Furthermore, results suggested that a promise to pay donation will increase cost per response in the first mailing for both cities with exception of the $3 donation in LA. Further research should be done to examine if the local

effect washes out the promise to pay donation incentive and examine the effect of the incentive on CPR.

Results showed that the use of a monetary incentive in the second mailing had a positive effect for both cities. This study did not examine the effect of these incentives on CPR but additional research should be done to examine this effect and the effect of the incentive combinations on total response rate.

These results can be useful to researchers that use consumer mail surveys and would like efficiently allocate their resources and achieve higher response rates by decreasing their costs. The second article of this study examined if those additional responses from the follow-up mailing would change the results and analysis. Thus, the study would attempt to validate the second mailing costs.

ESSAY 2. INFLUENCES ON RESPONSE RATES AND THE IMPACT OF RESPONSES TO A SECOND MAILING

CHAPTER 2.1. - Introduction

The issue of food safety has been a concern for consumers in recent years, particularly since the early 1990's outbreak of each related food poisoning associated with the Jack-in-the-Box restaurant chain and the emergence of Bovine Spongiform Encephalopathy (BSE) or mad cow disease and its link with the human form Creutzfeld-Jakob Disease (CJD). More recently, an *E. coli* outbreak in the US linked to contaminated spinach (September, 2006), some large recalls of bad products due to *E. coli* contamination, and the issue of Avian Influenza may have contributed to those concerns.

In 2000, medical costs, productivity losses and the costs of premature deaths caused by five bacterial foodborne pathogens in the US totaled $6.9 billion (USDA/ERS, 2007, a). Table 24 summarizes the number of cases, hospitalization, deaths, and costs for selected foodborne bacteria for 2000. In 2002 there were 42 deaths in the US due to *Escherichia coli* with $1 billion in associated costs (USDA/ERS, 2007, a). Other countries including England, Wales, Ireland, and Germany have also experienced increasing numbers of cases of foodborne diseases (Käferstein and Moy, 1993). Those authors reported that around 3.5 million deaths of children under the age of 5 worldwide are associated with microbial contamination of food, mainly in developing countries.

In 2003 there were around 45 million Americans under the age of 65 without health insurance, an increase of 5 million since 2000, were 65% of these uninsured people are low-income families and over 80% of the uninsured come from working families (Kaiser Family Foundation, 2004). Nayga cited Viscusi, Magat and Huber who found that households facing

larger health risks were more likely to undertake protective actions (Nayga, 1996). Thus, individuals without health insurance should be more likely to buy safer food products.

Table 24: Estimated annual costs in US due to selected foodborne illnesses, 2000

Pathogen	No. of Cases	Hospitalizations	Deaths	Costs (billion dollars)
Campylobacter spp	1,963,141	10,539	99	1.2
Salmonella	1,341,873	15,608	553	2.4
Escherichia coli O157	62,458	1,843	52	0.7
Escherichia coli, STEC	31,229	921	26	0.3
Listeria monocytogenes	2,493	2,298	499	2.3
Total	**3,401,194**	**31,209**	**1,229**	**6.9**

Source: USDA/ERS (2007, a)

The 2006 *E. coli* Outbreak Linked to Spinach

According to the USDA, the US is the second largest producer of spinach, with 3% of the world output. In 2005 production of fresh spinach reached a record of 680 million pounds (USDA/ERS, 2005). Consumption of fresh spinach has been increasing in the US where cello-packed spinach and baby spinach are the fastest growing segments of the packed salad industry (Lucier, Allshouse and Lin, 2004). Figure 3 shows spinach production, imports and exports in the U.S. from 1990 to 2007. Since 1990's spinach production had been increasing up to the year 2005, with a slight decrease in 2006 attributed to the *E. coli* outbreak. A slight increase in production occurred in 2007. In the mid 1990's spinach exports in the U.S. slowly increased reaching a maximum in 2003. After 2003 spinach exports decrease up to 2007. Furthermore, spinach imports have had an increasing trend since 1999 up to 2005. A slight decrease in spinach imports occurred for 2006 and a slight increase in 2007.

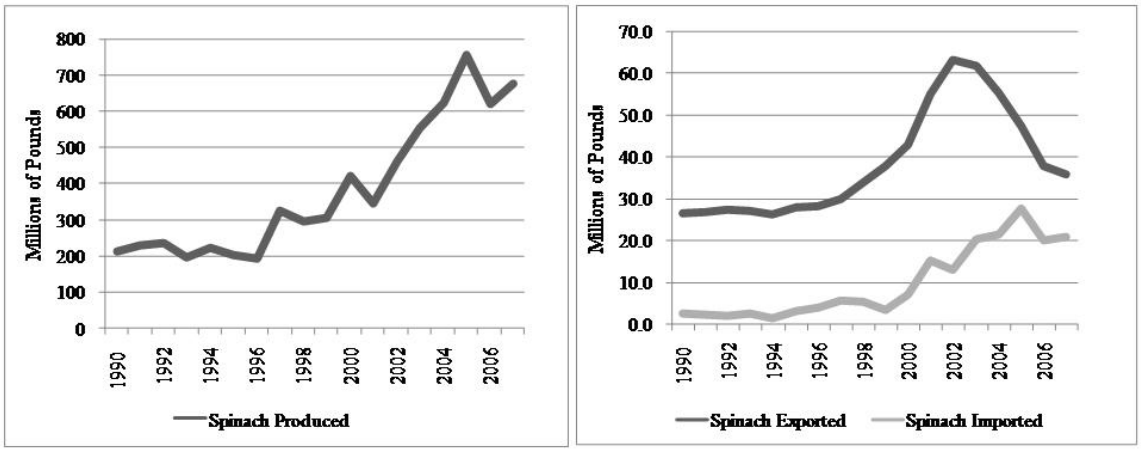

Figure 3: Production, Exports and Imports of Fresh Spinach in the U.S, 1990-2007.
Source: ERS, USDA: Vegetables and Melons Outlook, 2007.

The U.S is also the world's second largest producer of lettuce with 21 percent of global production. China is the largest producer with 48 percent, with Spain in third place with 5 percent (ERS Vegetables and Melons Outlook, 2005). Production of fresh romaine and leaf lettuce in the U.S has been increasing since 1990, while production of fresh head lettuce has been slowly declining, (Figure 4). U.S. exports of romaine and leaf lettuce have been also increasing since 1990 while exports of head lettuce have gradually declined for the same period.

The significant decrease in production and exports of both spinach and lettuce in the U.S during 2006 can be attributed to an *E. coli* outbreak. There were two outbreaks in the U.S during that year, the first associated with Dole Brand Baby Spinach and later in the same year an outbreak related to Taco Bell restaurants. The 2006 *E. coli* outbreak from spinach made 205 people ill and resulted in 3 death, while the Taco Bell *E. coli* outbreak made 71 people ill and led to no reports of deaths (FDA, 2007 and CDC, 2006).

The U.S. Food and Drug Administration (FDA) determined that the outbreak originated from one farm field while CDC, FDA, and USDA determined that the possible source of the outbreak in Taco Bell was caused by the lettuce. FDA listed three factors that could have caused

E. coli contamination of fresh spinach in that field: a) the presence of wild pigs near the fields, b) the proximity of irrigation wells used to grow produce for ready to eat packaging, and c) waterways exposed to feces from cattle and wild life. In April 2007, 99 % of leafy greens handlers signed an agreement to handle products only from producers who follow a set of Best Practices and use a traceback system (Calvin, 2007).

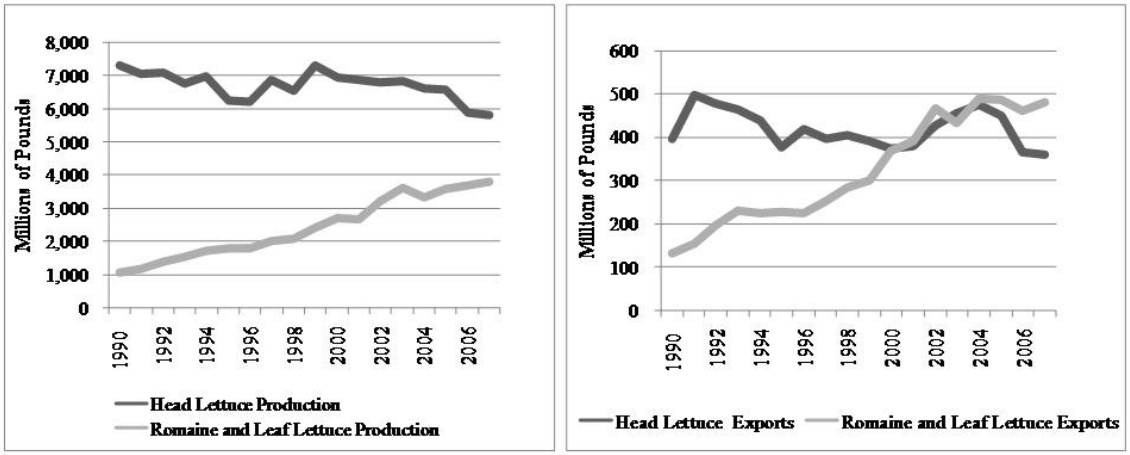

Figure 4: Production and Exports of Fresh Head Lettuce, Romaine and Leaf Lettuce in the U.S, 1990-2007.
Source: ERS, USDA: Vegetables and Melons Outlook, 2007.

Irradiated Products

Food irradiation is one of many alternatives that can be used to prevent foodborne illnesses. Irradiation is a process that exposes products to a source of electromagnetic energy. The process kills microbial pathogens and can extend the shelf life of food products by delaying ripening and spoilage (Buzby and Morrison, 1999). Irradiation does not change the nutritional value of foods (Lutter, 1999 and CDC, 2007). In 1997 the World Health Organization (WHO) concluded that irradiated food is safe and wholesome and nutritionally adequate (Lutter, 1999).

The FDA regulates irradiated food products in the U.S. Food products currently approved by the FDA for irradiation treatment include fresh pork, dry enzyme preparations, dry

spices/seasonings, poultry, frozen meats (for NASA), refrigerated meat, and frozen meat where each food product has a specific dose of irradiation (Morehouse, 2007). Two different technologies can be used to irradiate food - electro beam which work on the same principle as a TV tube and gamma rays produced by radioactive cobalt-60 or cesium-137 isotopes.

Consumers' reaction to new technologies that make food safer has typically been negative when the technology is first introduced. For example, when milk pasteurization was firstly introduced it was not immediately accepted (Käferstein and Moy, 1993). Even with all benefits that irradiation might offer consumers, as well as producers, this technology is not viewed favorably by consumers. Most consumers have never seen irradiated products in their local grocery thus consumer acceptance is yet to be tested (Frenzen et. al., 2000).

The purpose of this study is to determine consumer's knowledge and acceptance of irradiated food products, specifically irradiated salad greens. Most prior studies on acceptance of irradiated foods have been done on meats (Malone, 1990; Fox, and Olson, 1998; Frenzen, et. al., 2001; Wolfe, Huang, and McKissick, 2004; He, Fletcher, and Rimal, 2005, b; Huang, Wolfe, and McKissick 2006; Nayga, Woodward, and Aiew, 2006; Rousu, and Shogren, 2006). This study examines the willingness to pay for irradiated salad greens and effect of socioeconomic and demographic variables on consumer acceptance. To our knowledge this is the first study to examined willingness to pay for irradiated salad greens.

Objectives

This study will examine whether the responses obtained in the second mailing of the survey cause any significant changes. Examine consumer willingness to pay for irradiated salad greens the relationship with sociodemographic variables. This study will determine consumer

knowledge and acceptance of irradiated foods and if the irradiation technology, gamma rays or e-beam matters.

The purposes of this study are: a) to examine whether the responses obtained from a 2nd mailing of a survey cause any significant changes in the results that would be referred from using only the responses to the first mailing; and b) examine consumer acceptance of food irradiation as a risk reducing technology and, in the content consumer mail survey. The particular question we examine is whether respondents would choose irradiated salad greens instead of the untreated conventional product, and how that choice is influenced by the irradiation technology – gamma ray or e-beam irradiation.

CHAPTER 2.2. - Literature

This section will summarize research studies that have been done on spinach consumption, acceptance and safety of irradiated foods. The studies are organized by topic and by year in chronological order.

Spinach Consumption Literature

Lucier, Allshouse and Lin (2004)

Lucier, Allshouse and Lin (2004) used data from three different sources: Food Supply and Utilization Data, Continuing Survey of Food Intakes by Individuals (CSFII), and Food Commodity Intake Database (FCID) to examine spinach consumption in the U.S. They found that in 1994 and in 1998; 87 percent of spinach consumption was at home while 80 percent of the home consumers purchased spinach in retail stores. They also found that, in 2002, consumers in the Northeast and West regions, with 3.33 and 2.97 pounds per capita respectively, consumed more spinach than the national average of 2.37 pounds per capita. Metropolitan and suburban areas consumed more spinach per capita than the national average of 2.37, with 2.47 and 2.60 pounds per capita respectively. The data also showed that women consumed more spinach than men, and that Asians consumed more spinach than the other races. The authors found a positive relationship between income and spinach consumption.

Calvin (2007)

Calvin (2007) examined the change in retail sales of bagged spinach, and bagged salads with or without spinach following the 2006 *E. coli* outbreak. During the period from August 2006 to February 2007 the value of retail sales of bagged spinach was 43 percent lower compared to the

previous year. Similarly, during January/February 2007 the value of retail sales of bagged spinach was 27 percent lower compared with the same period a year before indicating a modest recovery in sales compared to the period immediately after the outbreak. Salads that contained spinach showed a similar trend, reduction of 42 percent and 27 percent for August 2006 to February 2007 and January/February 2007 respectively. Retail sales of bagged salads without spinach were also affected by the *E. coli* outbreak, but not as much as those as containing spinach. Sales declined by 8 percent and 5 percent for August 2006 to February 2007 and January/February 2007 respectively.

Onyago, et. al. (2007)

Onyago, et. al. (2007) examined public perceptions of spinach food safety following the *E. coli* outbreak and recall in 2006. They conducted their survey by telephone to 1,200 consumers in the U.S. in 2006, obtaining 782 responses. They used logit regression to model food safety perception for bagged, loose, canned, and frozen spinach. Results for the bagged spinach model showed that knowledge about *E. coli,* white respondents and trust conventional farmers to ensure food safety had significant positive effects on food safety perception on fresh spinach while consumers of less than 54 years, with less than high school education, and income below $35k had significant negative effects. Results for the loose spinach model showed that knowledge about *E. coli,* trust USDA to ensure food safety, white respondents, and trust conventional farmers to ensure food safety had significant positive effects while consumers of less than 35 years, with an income below $35k, and skeptical of food companies to ensure food safety of the U.S. food supply had significant negative effects. Results for the canned spinach model showed that knowledge about *E. coli,* trust CDC to ensure food safety on the U.S. food supply, white, and females had significant positive effects while consumers with less than high

school education, with an income below $35k, and skeptical of food companies to ensure food safety of the U.S food supply have significant negative effects. And results for the frozen spinach model showed that people that correctly identified the symptoms for *E. coli* illness, trust USDA to ensure food safety on the U.S food supply, and respondents that were white had significant positive effects while consumers with less than 54 years of age, less than high school education, income below $35k, and skeptical that the government ensures food safety of the U.S food supply have significant negative effects.

Irradiated Foods Literature

Bruhn and Noell (1987)

Bruhn and Noell (1987) conducted study on consumers' acceptance of irradiated papayas from Hawaii. The study was performed in two store locations in California, one in an upscale neighborhood at Irvine and the other at a middle class neighborhood at Anaheim. The study presented respondents with two choices for papayas, irradiated (purchase ripe) and non-irradiated (purchase green and treated for pest control) and included a taste test was also perform. Results for both locations showed that consumers considered the ripe irradiated papaya more appealing than the green double-dipped papaya 80% and 65% for Irvine and Anaheim respectively.

Malone (1990)

Malone (1990) study evaluated socio-economic variables that determine consumer willingness to pay more and accept for the benefits of irradiated fresh food: reduction of microorganisms and extension of shelf life. The study was conducted in 1987 to 800 households. Results from the study showed that 54.4% of the respondents were not willing to purchased irradiated food, 36% were willing to buy and 9.6% were not sure. Among the reasons

not to buy such products are: they were considered harmful or dangerous (60.6%), do not know not enough information (36.7%), and products are not necessary (2.7%). Two models to estimate willingness to purchase irradiated food: one including sex, education and income, and the other included the previous variables plus irradiation knowledge. Results showed that all variables in the first model were statistically significant, but when knowledge of irradiation was included education and sex became statistically insignificant. Results also showed that 77.1% of people who have not heard of irradiation are not willing to buy these products, and 56.0% of those who heard of irradiation were not willing to purchase. When it comes to income, 62% of the people with 15 thousand dollars or less are not willing to buy these products, while 52% of the people ranging from $15 to $45 thousand are willing to buy, 46% with an income of more than $45 thousand are also willing to buy those products. They also showed that 62% of the females and 53% of the males are not willing to buy irradiated foods. Variables that were not significant to the model were: number of people in the household, number of people over the age of 21 in the household, employment status, marital status, age of consumer, race, and regional location of consumer residence.

Nayga (1996)

Nayga (1996) used data from DHKS from USDA to study the relationship between socioeconomic and demographic factors and consumer concern about food production practices that have been approved: irradiated foods, meat from animals that have been given antibiotics, meat from animals that have been given hormones, and foods that have been grown using pesticides. The socioeconomic and demographic variables included in the study are: presence of children under 18 years of age, race, sex, employment status of the main meal planner, city, residential area (non-metro), age, income, education, and residence region. Results showed that

sex, residential area (non-metro), income and education were statistically significant with positive effects on acceptance of irradiated food products at approved levels. Results showed that males, consumers that live in a non-metro area, more educated people, and more older people are more likely to buy irradiated food products.

Fox and Olson (1998)

Fox and Olson (1998) performed a mail survey, retail trial and a market experiment to measure potential demand for irradiated chicken. They use the mail survey to study meat and poultry purchases, socio-economic characteristics and knowledge of irradiated foods have an effect on irradiated poultry consumption at different prices (same price, 10% less than non-irradiated, 10% and 20% higher than the non-irradiated poultry). In the retail trial they place irradiated poultry into the grocery store, including information on irradiated food, and change the price of the irradiated poultry using the same prices that were asked in the mail survey. The market experiment consisted of providing information on irradiated food and they were ask about their preference for irradiated or non-irradiated poultry using the same prices of the previous studies. Their results for the survey experiment and market experiment had similar results, they showed that when the price of the irradiated poultry is 10% less than regular poultry, around 80% of the consumers are willing to buy them, for the retail trial around 60% are willing to buy them. Results from their mail survey showed that 55% of respondents have heard of irradiation before the survey, where 82.5% of those who heard of irradiation are willing to buy it, while 78.5% of those who did not hear about irradiation were willing to buy these products. When the price was the same for both products the survey on the market experiment showed that around 80% of the consumers are willing to buy irradiated poultry while the retail trial around 40% of the consumers were willing to buy the irradiated poultry. When the price of the

irradiated poultry was 10% higher results for all experiments around 35%-25% of consumers were willing to buy irradiated poultry while when the price was 20% higher around 15% were willing to buy irradiated poultry.

Buzby and Morrison (1999)

Buzby and Morrison (1999) review literature on food irradiation. The authors publish estimates by ERS concerning benefits and costs of irradiated ground beef. Results showed that if 25% of ground beef were irradiated at a cost of 1.6 cents per pound, the net social benefits will outweigh the industry cost having benefits ranging from $3.2 to $174 million per year. On the other hand if the industry cost is 5 cents per pound then the industry cost can outweigh the social benefits, this will depend on the level of social benefits. They estimated that the net benefits when the cost is 5 cents per pound range from -$57.5 to $113.8 million.

Frenzen, Majchrowics, Buzby, Imhoff, and FoodNet Working Group (2000)

Frenzen, Majchrowics, Buzby, Imhoff, and FoodNet Working Group (2000) gather different references and study the consumer acceptance for irradiated food products and manufacturer's willingness to produce irradiated products. CDC's Foodborne Diseases Active Surveillance Network (FoodNet) study consumer acceptance of irradiated meat and poultry products and estimated that 50% of the people are willing to buy irradiated products but only 25% will pay a premium for this product were only 48% of adults have ever hear about irradiated foods. The same survey showed that the most frequent reason for not buying irradiated products was because of insufficient information about food irradiation (35%) and concern about the safety of eating such products (22.7%). They found several studies that estimated capital costs of irradiated plants where e-beam plants that process 100 million pounds of meat are about $4.4 million, a gamma ray plant that process 220 million pounds range from $5.7 to $17 million. A

study from ERS estimated that operating costs for a plant that process 100 million pounds using e-beam range from $0.8 to $1.1 million and for gamma ray range from $0.9 to $1.1 million. The study also found that there are economies of scale for food irradiation systems. The authors stated that even though the technology has high costs the processor would have benefits for reducing pathogen contaminated product and adverse consequences like product recalls, fines and penalties for violating food safety regulations, litigations and damage awards from foodborne illness and loss of reputation from negative media attention.

Frenzen, DeBess, Hechemy, Kassenborg, Kennedy, McCombs, McNees, and FoodNeet Working Group (2001)

Frenzen et. al. (2001) study consumer characteristics that are willing to buy irradiated meat and poultry in the U.S. using Foodborne Diseases Active Surveillance Network (FoodNet). They had two approaches to analyze the data, bivariate and logistic regression analysis. The bivariate analysis showed that risky food handlers, males, people with some college education, people with household income of $30,000 or more, persons who have heard information on food irradiation are the groups that are willing to buy irradiated meat and poultry. This analysis showed that there was no statistical difference between metropolitan and non-metropolitan residential areas, and that elderly people are not willing to buy irradiated meat and poultry. The logistic regression analysis showed that the factors that increased and individual's risk of foodborne illness is not related to willingness to buy irradiated poultry and meat. Results also showed that males, more educated people, people with high household income, people who heard of food irradiation, people who prepare raw meat and poultry at home, and people who ate recently in restaurants are the groups that are willing to buy irradiated meat and poultry products.

Wolfe, Huang, and McKissick (2004)

Wolfe, Huang, and McKissick (2004) examine the willingness to buy and to pay for irradiated poultry, and consumer knowledge and level of concern about food irradiation process in Georgia. The authors created two models. The first estimated consumer's intention to buy irradiated poultry products or likelihood to buy irradiated foods. The second would estimate consumer's willingness to pay for irradiated poultry products. The independent variables for the first model were: additive of chemicals in food; bacteria concern; knowledge of irradiation; irradiation necessary; support irradiation; knowledge of GM foods; confidence in FDA, USDA, WHO, and AMA; primary shopper; urban household; white; female; children less than 18 years; married; high school education; and household income. The second model independent variables included: likelihood to buy irradiated food, support irradiation, consume GM foods, urban household, white, female, children less than 18 years, married, high school education, and household income. The first model, likelihood of consumer's willing to buy irradiated foods, the authors used a probit analysis that resulted with a significant log-likelihood test at the 1% level. Results suggested that respondents who are concerned about food safety issues regarding chemical usage are less likely to buy irradiated foods. Consumers that thought that irradiation was necessary and show support for irradiation increases the probability of purchasing irradiated poultry by 58% and 52% respectively. If the consumer is the primary shopper and married then the probability of purchasing irradiated poultry products would increase by 27%. Respondents were less likely to buy irradiated foods if the process was endorsed by the WHO, are older, with lower household income, and the presence of children under the age of 18. Respondents were more likely to buy irradiated foods if it was endorsed by FDA, USDA, and AMA. The second model, willingness to pay for irradiated foods, the authors ran an OLS regression using a two

stage least square procedure with a statistically significant the log-likelihood test at the 1% level. Results for this model showed that if a respondent is willing to buy irradiated foods they are willing to pay a higher price for irradiated chicken breast for $1.13/lb. Their results also showed that respondents that supported irradiation technology and willing to consume GM foods are willing to pay about $0.46/lb and $0.44/lb for irradiated chicken breasts respectively. Households with children under 18 years had a positive effect on willingness to pay.

He, Fletcher, and Rimal (2005, b)

He, Fletcher and Rimal (2005) examine consumer perceptions and attitudes towards food irradiation, especially on consumer acceptance and unwillingness to pay for irradiated beef. A telephone survey was conducted to 740 households that were randomly selected nationwide. A dichotomous choice question was used to examine consumer acceptance for irradiated beef at the market price for the non-irradiated beef. Results showed that 51% of the respondents would buy the irradiated beef at the current market price while 31% would not. Furthermore, consumers that refuse to buy irradiated beef were asked the reason of their unwillingness to buy irradiated food. Results showed that 66% indicated that they were not sure if the technology is safe and 23% believe that irradiated beef may lead to health implications. Other reasons for their unwillingness to buy was the perception that food irradiation posses occupational hazards and because they perceived that food irradiation can cause environmental pollution with 4% and 3% respectively. Consumers that were willing to buy irradiated beef were asked if they were willing to pay a higher price for the irradiated beef. Results showed that 60% of the respondents will buy irradiated beef at a higher price, 32% were unwilling to pay, and 8% were not sure about their attitude. From those that were unwilling to buy irradiated beef at a higher price were asked the reason of their unwillingness to buy at a higher price were 40% of the respondents said that

the market price is what they are willing to pay. Another 10% said that they do not believe that irradiated beef is safer, and 19% of the respondents believe that the government should pay for the irradiation costs. A multinomial logit regression was used to estimate consumer's resistance to buy irradiated beef. There were three choices for unwillingness to consume irradiated beef: "irradiation is harmful and consumption might lead to health complications" (Reason 1), "irradiation posses occupational hazards for those involved" (Reason 2), "irradiation poses serious environmental hazards" (Reason 3), and "not sure of whether the process is safe", were this last was used to normalize the set of equations. Results showed that younger and senior respondents, compared with middle aged (between 40-60), are more likely to resist irradiated beef because of the perceptions that irradiation is harmful and consumption might lead to health complications (Reason 1) and because irradiation posses serious environmental hazards (Reason 3). Females tend to resist irradiated beef because they think irradiation is harmful and consuming irradiated beef may lead to health complications. Furthermore, consumers that consider food safety regulations inadequate or ineffectively enforced were more likely to select Reasons one and two for their unwillingness to buy irradiated beef. Consumers that think they had sufficient knowledge about irradiation are unwilling to buy irradiated beef because of reasons two and three. The authors estimated another multinomial logit regression to study consumer's unwillingness to pay a higher price for irradiated beef. Results showed that females are unwilling to pay higher prices because the think the government have to pay for the cost of irradiated beef.

He, Fletcher, and Rimal (2005, a)

He, Fletcher and Rimal (2005) examine consumer assessment of desirability of beef irradiation and their attitude towards irradiated beef. A telephone survey was conducted to 740

households that were randomly selected nationwide. Results showed that 56% of the respondents think that irradiated beef is necessary, 19% are indifferent or not sure about their assessment, and 25% believe is unnecessary. Also results showed that 51% of the respondents would buy the irradiated beef at the current market price while 31% would not, and 14% were unsure of their decision. Consumers were asked about their reaction of a label in the irradiated beef product and more than 30% consider it a symbol of warning and avoid the product, less than 21% would consider it as assurance of quality and safety to buy and the rest were unsure or indifferent about their attitudes. Of those who consider irradiated symbols as warning and would avoid the product, more than 34% considered the product necessary. The authors specified an ordered probit regression to explore factors affecting consumers' assessment of desirability of irradiated beef. Two regressions were run, one which includes inconsistent responses (inclusive model) and one that excludes inconsistent responses (exclusive model). Results on the exclusive model showed that age, sex, college education dummy, and high income dummy (more than 75k) were statistically significant. In the inclusive model results showed that age, employed, and high income dummy were statistically significant. The authors conclude that consumers in the United States are resistant to the adoption of this food-processing technology.

Huang, Wolfe, and McKissick (2006)

Wolfe, Huang, and McKissick (2006) examine the willingness to buy and to pay for irradiated poultry, and consumer knowledge and level of concern about food irradiation process in Georgia. The data was collected from a telephone survey to 303 randomly selected food shoppers from Georgia. The survey was conducted in May 2003 by the University of Georgia's Center for Survey Research. The authors created two models and estimated each model for irradiated poultry and irradiated pork. The first was to estimate consumer's intention to buy

irradiated meat products or likelihood to buy irradiated meat products. The second will estimate consumer's willingness to pay for irradiated meat products. A double-bounded bidding procedure was used to elicit consumers' willingness to buy irradiated poultry and pork products. The first offer consisted of $1/lb above the market level were if they agree to pay the additional premium the following offer was randomly assigned with higher prices (5%, 10%, 25%, 75%, to 100%). If the consumer did not agree to pay the higher price the following offer consisted of a lower price. The analysis consisted of 212 observations. Results showed that 65% and 58% of the consumers are somewhat likely to buy irradiated poultry and pork products respectively. Two models were estimated the first was a probit analysis on purchasing irradiated poultry and pork, and the second estimated the willingness to pay for irradiated poultry and pork. The independent variables for first model were: additive of chemicals in food; bacteria concern; knowledge of irradiation; irradiation necessary; support irradiation; knowledge of GM foods; confidence in FDA, USDA, WHO, and AMA; primary shopper; urban household; white; female; children less than 18 years; married; high school education; and household income. The log-likelihood ratio test statistic was significant at the 1% level for all four regressions. For the first model the Efron's pseudo R^2s were 0.512 and 0.443 for irradiated chicken breasts and irradiated pork. Results showed that respondents were concerned about food safety issues related to additives and chemicals are less likely to buy irradiated chicken breasts and irradiated pork. Necessary and Support irradiation variables were significant at the 1% level and having the largest marginal effect for both chicken breasts and pork. If the respondent was married or the primary shopper the probability of purchasing irradiated poultry will increase by 27% and if the respondent was married the probability of purchasing irradiated pork will increase 24% and 21% if the primary shopper. Results showed that respondents are not likely to buy irradiated chicken

breasts or pork if the process is endorsed by the WHO. Furthermore, respondents were likely to buy irradiated chicken breasts if endorsed by the FDA and irradiated pork if endorsed by the USDA and AMA. The presence of children under 18 years of age has a negative significant effect in purchasing chicken breasts by 21%. Age and household income have significant negative effect in purchasing irradiated chicken breasts but with small marginal effects. The second model included the following independent variables: likelihood to buy irradiated food, support irradiation, consume GM foods, urban household, white, female, children less than 18 years, married, high school education, and household income. The log-likelihood test shows that the estimated models are statistically significant at the 1% level, the adjusted R^2s are 0.207 and 0.157 for irradiated chicken breasts and pork respectively. Results showed that the most important variable that has an effect on willingness to pay for irradiated products is the likelihood of purchasing irradiated products. Respondents that were willing to buy irradiated products would be willing to pay and average of $1.17/lb for chicken breasts and willing to spend $8.45 per month for irradiated pork. Urban households and larger households had a significant effect on willingness to pay more for pork, were respondents will spend $3.26 and $2.59 per month respectively. Households with children under 18 years of age would be spending $5.33 less per month for irradiated pork and pay $0.64 more for irradiated chicken breasts. The authors concluded that educating consumers about the benefits of irradiated meat products has "a potential to create positive perception about the process and increase the probability a consumer will purchase and pay a higher price for irradiated products."

Nayga, Woodward, and Aiew (2006)

Nayga, Woodward, and Aiew (2006) examined willingness to pay for reducing the risk of getting foodborne illness using a nonhypothetical field experiment using ground beef, real cash,

and exchange in a market setting. They conducted a face-to-face WTP dichotomous choice field experiments at selected stores in Austin, Houston, San Antonio, and Waco, Texas in 2002. They interviewed 256 consumers that were randomly selected. Consumers were provided with two sets of information, the first containing a general statement on food irradiation and the second with two irradiation process technologies (gamma rays and e-beam). The authors used two models to analyze the data, single bounded model and OOHB model. Results indicated that WTP for the single bounded model was 76.96 cents and 76.98 for the OOHB model. Results showed that there was no statistical difference between the models. Their study suggested that consumers are willing to pay irradiated ground beef to reduce the risk of getting foodborne illness.

Rousu, and Shogren (2006)

Rousu, and Shogren (2006) used a Vickery second price auction to study the value of information for each participant that gains value. Eighty seven households from Ames, Iowa were recruited from a random sample of 200. Each participant can place a bid to exchange a non-irradiated pork sandwich for an irradiated pork sandwich, this process was repeated in 10 different rounds. All participants received baseline information in the first round which described irradiation and *Trichinella* pathogen. After the fifth round participants received additional information about irradiation, 18 participants receive pro-irradiation materials (group 1), 19 anti-irradiation materials (group 2), and 50 received both irradiation materials (group 3). In the first group, 39% of the participants bought the irradiated pork sandwich before the additional information was given, 56% would buy the irradiated sandwich after the information was given with a value of information of $0.65 per person for those who switch to the irradiated sandwich, and an average value of $0.11 for all participants. In the second group, 26% would

buy the irradiated pork sandwich before the additional information, 5% would buy the irradiated sandwich after the information was given, 21% switch to the non-irradiated pork sandwich with a value of information of $1.80 per person for those who switch to the irradiated sandwich, and an average value of $0.38 for all participants. The third group, 38% would buy the irradiated pork sandwich before the additional information, 18% would buy the irradiated sandwich after the information was given, 20% switched to the non irradiated sandwich with a value of information of $0.60 per person for those who switch to the irradiated sandwich, and an average value of $0.12 for all participants. The authors ran a probit regression to examine the characteristics that influence participants to switch to the non-irradiated pork sandwich if they received the anti-irradiation information. Results showed that concern of food safety had a positive significant effect for the switch at the 5% level. Furthermore, more educated people are less likely to switch to the non-irradiated sandwich and participants with more income are more likely to make the switch to the non-irradiated pork sandwich.

CHAPTER 2.3. - Methods and Procedures

A survey was mailed to two thousand households, half in Wichita, Kansas and the other half in Los Angeles, California. The survey included questions on spinach and fresh vegetables consumption, spinach consumption before, after, and during the *E. coli* outbreak in 2006, attitudes towards irradiation and willingness to pay questions. The questionnaire had two main versions and four sub versions within each version. The difference between the two main versions was the irradiation technology described in the survey. One version described e-beam technology while the other described gamma ray technology. In all versions, the survey included the following statement about food irradiation:

> "Food irradiation is a process that can eliminate disease-causing bacteria in many food products. It can be used to control bacteria such as *E.coli* in spinach and other vegetables without affecting the nutritional quality of the food. The Food and Drug Administration is now considering approving irradiation for that purpose.
> Irradiation does not make foods radioactive – in the same way that X-rays used for airport security don't make your suitcase radioactive. Agencies such as the *Centers for Disease Control,* the *American Medical Association,* the *American Dietetic Association* and the *World Health Organization* have concluded that irradiated food is safe and wholesome."

Following that statement the survey provided additional information about either gamma-ray or e-beam irradiation, i.e.

> "Irradiation involves exposing food to ionizing energy. One type of ionizing energy commonly used for food irradiation is gamma rays.
>
> In a gamma-ray irradiation facility, food is passed on a conveyer system in front of a source of gamma rays. The most common source is the radioactive isotope cobalt 60. Gamma rays pass through food in a manner similar to the way an X-ray would pass through your body. The gamma-rays interfere with bacteria's DNA, destroying its ability to reproduce and rendering it harmless.
>
> Gamma ray irradiation does not use any chemical additives and leaves no residue. It does

not significantly change the temperature of the food, and does not alter the appearance, taste or chemical makeup of the food product or its packaging.
Gamma ray irradiation is a safe process. While ionizing radiation is present when the source is exposed, workers in the facility are protected by thick concrete walls. When not in use the radioactive source is stored in a pool of water which absorbs the radiation harmlessly and completely."

or

"Irradiation involves exposing food to ionizing energy. One type of ionizing energy commonly used for food irradiation is a beam of accelerated electrons.

In an electron beam (E-beam) irradiation facility, food is passed on a conveyer system underneath a beam of electrons. E-beam technology is similar to what is used in a cathode ray tube in a TV set. Electron beams pass through food in a manner similar to the way an X-ray would pass through your body. The electron beam interferes with bacteria's DNA, destroying its ability to reproduce and rendering it harmless.

Electron beam irradiation does not use any chemical additives and leaves no residue. It does not significantly change the temperature of the food, and does not alter the appearance, taste or chemical makeup of the food product or its packaging.

Electron beam irradiation is a safe process. While ionizing radiation is present when the machine is on, workers in the facility are protected by thick concrete walls. However, when the machine is switched off, the ionizing radiation stops, just like in a TV set."

Half of the households in each city received one of the information technologies, a total of one thousand households for e-beam and one thousand for gamma rays. The four subversions differed in the price premium used in the willingness to pay question for irradiated salad greens - 10¢, 25¢, 35¢, or 50¢, Table 7. Two hundred and fifty households in each city received one of the price premiums used in the willingness to pay question. Thus, five hundred households received one of the price premiums (e.g., 10¢ premium to five hundred household, 25¢ premium to five hundred households, etc.)

Following this information questions on knowledge about food irradiation, attitude towards food irradiation before and after reading the technology information, and willingness to

pay question were included. Finally demographic variables were asked including gender, age, household income, household size, Race and Ethnicity, education, health insurance, children less than 6 years old, and children between 6 and 18 years of age.

CHAPTER 2.4. - Data

A total of 622 responses were obtained, 402 from the first mailing and an additional 220 following a re-mailing, 443 responses were from Wichita and 179 from LA. There were 554 usable observations for the model with all the observations and 355 for the model that included only the first mail observations. Thus, a gross effective response rate (GERR) of 27.7% for the model with all the observations and 17.8% for the model with first mailing observations.

Spinach Consumption

Before the *E.coli* outbreak in 2006, 56.7% of the respondents consumed spinach - 37.0% once or twice a month and 15.6% once or twice a week. For more detail information see Appendix H. Before the outbreak, Wichita households consumed less spinach than LA households 48.7% versus 76.3% respectively. Following the *E. coli* outbreak, 51.6% continued to consume fresh spinach – with 36.3% reporting consumption once or twice a month, and 11.6% consuming about once or twice a week. After the outbreak 44.1% of households in Wichita consumed fresh spinach and only 70% in LA.

During the outbreak 16.7% of the households stopped consuming fresh spinach and 33.7% stop consuming fresh spinach during the outbreak and gradually increased their consumption. In Wichita 16.4% stopped consuming fresh spinach and 17.3% in LA. While 30.8% and 38.1% of the households in Wichita and LA respectively, stopped consuming fresh spinach during the outbreak but gradually increased their consumption.

Food Irradiation Post Attribute

Results showed that households had a positive attitude towards irradiation technology with 51.2% while 33.8% had a neutral attitude. In Wichita 53.3% of the households had a positive attitude towards irradiated foods and 34% a neutral attitude. In LA 46% of the households had a positive attitude towards irradiated foods and 31% a neutral attitude. When it comes to irradiation technology, 50.3% and 52.1% of the households had a positive attitude for irradiated food treated with gamma rays and E-beam respectively. Results for attitude after reading the information on irradiation technology are shown in Appendix H.

Willingness to Pay for Irradiated Salad Greens

Results for the WTP question for buying irradiated salad greens at the same price as the non-irradiated salad greens by city and irradiation technology are shown in Appendix G. More than half of the households are willing to buy irradiated salad greens at the same price of non-irradiated salad greens, 57.6%. Households from Wichita are more willing to buy irradiated salad greens at the same price of non-irradiated salad greens than households from LA, 64.2% and 43.9% respectively. Of those that are not willing to buy irradiated salad greens at the same price only 26.9% will be willing to buy irradiated salad greens at a lower price. Of those that are willing to buy irradiated salad greens at the same price as non-irradiated salad greens more than half (67%) will pay a higher price. Households from Wichita are more willing to buy irradiated salad greens at a lower price than LA households, 34.1% and 27.6% respectively. Also residents from Wichita are more willing to buy irradiated salad greens at a higher price than LA residents,

42.4% and 39.8% respectively. The distribution for the WTP responses for irradiated and regular salad greens are presented in Table 25.

Table 25: Distribution of WTP responses – initial price=$2.49

High Price	Yes-Yes	Yes-No	Low Price	No-Yes	No-No	Total
$ 2.59	60	16	$ 2.39	23	57	156
$ 2.74	82	27	$ 2.24	14	53	176
$ 2.84	49	32	$ 2.14	15	28	124
$ 2.99	39	38	$ 1.99	16	46	139
Total	**230**	**113**		**68**	**184**	**595**

Yes – Yes = Consumer is willing to buy irradiated salad greens at a higher price.
Yes – No = Consumer is willing to buy irradiated salad greens but would not pay a higher price.
No – Yes = Consumer is not willing to buy irradiated salad greens at same price but will at a lower price.
No – No = Consumer is not willing to buy irradiated salad greens.

CHAPTER 2.5. - Analysis of Consumer Demand

This section would present consumer demand analysis for spinach consumption after the 2006 *E. coli* outbreak, attitude towards food irradiation after reading the technology information, and consumer willingness to pay for irradiated salad greens.

Spinach Consumption

A multinomial logit analysis was used to study if any change in spinach consumption occurs during the *E. coli* outbreak. Household had three choices to choose from:

(1) For a few months after fresh spinach came back to the store we didn't buy any, but we gradually consume more as time went by.
(2) Our consumption didn't really change when fresh spinach came back to the store we continued to purchase about as much as before the contamination.
(3) We stopped consuming fresh spinach and now we don't purchase any.

Two analyses were done, one with all observations and the other with observations form the first mailing to examined responses from the second mailing influence the analysis. Independent variables used were: gender, Race or Ethnicity, education, income, household size, presence of kids in the household, age, and current spinach consumption.

A multinomial logit regression was run to determine spinach consumption behavior during the outbreak. Results were estimated in NLOGIT 3.0 (LIMDEP). The model to estimate the probabilities is as follows:

$$\Pr ob(Y_i = j) = \frac{e^{\beta'_j x_i}}{\sum_{k=0}^{J} e^{\beta'_k x_i}} \qquad j = 0,1,\ldots,J \tag{10}$$

where Y_i denotes the *j*th individual's choice from the given alternative reasons; $j = 0, 1, \ldots J$ and k = 0, 1, …, *J* indicates possible reasons considered in the study (Greene, 2007). The estimated equations provide a set of probabilities for the *J*+1 choices for the decision maker with characteristics $\mathbf{x_i}$. This is normalized by assuming that β=0 to estimate *J* parameter vectors to determine *J+1* probabilities, therefore probabilities are estimated as follows:

$$\Pr ob(Y_i = j) = \frac{e^{\beta'_j x_i}}{1 + \sum_{k=1}^{J} e^{\beta'_k x_i}} \qquad \text{for } j=0,2,\ldots,J,\ \beta = 0. \tag{11}$$

The log-likelihood function is specified as follows:

$$\ln L = \sum_{i=1}^{n} \sum_{j=0}^{J} d_{ij} \ln prob(Y_i = j), \tag{12}$$

Table 26 presents the description and mean values of the dependent and independent variables for both, all observations and first mailing observation models.

Multinomial logit coefficient results and marginal effects are presented in Appendix H. Pseudo R^2 for both models was 0.096 with a significant χ^2 at the 1% level. There were 317 and 194 observations for both, all and first mail observations models respectively. Education, income, race and ethnicity, income, and current spinach consumption were significant for households who no longer consume spinach, (i.e. the model that included all the observations). Furthermore, education, income, and current spinach consumption were significant for households who no longer consume spinach (i.e. the model that included only the first mail observations). As Onyago, et.al. (2007) race and ethnicity marginal effect for those households that stop consuming spinach had a significant effect. Age, and income had significant but negative effects as opposed to Onyago, et.al. who had significant positive effects.

Table 26: Description and Mean Values of the Variables

Variable	Description	Mean All Observations	Mean First Mailing Observations
Know1	1 = Have some knowledge in food irradiation, 0 = otherwise	0.509	0.547
Know2	1 = Knowledge a lot of food irradiation, 0 = otherwise	0.087	0.089
Gamma	1 = Gamma Rays technology 0 = E-beam technology	0.482	0.489
FVeg	Fresh Vegetable Consumption 1 = every day 2 = 3-4 times a week 3 = about once or twice a week 4= less than once a week 5 = never – we do not consume	1.982	1.944
MttWeek	1 = Consume Fresh Vegetables more than Twice a week 0 = Otherwise	0.699	0.711
Female	1 = Female 0 = Male	0.616	0.642
Income	1 = Less than $20K 2 = $20K - $30K 3 = $30K - $40K 4 = $40K - $50K 5 = $50K - $70K 6 = $70K - $100K 7 = $100K - $150K 8 = More than $100K	4.464	4.599
Kids	1 = Have children under 18 years 0 = otherwise	0.291	0.268
PostAtt	Post Attribute Attitude towards Irradiation 0 = Very Negative 1 = Negative 2 = Neutral 3 = Positive 4 = Very Negative	2.531	2.576

Age, race and ethnicity coefficients for households that stop consuming spinach after the outbreak became significant by adding additional observations from the follow-up mailing into the model. Additionally, education and income change from being significant at 10% level to 1% level. Furthermore, marginal effects maintain their significance in most cases but changed their significance level in other cases by adding those additional observations. Thus when a multinomial logit was used, those additional observations from the follow-up mailing would add to the results of the study, specifically to the significance levels of the marginal effects.

Food Irradiation Post Attribute

A question on attitude towards food irradiation after reading either of information on the irradiation technology was asked. This was measured in a scale of one to five where 1 was very negative attitude and 5 a very positive attitude. For programming purposes the scale of the dependent variable was changed to 0 to 4, from very negative to very positive and neutral when a value of 2. Taking the categorical and ordered nature of the dependent variable an order probit regression (Greene, 2007) was run to determine attitude towards food irradiation after reading the technology information. The order probit regression is based on a latent regression model which can be specified as:

$$y^* = \mathbf{x'\beta} + \epsilon_i \qquad (13)$$

where **x** is the vector of explanatory variables, β are the parameters to be estimated, and ϵ is the error term which is *iia*. Letting y be an indicator of different integer values, 0 to 4 , depending on the household response then the relationship between y and y^* is specified as follows:

$$\begin{aligned} y &= 0 \quad \text{if } y^* \le 0, \\ &= 1 \quad \text{if } 0 < y^* \le \mu_1, \end{aligned}$$

$= 2 \quad \text{if } \mu_1 < y^* \leq \mu_2,$
$= 3 \quad \text{if } \mu_2 < y^* \leq \mu_3,$
$= 4 \quad \text{if } \mu_3 \leq y^*,$ (14)

which is a form of censoring. The μs' are unknown parameters to be estimated with β. Also μs' have to be positive in order to get positive probabilities. The model has the assumption that ϵ is normally distributed across observations. The mean and variance of ϵ are normalized to zero and one to get the following probabilities:

Prob (y = 0 | **x**) = $\Phi(-\mathbf{x'\beta})$,
Prob (y = 1 | **x**) = $\Phi(\mu_1 - \mathbf{x'\beta}) - \Phi(-\mathbf{x'\beta})$,
Prob (y = 2 | **x**) = $\Phi(\mu_2 - \mathbf{x'\beta}) - \Phi(\mu_1 - \mathbf{x'\beta})$,
Prob (y = 3 | **x**) = $\Phi(\mu_3 - \mathbf{x'\beta}) - \Phi(\mu_2 - \mathbf{x'\beta})$,
Prob (y = 4 | x) = $1 - \Phi(\mu_3 - \mathbf{x'\beta})$ (15)

were Φ denotes the standard normal cumulative distribution function. The maximum likelihood estimation techniques are used to estimate the parameters that maximize the probability of observing an outcome y. The marginal effects of changes in the regressor are:

$$\frac{\partial \Pr ob(y=0)|x)}{\partial x} = -\phi(x'\beta)\cdot\beta$$
$$\frac{\partial \Pr ob(y=1|x)}{\partial x} = \left[\phi(-x'\beta - \phi(\mu_1 - x'\beta)\right]\cdot\beta$$
$$\frac{\partial \Pr ob(y=2|x)}{\partial x} = \left[\phi(\mu_1 - x'\beta) - \phi(\mu_2 - x'\beta)\right]\cdot\beta$$
$$\frac{\partial \Pr ob(y=3|x)}{\partial x} = \left[\phi(\mu_2 - x'\beta) - \phi(\mu_3 - x'\beta)\right]\cdot\beta$$
$$\frac{\partial \Pr ob(y=4|x)}{\partial x} = \phi(\mu_3 - x'\beta)\cdot\beta \qquad (16)$$

This model may use continuous or discrete regressor variables, where they have to satisfy the above models for the conditional distribution of *y* given **x** (Anderson, and Phillips, 1981). Is unclear how coefficients in the ordered probit should be interpreted (Greene, 2007).

The dependent variable in this model is the attitude towards irradiated foods after reading the irradiation technology information. Table 26 shows the variable description and mean values for both all observations and first mailing observations. The model was run with all observations and with the observations received in the first mailing of the survey to check if there is a difference between these two models. The ordered probit regression was run to estimate the effect of the demographics and other explanatory variables on attitude towards irradiation after reading the irradiation technology information. Results were estimated in NLOGIT 3.0 (LIMDEP).

Coefficients results and standard errors for the ordered probit are shown in Table 27. Results showed that μs are significant at the 1% level which implies that the dependent variable is ordered, thus there is no need to combine attitude post attribute categories. The same coefficients were significant in both models. Coefficients for households that have some and a lot of knowledge about food irradiation, Wichita residents, income, and households with health insurance were significant. Significance levels in both models were the same with the exception of Know2 which change its significance level from 5% to 1%. One of the objectives of this study was determine if the coefficients from having fewer observations is statistically different from a model with more observations. One way to examine this is by looking at the 95% confidence intervals. Confidence intervals for households with a lot of knowledge about food irradiation, Wichita residents, gender, income, presence of kids, and health insurance overlap, thus resulting also in no statistical difference between the coefficients, Figure 5, Panel A.

Confidence intervals of households with some knowledge about food irradiation and those that received information about gamma rays technology from the model that included all the observations were within the confidence interval for the first mail model, thus resulting in no statistical difference, Figure 5, Panel B.

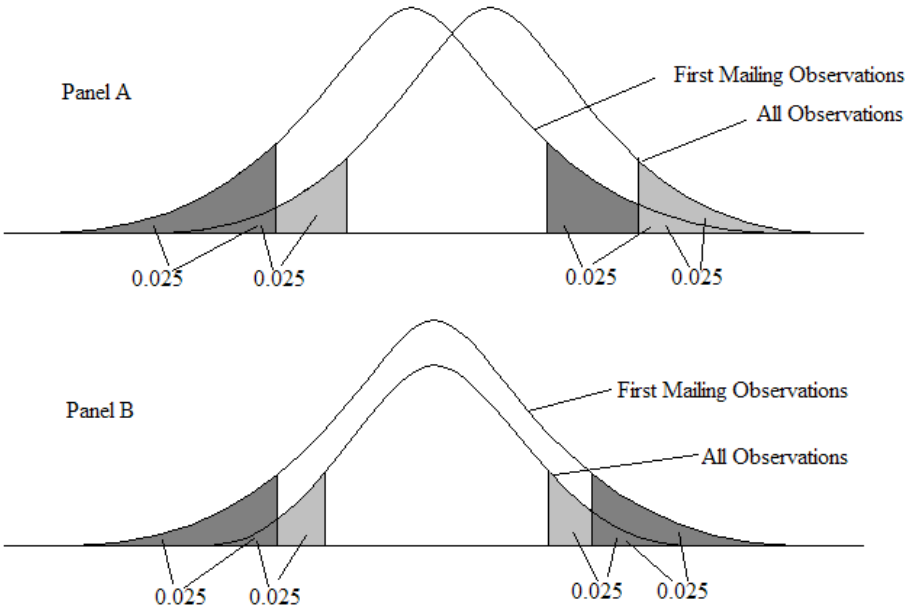

Figure 5: Confidence Interval Graphical Representation, 95% level.

Table 27: Ordered Probit Results for Households Attitude Towards Food Irradiation after Reading Technology Information.

Variable	All Observations			First Mailing Observations		
	Coefficients	Confidence Intervals		Coefficients	Confidence Intervals	
Know1	0.299***	0.118	0.479	0.346***	0.117	0.575
	(0.092)			(0.117)		
Know2	0.550***	0.201	0.900	0.446**	0.019	0.873
	(0.178)			(0.218)		
Gamma	0.082	-0.092	0.255	0.117	-0.099	0.333
	(0.089)			(0.110)		
Wichita	0.355***	0.164	0.546	0.546***	0.291	0.801
	(0.098)			(0.130)		
Female	0.017	-0.161	0.195	(0.037)	-0.262	0.188
	(0.091)			(0.115)		
Income	0.049**	0.006	0.092	0.069**	0.015	0.123
	(0.022)			(0.028)		
Kids	0.082	-0.117	0.282	(0.020)	-0.274	0.234
	(0.102)			(0.130)		
HIns	0.726***	0.461	0.991	0.579***	0.215	0.943
	(0.135)			(0.186)		
μ_1	0.421***	0.329	0.513	0.441***	0.318	0.565
	(0.047)			(0.063)		
μ_2	1.375***	1.274	1.476	1.453***	1.325	1.582
	(0.052)			(0.066)		
μ_3	2.284***	2.161	2.407	2.417***	2.262	2.572
	(0.063)			(0.079)		
Log Likelihood	-803.08			-501.45		
Num. of observations	552			355		

Standard Errors are in parenthesis
*, **, and *** are significant at the 10%, 5%, and 1% level respectively.

The marginal effects and predictions for both models are shown in Table 28 and Table 29. Shaded cells represent those marginal effects that were significant in one model and not in the other. Significant marginal effects for both models were the same with the exception for income when households have very negative and positive attitude to irradiated foods. By including additional observations into an ordered probit, this resulted in two additional

significant marginal effects. Predictions are reported also in Table 28 and Table 29. Results showed that by adding more observations into the model the predictions when Y equals zero (very negative attitude), when Y equals two (neutral), three (positive), and four (very positive) improved.

Households that have some and a lot of knowledge when having very negative, negative, neutral, and very positive attitude to irradiated foods were significant for both models. Furthermore, residents from Wichita, income variable, and households that had health insurance had significant marginal effects for all post attribute categories. Interpretations for significant marginal effects are as follows:

- Households that have some knowledge about food irradiation have a lower likelihood of having a very negative, negative, or neutral attitude towards food irradiation after reading the information by 4.5%, 2.9%, and 4.5% for the model containing all the observations and 4.4%, 3.3%, and 6.0% for the model with the first mailing observations respectively, *ceteris paribus*. Furthermore, households that has some knowledge about irradiated food have a higher likelihood of having a very positive attitude towards food irradiation after reading the information by 8.1% and 9.3% for the model with all observations and first mail observations respectively, *ceteris paribus*.
- Households that have a lot of knowledge about food irradiation have a lower likelihood of having a very negative, negative, or neutral attitude towards food irradiation after reading the information by 5.9%, 4.7%, and 10.4% for the model containing all the observations and 4.1%, 3.8%, 9.2% for the model with the first

mailing observations respectively, *ceteris paribus*. Furthermore, households that have a lot of knowledge about irradiated food have a higher likelihood of having a very positive attitude towards food irradiation after reading the information by 17.7%, and 14% for the model with all observations and first mail observations respectively, *ceteris paribus*.

- As income increases, by one income category, households will have a lower likelihood of having a very negative, negative, neutral, attitude towards food irradiation by 0.7%, 0.5%, and a higher likelihood of having a positive and very positive attitude for irradiated food by 0.6% and 1.3% for the model that included all observations, *ceteris paribus*. Furthermore, as income increases, by one income category, households have a lower likelihood of having a negative, neutral, attitude towards food irradiation by 0.7% and 1.2% and a higher likelihood of having a very positive attitude for irradiated food by 1.9% for the model that included first mailing observations, *ceteris paribus*.
- Compare to households that do not have health insurance, households with health insurance have a lower likelihood of having a very negative, negative, or neutral attitude to irradiated food after reading the information by 15.8%, 6.9%, and 4.8% for the model with all observations and 10.1%, 5.9%, and 6.5% for the model that included the first mailing observations respectively, *ceteris paribus*. Compared to households that do not have health insurance, households with health insurance have a higher likelihood of having a positive and a very positive attitude to irradiated food after reading the information by 12.8% and 14.6% for the model

with all observations and 10.2% and 12.3% for the model that included the first mailing observations respectively, *ceteris paribus*.

- Compared to LA, households in Wichita has a lower likelihood of having a very negative, negative, neutral attitude to food irradiation after reading the information by 5.8%, 3.5%, and 4.8% for all observations model, and 8.4%, 5.5%, and 7.5% for the first mailing observations model, *ceteris paribus*. Furthermore, households in Wichita had a higher likelihood of having a positive and very positive attitude to irradiated food after reading the attitude by 5.1% and 9.0% for the model with all the observations and 8.7%, and 12.8% for the model with only the first mailing observations respectively, *ceteris paribus*.

Table 28: Marginal Effects for All Observations

Variable	**Y = 0**	**Y = 1**	**Y = 2**	**Y =3**	**Y = 4**
Know1	-0.045***	-0.029***	-0.045***	0.038	0.081***
Know2	-0.059***	-0.047***	-0.104***	0.033	0.177***
Gamma	-0.012	-0.008	-0.013	0.010	0.022
Wichita	-0.058***	-0.035***	-0.048***	0.051*	0.090***
Female	-0.003	-0.002	-0.003	0.002	0.005
Income	-0.007***	-0.005**	-0.008***	0.006*	0.013**
Kids	-0.012	-0.008	-0.013	0.010	0.023
HIns	-0.158***	-0.069***	-0.048***	0.128***	0.146***
Predictions	**7%**	**0%**	**33%**	**38%**	**41%**

Standard Errors are in parenthesis
*, **, and *** are significant at the 10%, 5%, and 1% level respectively.

Table 29: Marginal Effects for the First Mailing Observations

Variable	Y = 0	Y = 1	Y = 2	Y =3	Y = 4
Know1	-0.044***	-0.033***	-0.060***	0.045	0.093***
Know2	-0.041***	-0.038***	-0.092***	0.031	0.140***
Gamma	-0.014	-0.011	-0.021	0.015	0.032
Wichita	-0.084***	-0.055***	-0.075***	0.087*	0.128***
Female	0.004	0.004	0.007	-0.005	-0.010
Income	-0.008	-0.007**	-0.012**	0.009	0.019**
Kids	0.002	0.002	0.004	-0.003	-0.005
HIns	-0.101***	-0.059***	-0.065***	0.102**	0.123***
Predictions	**0%**	**0%**	**32%**	**36%**	**27%**

Standard Errors are in parenthesis
*, **, and *** are significant at the 10%, 5%, and 1% level respectively.

Willingness to Pay for Irradiated Salad Greens

Following the description of the irradiation technology, a willingness to pay question was included. Households were asked if they will buy pre-wash irradiated salad greens for the same price as regular pre-washed salad greens, the choices were:

(1) definitely buy non-irradiated pre-wash salad greens
(2) probably buy non-irradiated pre-wash salad greens
(3) be unsure I need to know about irradiation but I think I'll buy non irradiated pre-washed salad greens
(4) definitely buy irradiated pre-wash salad greens
(5) probably buy non-irradiated pre-wash salad greens
(6) be unsure I need to know about irradiation but I think I'll buy irradiated pre-washed salad greens

Households that chose 1, 2, and 3 represented the consumers that are not willing to buy pre-washed irradiated salad greens and those that answer choices 4, 5, and 6 represented households that are willing to buy pre-washed irradiated salad greens. If respondents answered that they were not willing to buy the irradiated salad greens they were asked if they will buy the product at a lower price and those who responded that they were willing to buy were asked if they were willing to pay a higher price for irradiated salad greens.

This study used a Double-Bounded Dichotomous Choice Contingent Valuation (Hanemann, Loomis, and Kanninen, 1991) to study consumers' willingness to pay for irradiated salad greens. As mentioned before, each household was presented with one of four prices in the willingness to pay question, 10¢, 25¢, 35¢, and 50¢. Each household was presented with two bids where the first bid determined the level of the second bid. There are four possible outcomes: (1) both answers are "yes" that is would buy irradiated salad greens at the same price and at a higher price; (2) both answers are "no", would not buy irradiated salad greens at the same or at lower price; (3) "yes" and "no", that is would buy irradiated product at same price but not at a higher price; (4) "no" and "yes", would not buy irradiated product at the same price but will at a lower price. The likelihoods of these outcomes would be represented by π^{yy}, π^{nn}, π^{yn}, and π^{ny} respectively. Let the initial price be denoted by B_i, some amount greater than the initial price by B_i^u, and B_i^d for a smaller amount. Under the assumption of utility maximizing the likelihood functions are as follows:

$$\pi^{yy}(B_i, B_i^u) = 1 - G(B_i^u; \theta) \tag{17}$$

$$\pi^{nn}(B_i, B_i^d) = G(B_i^d; \theta) \tag{18}$$

$$\pi^{yn}(B_i, B_i^u) = G(B_i^u; \theta) - G(B_i; \theta) \tag{19}$$

$$\pi^{ny}(B_i, B_i^d) = G(B_i; \theta) - G(B_i^d; \theta) \tag{20}$$

where: $G(B_i^u; \theta)$, $G(B_i; \theta)$, *and* $G(B_i^d; \theta)$ are the cumulative distribution functions parameterized by θ. Given a sample of N respondents the log-likelihood function takes the following form:

$$\ln L(\theta) = \sum_{i=1}^{N} \{d_i^{yy} \ln \pi^{yy}(B_i, B_i^u) + d_i^{nn} \ln \pi^{nn}(B_i, B_i^d) + d_i^{yn} \ln \pi^{yn}(B_i, B_i^u) + d_i^{ny} \ln \pi^{ny}(B_i, B_i^d)\} \quad (21)$$

where d_i^{yy}, d_i^{nn}, d_i^{yn}, and d_i^{ny} are binary-valued indicator variables and the formulas are corresponding response probabilities are given by equations 2-5. Using the logistic distribution function, each $G(B_i;\theta)$ takes the form $G(B;\alpha,\gamma,\beta) = [1 + e^{\alpha+\gamma Z-\beta B}]^{-1}$. Where Z is a vector of explanatory variables, technology information treatments and demographic variables expected to influence WTP, B is the price of the irradiated product, and α,γ, and β are parameters to be estimated. The model was estimated with all the observations and with the observations received in the first mailing of the survey to check if there is a difference between these two models. Table 26 presents the variable description and mean values for all observations and first mailing observations.

The mean WTP can be estimated in two ways the first as ration of α/β by restricting the coefficients for all variables except the random bid to be zero in estimating the parameters (Hanemann, Loomis, and Kanninen, 1991, Lin, Somwaru, Tuan, Huang, and Bai, 2006). The second method is as a ratio of (α + γ'Z)/β based on random utility framework in which is postulated that the consumer is willing to purchase irradiated salad greens when the utility of the purchase is at least as good as the non-irradiated salad greens (Lin, Somwaru, Tuan, Huang, and Bai, 2006). The second method would be used to calculate the mean WTP. As before the mean WTP is calculated for all the observations and for the first mail observations to check if there is a there is a difference between the models.

Results for the double bounded WTP model for irradiated salad greens for both the full sample and only first mailing observations are shown in Table 30. NLogit 3.0 (Limdep) was used to estimate WTP models. Results for both models showed that Wichita significantly

increase consumer's WTP at the 1% level. Nayga (1996) study showed that households that live in a non-metropolitan residential area have a positive effect, as opposed to Huang, Wolfe and McKissick (2006) study where households that live in urban areas had a positive effect in willingness to pay for pork. Household income also significantly increase consumer's WTP for irradiated salad greens at the 1% level and 5% level for the model with all observations and first mail observations respectively. These results compare with Malone (1990); Nayga (1996); and Frenzen, DeBess, et. al. (2001) where their results had positive effects for income. The other independent variables were not statistically significant in either model.

As before, confidence intervals were examined to check if the coefficients were statistically different. Confidence intervals for price coefficient, know1, Wichita, female, and presence of kids under 18 years of age for the model that included all the observations were within the first mailing model. Thus, no statistical difference between coefficients for both models was found. The other the independent variables: intercept, know2, gamma, and income confidence intervals from both models overlap resulting in no statistical difference between the coefficients. Furthermore, the same coefficients were significant for both models. Thus in this study the additional observations from the follow-up mailing did not add to the analysis when the Double-Bounded WTP model was applied.

A WTP model without demographics was also estimated, that is estimate the WTP for the average respondent. Results suggested that for the average respondent the median willingness to pay for a 10 oz bag of irradiated salad greens was $2.59 and $2.63 for the model that included all observations and first mailing observations respectively. These results reflect an increase of 4% (all observations model) and 5.6% (first mail observations) in price when non-irradiated salad greens are available at $2.49 for a 10oz bag.

Median WTP for irradiated salad greens relative to non-irradiated salad greens were estimated for all variables and both models which is α/β, Table 31. The largest median WTP for irradiated salad greens is attributed to the city of residence. The difference in WTP for irradiated salad greens between a Wichita resident and a resident from LA is 27¢ and 33¢ for all observations and first mailing observations models respectively, *ceteris paribus*. Furthermore, second largest effect on WTP was attributed to income, where the difference in WTP for irradiated salad greens when increasing income category by one (i.e. less than 20K to $20K-$30K category) is 23¢ and 26¢ for all and first mailing observations respectively.

Table 30: Willingness to Pay for Irradiated Salad Greens Results

Variable	All Observations		First Mail Observations	
	Coefficients	Confidence Intervals	Coefficients	Confidence Intervals
Intercept	4.901***	4.035, 5.767	4.755***	3.626, 5.885
	(0.442)		(0.576)	
Price Coeff.	2.324***	2.029, 2.619	2.386***	2.001, 2.770
	(0.150)		(0.196)	
Know1	0.188	-0.140, 0.517	0.252	-0.169, 0.673
	(0.167)		(0.215)	
Know2	0.409	-0.218, 1.036	0.270	-0.464, 1.003
	(0.320)		(0.374)	
Gamma	-0.100	-0.416, 0.216	0.149	-0.240, 0.538
	(0.161)		(0.200)	
Wichita	0.636***	0.304, 0.968	0.790***	0.330, 1.251
	(0.169)		(0.235)	
Female	0.053	-0.281, 0.388	0.018	-0.406, 0.443
	(0.171)		(0.216)	
Income	0.121***	0.046, 0.196	0.134**	0.040, 0.228
	(0.038)		(0.048)	
Kids	0.052	-0.299, 0.402	0.092	-0.361, 0.546
	(0.179)		(0.231)	
Log Likelihood Function	723.13		454.12	
χ^2	1,446.27***		908.24***	
Num. of observations	554		357	

Standard errors are in parenthesis
*, **, and *** are significant at the 10%, 5%, and 1% level respectively.

Table 31: Median WTP

Variable	All Observations	First Mail Observations
Intercept	$2.11	$1.99
Know1	$0.08	$0.11
Know2	$0.18	$0.11
Gamma	($0.04)	$0.06
Wichita	$0.27	$0.33
Female	$0.02	$0.01
Income	$0.23	$0.26
Kids	$0.02	$0.04

CHAPTER 2.6. - Conclusions

This study examined the impact of responses of the second mailing. A consumer mail survey was sent to 2,000 households, half to Wichita, Kansas and the other half to Los Angeles, California. Two mailings were sent out, three weeks apart. The study included two main versions and four sub versions within each version. The questionnaire versions differ on the irradiation technology (i.e. gamma ray or e-beam) and the subversions differ in price premiums for the willingness to pay questions for salad greens - 10¢, 25¢, 35¢, and 50¢. The survey also included questions regarding spinach consumption during the *E. coli* outbreak and attitude towards irradiated food products after reading information on irradiation technology.

A multinomial regression was run to study spinach consumption during the 2006 *E. coli* outbreak. In this study, results showed that by including those additional observations from the follow-up mailing into a multinomial regression will result in the occurrence of additional significant coefficients and marginal effects. Thus, a multinomial logit regression with additional observations from the follow-up mailing leads to more results in the study being significant, specifically the marginal effects.

An ordered probit was run to estimate the effect of socioeconomic variables on attitude towards irradiation after reading the information on irradiation technology. In this study, coefficients in the ordered probit were proven not to be statistically different by adding additional observations from the second mailing. Furthermore, most of the marginal effects that were significant in one model were also significant in the other with the exception of two marginal effects. In addition, correct predictions slightly improved by adding those additional observations. Thus, this study showed that coefficients were not statistically different, only two

additional marginal effects changed their significance, and slight improvements in correct predictions resulted in the ordered probit when including additional observations from the follow-up mailing. Further research should be done to examine the impact of additional responses to the second mailing when an ordered probit is used.

A Double-Bounded Dichotomous Choice model was used to study consumers' WTP for irradiated salad greens. Results showed that consumers from Wichita and LA are willing to pay up to 5% more for 10 oz. bag of irradiated salad greens. Coefficients were not statistically different in the WTP model when the follow-up observations were added to the model. Furthermore, both model had the same significant coefficients. Hence, in this study additional observations do not add information to the model. In this study, follow-up costs are not validated when a Double-Bounded Dichotomous Choice model is used. Further research should be done to examine the impact of additional responses to the second mailing when using a Double-Bounded Dichotomous Choice model.

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Appendix A: Response Rates and Incentives

Autors	Type of study	Results
Cox, Anderson, and Fulcher (1974)	Examined effect of Personalized Cover Letter.	Positive impact on response rates.
Lynsky (1975)	Literature review of techniques that affect response rates in mail surveys.	Pre-contact letter, follow-up letter or post card increased the response rates. In 4 out of seven studies length of the questionnaire had no effect on response rates. Color questionnaire and pre-coded vs. open ended questions had no effect in response rates.
Fox, Crask, and Kim (1988)	Meta Analysis of 40 studies on factors influencing response rates.	Pre-notification letter, follow-up with post card, stamped postage, stamped return envelope and university sponsorship increase response rate.
Yammarino, Skinner, and Childers (1991)	Meta Analysis of 115 studies on factors influencing response rates.	Preliminary notification, follow-ups, sponsorship, return envelope, stamped or metered return postage, personalization, anonymity, and a questionnaire of less than 4 pages increase response rate.
Greer, Chuchinprakarn, and Seshadri (2000)	Survey on survey study	
	Study 1: Examined day of the week respondent received the questionnaire and length of the questionnaire.	More than half of the respondents did not care the about the day of the week they receive the questionnaire. Length of questionnaire, content, sponsorship, and pre-paid return envelope were factors influencing the likelihood to respond.
	Study 2: Examined preferences about various aspects of questionnaire and perceptions about the use of pre-notification and follow-up.	Respondents preferred fixed alternative questions, and questions asking for opinions. Neither color of the questionnaire and quantitative of qualitative questions, pre-notification letter or follow-up were significant factors influencing the likelihood of answering the survey.
Hager, Wilson, Pollak and Rooney (2003)	Examined length of survey, incentive and delivery method.	Shorter less complicated survey results in a higher response rate.
		Federal Express delivery had a positive effect on response rate.
		$5 incentive and resulted in no significant difference.

Authors	Type of study		Results
Armstrong (1975)	Study included data for 18 empirical studies which included monetary incentives.		Incentives have a positive impact on response rates.
Nederhof (1983)	1st study: Non-monetary incentive vs. No incentive with 4 Follow ups.		Positive impact on response rate after the1st mailing no significant difference
	2nd study: Non-monetary incentive vs. No incentive with 4 mailings.	Group 1: Pool Group	Significant difference at 0.10 level in the 1st mailing, no significant difference after the 1st mailing.
		Group 2: General Population	No significant difference on any mailing
Jobber and Saunders (1988)	Study included data for 18 empirical studies which included monetary incentives.		Monetary incentives increase response rates but found no evidence of a relationship between response rate and size of incentive.
James and Bolstein (1990)	Study the effect of monetary incentives, used four different monetary incentives ($0.25, $0.50, $1, $2) and a non monetary incentive group, with four mailings.		1st Mailing: significant difference among all incentive groups and the non incentive group, $0.25 and $0.50 no difference, $0.25-$0.50 and $1 significant difference and no difference for the $1 and $2 groups.
			2nd Mailing: no significant difference for no incentive vs. $0.25-$0.50; significant difference for no incentive vs. $1, and significant difference for $0.25-$0.50 vs. $1 ; no significant difference for $1 and $2 groups.
			3rd Mailings: significant difference for no-incentive-$0.25-$0.50 vs. $1 and $2; no significant difference $1 vs. $2.
			4th Mailings: significant difference for no-incentive-$0.25-$0.50 vs. $1 and $2; no significant difference $1 vs. $2.

Authors	Type of study	Results
James and Bolstein (1992)	Study the effect of monetary incentives, used four different monetary incentives ($1, $2, $5 cash and $5 check, $10 check, $20 check, $40 check) a promise of $50 after completion and a non monetary incentive group, with four mailings.	1st Mailing: significant difference between No incentive vs. $1, $1 vs. $5 and no significant difference between $5 group and all other groups.
		2nd Mailing: significant difference between no incentive vs $1, $1 vs. $5, $5 vs. $20 no significant difference among other groups.
		3rd Mailings: There is a significant difference among the no incentive vs $1 group and $1 vs $20 group.
		4th Mailing: There is a significant difference among the no incentive vs $1 group and $1 vs $20 group.
Church (1993)	Study included data from 38 studies which included monetary and non monetary incentives. Four Groups: monetary and non monetary incentives mailed with the survey and promise to send monetary and non monetary incentive after completion.	Monetary and non monetary incentives have a positive effect on response rates. Monetary incentives would not yield in higher response rates than non monetary incentives. Monetary and non monetary incentives mailed with the survey would improve returns compared to the promise to send them after completion.
Armstrong and Yokum (1994)	Survey members and non-members of an organization, half of each group had a monetary incentive.	Members of the organization had a higher response rate than non-members. The members that received an incentive had higher returns, also the non member group with incentive.

Authors	Type of study	Results
Angur and Nataraajan (1995)	Industrial mail survey in the international setting using incentives, in India.	1st test: Monetary incentives are better than no incentive: Results showed that there monetary incentives are better than the no incentive group.
		2nd test: Within monetary incentives, a price giveaway is better than a monetary incentive: Results showed that there is a significant difference between the groups, price giveaway is better than monetary incentive.
		3rd test: Joint effects is better than the no incentive group: Results showed that there is no significant difference between groups.
Wheeler, Lazo, Heberling, Fisher and Epp (1997)	Study the effect of monetary incentives, used four different monetary incentives ($1, $2, $5, $10) and a non monetary incentive group, with four mailings.	There is a significant difference between the no incentive groups and the incentive groups, that is for all mailings.
		There is not a significant difference within the incentive groups, that is for all mailings.
Singer, Hoeweyk and Maher (1998)	1st study: Examined the day of the week respondent received the questionnaire and length of the questionnaire on the likelihood of participating in the mail survey.	Results showed that respondents do not care about the day of the week they receive the survey. Respondents preferred questionnaires with fewer pages and questions.
	2nd study: Examined preferences towards various aspects of the questionnaire and perceptions of respondents toward the use of pre-notification and follow-up.	Results showed that factors such as content, survey sponsorship and postage paid return envelops influence the likelihood to respond the survey. Also respondents preferred fixed alternative questions, comparative scale questions and questions asking for opinions. Pre-notification letter and follow-up have a little impact on participation.

Appendix B: Response Rates of Agricultural Economics Literature

	Journal	Author(s)	Year	Survey Type	Sample Size		Number of Responses		Response Rates			
									Numerator			
									Completed		Usable	
					Sent	Undeliverable	Completed	Usable	Denomenator			
									Sent	Sent - Undeliverable	Sent	Sent - Undeliverable
1	*Review of Agricultural Economics*	Valentin, Bernardo and Kastens	2004	Mail	2,115	678	NR	963			45.5%	67.0%
2	*Review of Agricultural Economics*	Grunewald, Shroeder, and Ward	2004	Mail	1,501	NR	NR	316			21.1%	
3	*Review of Agricultural Economics*	Park and Lohr	2006	Mail	4,585	NR	1,192	569	26.0%		12.4%	
4	*Review of Agricultural Economics*	Fouayzi, Caswell, and Hooker	2006	Mail	272	NR	38	NR	14.0%			
5	*Review of Agricultural Economics*	Krishantha, Jayasinghe-Mudalige, and Henson	2006	Mail	816	NR	279	251	34.2%		30.8%	
6	*Review of Agricultural Economics*	Collins and Basden[1/]	2006	Mail and Telephone	60	NR	47	NR	78.3%			
7	*American Journal of Agricultural Economics*	Lusk	2003	Mail	4,900	476	632	574	12.9%	14.3%	11.7%	13.0%
8	*American Journal of Agricultural Economics*	Brox, Kumar and Stollerry	2003	Mail	3,070	NR	2,182	1,003	71.1%		32.7%	
9	*American Journal of Agricultural Economics*	Mark Lusk and Daniel[1/]	2004	Mail and Internet	350	NR	95	NR	27.1%			
10	*American Journal of Agricultural Economics*	Sherrick, Barry, Ellinger and Scnitkey	2004	Mail	3,000	NR	868	NR	28.9%			
11	*American Journal of Agricultural Economics*	Roe, Sporleder, and Belleville	2004	Mail	4,000	498	434	371	10.9%	12.4%	9.3%	10.6%

	Journal	Author(s)	Year	Survey Type	Sample Size		Number of Responses		Response Rates			
									Numerator			
									Completed		Usable	
					Sent	Undeliverable	Completed	Usable	Denomenator			
									Sent	Sent - Undeliverable	Sent	Sent - Undeliverable
12	*Journal of Agricultural and Resource Economics*	Alexander, Fernandez-Cornejo, and Goodhue[2/]	2003	Mail	1,000	NR	430	389	43.0%		38.9%	
13	*Journal of Agricultural and Resource Economics*	Lohr, and Park[3/]	2003	Mail	1,192	NR	NR	613			51.4%	
14	*Journal of Agricultural and Resource Economics*	Pennings, Isengildina, Irwin, and Good	2004	Mail	3,990	NR	NR	1,399			35.1%	
15	*Journal of Agricultural and Resource Economics*	Hoag, Lacy, and Davis[4/]	2004	Mail	1,170	477	273	NR	23.3%	39.4%		
16	*Journal of Agricultural and Resource Economics*	Norwood, Luter, and Massey	2005	Mail	513	NR	294	288	57.3%		56.1%	
17	*Journal of Agricultural and Resource Economics*	Stewart, Blisard, Jolliffe, and Bhuyan	2005	Mail	2,400	NR	981	700	40.9%		29.2%	
18	*Journal of Agricultural and Resource Economics*	Hurd	2006	Mail	1,216	63	423	NR	34.8%	36.7%		
19	*Journal of Agricultural and Resource Economics*	Hurley, Langrock, and Ostlie	2006	Mail	2,000	NR	900	630	45.0%		31.5%	
20	*Journal of Agricultural and Resource Economics*	Norwood, Winn, Chung, and Ward	2006	Mail	2,950	83	NR	670			22.7%	23.4%
21	*Journal of Agricultural and Resource Economics*	Johnston and Roheim	2006	Mail	1,500	86	432	368	28.8%	30.6%	24.5%	26.0%
22	*Journal of Food Distribution Research*	Park and German	2000	Mail	NR	NR	NR	NR				
23	*Journal of Food Distribution Research*	Schupp and Gillespie	2001	Mail	2,000	NR	381	337	19.1%		16.9%	
24	*Journal of Food Distribution Research*	Ekanem, Muhammad, Mafuyai-Ekanem, Tegegne,	2004	Mail	NR	NR	163	NR				
25	*Journal of Food Distribution Research*	Onianwa, Wheelock, Mojica, and Singh	2005	Mail	300	NR	30	NR	10.0%			
26	*Journal of Food Distribution Research*	Schupp, Gillespie, Prinyawiwatkul, and O'Neil	2005	Mail	3,400	NR	704	NR	20.7%			
27	*Journal of Food Distribution Research*	Schupp, Gillespie, O'Neil, Prinyawiwatkul, and	2006	Mail	2,000	160	414	394	20.7%	22.5%	19.7%	21.4%

	Journal	Author(s)	Year	Survey Type	Sample Size		Number of Responses		Response Rates			
									Numerator			
									Completed		Usable	
					Sent	Undeliverable	Completed	Usable	Denomenator			
									Sent	Sent - Undeliverable	Sent	Sent - Undeliverable
28	*Land Economics*	Breffle and Rowe	2002	Mail	653	NR	470	NR	72.0%			
29	*Land Economics*	Moon, Florkowiski, Bruckner, and Schonhof	2002	Mail	2,773	NR	525	NR	18.9%			
30	*Land Economics*	Horne and Petajisto	2003	Mail	1,296	NR	765	NR	59.0%			
31	*Land Economics*	Langpag	2004	Mail	1,500	101	947	777	63.1%	67.7%	51.8%	55.5%
32	*Land Economics*	Roe, Irwin, and Morrow-Jones	2004	Mail	2,600	NR	1,352	1,257	52.0%		48.3%	
33	*Land Economics*	Sundberg	2006	Mail	600	NR	279	NR	46.5%			
34	*Land Economics*	Kinnell, Bingham, Mohamed, Desvousges.	2006	Mail and Telephone	1,629	NR	651	NR	40.0%			
35	*Land Economics*	Banzhaf, Burtraw, Evans, and Krupnick[1/]	2006	Mail, Internet	3,905	1,533	NR	570	14.6%	24.0%		
36	*Agricultural and Resource Economic Review*	Larson, Findeis, and Smith	2001	Mail	800	NR	477	300	59.6%		37.5%	
37	*Agricultural and Resource Economic Review*	Jakus, Jensen, and Davis	2003	Mail	764	38	225	150	29.5%	31.0%	19.6%	20.7%
38	*Agricultural and Resource Economic Review*	Shields, and Willits	2003	Mail	2,909	96	1,025	842	35.2%	36.4%	28.9%	29.9%
39	*Agricultural and Resource Economic Review*	Duke[5/]	2004	Mail	402	41	276	262	68.7%	76.5%	65.2%	72.6%
			2004	Mail	310	60	127	115	41.0%	50.8%	37.1%	46.0%
40	*Agricultural and Resource Economic Review*	Bernard, Pesek, and Fan	2004	Mail	787	NR	175	116	22.2%		14.7%	

	Journal	Author(s)	Year	Survey Type	Sample Size		Number of Responses		Response Rates			
									Numerator			
									Completed		Usable	
					Sent	Undeliverable	Completed	Usable	Denomenator			
									Sent	Sent - Undeliverable	Sent	Sent - Undeliverable
41	*Agribusiness*	Vergara, Coble, Knight, Patrick, and Baquet	2004	Mail	6,810	NR	NR	1812			26.6%	
42	*Agribusiness*	Benard, Pesek, and Fan	2004	Mail	787	NR	175	128	22.2%		16.3%	
43	*Agribusiness*	Fisher	2004	Mail	1,298	NR	184	166	14.2%		12.8%	
44	*Agribusiness*	Baker, and Leidecker	2001	Mail	25	NR	16	NR	64.0%			
45	*Journal of Agribusiness*	Adrian, and Green	2001	Mail	105	NR	NR	41			39%	
46	*Journal of Agribusiness*	Wachenheim, and Lesch[3/]	2002	Mail	241	NR	40	NR	16.6%			
					52	NR	30	NR	57.7%			
47	*Journal of Agribusiness*	Jensen, Burton, Menard, and Zhang	2004	Mail	2,452	40	561	276	22.9%	23.3%	11.3%	11.4%
48	*Journal of Agribusiness*	Gillespie, Basarir, and Schupp[3/]	2004	Mail	1,472	NR	495	NR	33.6%			
49	*Journal of Agribusiness*	Onianwa, Wheelock, Gyawali, Gan, Dubois, and	2004	Mail	1,215	NR	800	710	65.8%		58.4%	
50	*Agricultural and Applied Economics*	Gilliespie, Davis, and Rahelizatovo	2004	Mail	4,986	NR	1031	944	20.7%		18.9%	
51	*Agricultural and Applied Economics*	Harrison, and Sambidi	2004	Mail	43	NR	13	10	30.2%		23.3%	
52	*Agricultural and Applied Economics*	Hu, Chen, and Yoshida	2006	Mail	1,050	NR	430	403	41.0%		38.4%	
53	*Journal of International Food and Agribusiness Marketing*	Renee	2003	Mail	NR	NR	185	NR				

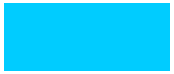
	Journal	Author(s)	Year	Survey Type	Sample Size		Number of Responses		Response Rates			
									Numerator			
									Completed		Usable	
					Sent	Undeliverable	Completed	Usable	Denomenator			
									Sent	Sent - Undeliverable	Sent	Sent - Undeliverable
54	*AgBioForum*	Burton, and Pearse[3/]	2002	Mail	250	NR	64	NR	25.6%			
55	*AgBioForum*	Teisl, Garner, Roe, and Vayda[5/]	2003	Mail	5,462	NR	2012	NR	36.8%			
					710	NR	375	NR	52.8%			
56	*AgBioForum*	Harrison, Boccaletti, and House	2004	Mail and Personal	3,450	NR	NR	509			14.8%	
57	*AgBioForum*	Alexander, and VanMellor	2005	Mail	4,000			794			19.9%	
58	*AgBioForum*	Goldberg, Merill, and Hurley	2005	Mail	2,000	NR	NR	NR	39.0%			
					2,000	NR	NR	NR	39.0%			
59	*AgBioForum*	Hwang, Roe, Teisl[6/]	2005	Mail	6,172	NR	2387	1656	38.7%		26.8%	
60	*AgBioForum*	Chimmin, Tudor, and Spaulding	2006	Mail	400	NR	156	134	39.0%		33.5%	
61	AgBioForum	Anderson, Wachenheim, and Lesh	2006	Assumed Mail	NR	NR	340	258				
62	*AgBioForum*	Lagerkuist, Carlsson, and Viske	2006	Mail	700		347	285	49.6%		40.7%	
63	*AgBioForum*	Alexander[3/]	2007	Mail and Phone	4,000	NR	NR	794			19.9%	
64	*Canadian Journal of Agricultural Economics*	Shaikh, Sun, and VanKooten[6/]	2007	Mail	2,000	NR	NR	NR			13.0%	
65	*Canadian Journal of Agricultural Economics*	Nilsson, Foster, and Lusk	2006	Mail	5,836	NR		642			11.0%	
66	*Canadian Journal of Agricultural Economics*	Isgin, and Forster	2006	Mail	NR	NR	780	252				
67	*Canadian Journal of Agricultural Economics*	Cranfield, and Magnusson	2005	Mail	2,000	200	374		18.7%	20.8%		
68	*Canadian Journal of Agricultural Economics*	Hudson, and Hile[7/]	2003	Mail	780			98			12.6%	

Journal of Agricultural Economics *None 2002-2007*

NR = Not Reported

1/ Only Mail Response Rates are included

2/Response Rate was Called Gross Response Rate
3/ Reported Other Response Rate
4/ Undeliverable = Undeliverable + Firms that are no longer producing
5/ Included Cash Incentive
6/ Response Rate was Called Effective Rate
7/ Response Rate was not Reported

 = Reported Response Rate in Publication

Response Rate =

Completed / Sent
Completed / (Sent-undeliverable)
Usable / Sent
Usable / (Sent-Undeliverable)

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Appendix C: Survey Questionnaire

CONSUMER SURVEY

Kansas State University
Department of Agricultural Economics

We are interested in your perceptions and opinions about various food safety issues. This survey is in multiple-choice and fill-in-the-blank format and will take only 8 to 15 minutes to complete (depending on the length of the questionnaire). Please have the person responsible for most of your household's food purchasing decisions complete the survey and return it in the enclosed postage paid envelope. Thank you for assisting us with this research.

1. Approximately how often does your household consume <u>beef</u> products?

_____ almost every day
_____ 3-4 times a week
_____ about once or twice a week
_____ less than once a week
_____ never – we do not consume beef products

2. Approximately how often does your household consume <u>poultry</u> (chicken, turkey) products?

_____ almost every day
_____ 3-4 times a week
_____ about once or twice a week
_____ less than once a week
_____ never – we do not consume poultry products

3. Approximately how often does your household consume <u>fresh vegetables</u>?

_____ almost every day
_____ 3-4 times a week
_____ about once or twice a week
_____ less than once a week
_____ never – we do not consume fresh vegetables

Spinach and E-coli

You may recall that in August 2006, fresh spinach contaminated with *E.coli* bacteria caused an outbreak of food poisoning. More than 200 people became ill and 100 were hospitalized. At least three people died. For several weeks fresh spinach was removed from grocery stores.

We are interested in how your consumption of fresh spinach was affected by that event.

4. Prior to the *E.coli* contamination, how often did your household consume fresh spinach?

_____ almost every day

_____ 3-4 times a week

_____ about once or twice a week

_____ about once or twice a month

_____ never – fresh spinach had not been part of our diet → Skip to Question 6

5. Did your household's consumption of fresh spinach change after the *E.coli* contamination? (Mark the response that best describes how your consumption changed)

_____ We stopped consuming fresh spinach and now we do not purchase any.

_____ For a few months after fresh spinach came back to the store we didn't buy any, but we gradually consumed more as time went by.

_____ Our consumption didn't really change - when fresh spinach came back to the store we continued to purchase about as much as before the contamination.

6. How often does your household consume fresh spinach now?

_____ almost every day

_____ 3-4 times a week

_____ about once or twice a week

_____ about once or twice a month

_____ never – we don't eat fresh spinach

Food Irradiation

Food irradiation is a process that can eliminate disease-causing bacteria in many food products. It can be used to control bacteria such as *E.coli* in spinach and other vegetables without affecting the nutritional quality of the food. The Food and Drug Administration is now considering approving irradiation for that purpose.

Irradiation does not make foods radioactive – in the same way that X-rays used for airport security don't make your suitcase radioactive. Agencies such as the *Centers for Disease Control,* the *American Medical Association,* the *American Dietetic Association* and the *World Health Organization* have concluded that irradiated food is safe and wholesome.

How are foods irradiated?

Irradiation Information Set, Gamma Rays
<In Versions 1.1, 1.3, 1.5, 1.7, 2.1, 2.3, 2.5, 2.7, 3.1, 3.3, 3.5, and 3.7>

Irradiation involves exposing food to ionizing energy. One type of ionizing energy commonly used for food irradiation is gamma rays.

In a gamma-ray irradiation facility, food is passed on a conveyer system in front of a source of gamma rays. The most common source is the radioactive isotope cobalt 60. Gamma rays pass through food in a manner similar to the way an X-ray would pass through your body. The gamma-rays interfere with bacteria's DNA, destroying its ability to reproduce and rendering it harmless.

Gamma ray irradiation does not use any chemical additives and leaves no residue. It does not significantly change the temperature of the food, and does not alter the appearance, taste or chemical makeup of the food product or its packaging.

Gamma ray irradiation is a safe process. While ionizing radiation is present when the source is exposed, workers in the facility are protected by thick concrete walls. When not in use the radioactive source is stored in a pool of water which absorbs the radiation harmlessly and completely.

OR

Irradiation Information Set, E-beam
<In Versions 1.2, 1.4, 1.6, 1.8, 2.2, 2.4, 2.6, 2.8, 3.2, 3.4, 3.6, and 3.8 >

Irradiation involves exposing food to ionizing energy. One type of ionizing energy commonly used for food irradiation is a beam of accelerated electrons.

In an electron beam (E-beam) irradiation facility, food is passed on a conveyer system underneath a beam of electrons. E-beam technology is similar to what is used in a cathode ray tube in a TV set. Electron beams pass through food in a manner similar to the

way an X-ray would pass through your body. The electron beam interferes with bacteria's DNA, destroying its ability to reproduce and rendering it harmless.

Electron beam irradiation does not use any chemical additives and leaves no residue. It does not significantly change the temperature of the food, and does not alter the appearance, taste or chemical makeup of the food product or its packaging.

Electron beam irradiation is a safe process. While ionizing radiation is present when the machine is on, workers in the facility are protected by thick concrete walls. However, when the machine is switched off, the ionizing radiation stops, just like in a TV set.

7. Which of the following best describes your knowledge of food irradiation <u>before</u> receiving this survey? *Please mark only one answer.*

_____ I had never heard of food irradiation until now

_____ I had heard of food irradiation, but did not know much about it

_____ I knew quite a lot about food irradiation

8. a) <u>Before receiving this survey</u>, how would you have characterized your attitude to food irradiation? *Please circle one number*

very negative		neutral		very positive
1	2	3	4	5

b) <u>Having read the information above</u>, how would you now characterize your attitude to food irradiation? *Please circle one number*

very negative		neutral		very positive
1	2	3	4	5

9. If you were purchasing a package of pre-washed salad greens at your local grocery and you could choose between regular pre-washed salad greens (at $2.49 for a 10oz bag) and pre-washed salad greens that were treated with irradiation to control *E. coli* and other harmful bacteria (<u>also at $2.49</u> for a 10oz bag), which type of pre-washed salad greens would you buy? Assuming both bags were identical in all attributes – i.e., same brand, same freshness, same color, etc, I would …… (*Please mark only one of the six answers)*

_____ definitely buy regular <u>non-irradiated</u> salad greens
_____ probably buy the regular <u>non-irradiated</u> salad greens
_____ be unsure - I'd need to know more about irradiation, but I think I'd buy the regular <u>non-irradiated</u> salad greens

→ Go to Question 10

_____ definitely buy <u>irradiated</u> salad greens
_____ probably buy the <u>irradiated</u> salad greens
_____ be unsure - I'd need to know more about irradiation, but I think I'd buy the <u>irradiated</u> salad greens

→ Go to Question 11

<Versions 1.1, 1.5, 2.1, 2.5, 3.1, and 3.5 cost is 10c more >
<Versions 1.2, 1.6, 2.2, 2.6, 3.2, and 3.6 cost is 25c more>
<Versions 1.3, 1.7, 2.3, 2.7, 3.3, and 3.7 cost is 35c more>
<Versions 1.4, 1.8, 2.4, 2.8, 3.4, and 3.8 cost is 50c more>

10. If you chose the <u>regular non-irradiated</u> salad greens in question 9, would you still buy regular non-irradiated salad greens if they cost __c per bag <u>more</u> (i.e. $2.__/bag) than irradiated salad greens?

_____ Yes, if regular non-irradiated salad greens cost __c/bag more than irradiated salad greens, I'd still buy regular <u>non-irradiated</u> salad greens.

_____ No, if regular non-irradiated salad greens cost __c/bag more than irradiated salad greens, I'd choose to buy <u>irradiated</u> salad greens instead.

11. If you chose the irradiated salad greens in question 9, would you still buy irradiated salad greens if they cost __c per bag more (i.e. $2.__/bag) than regular non-irradiated salad greens?

_____ Yes, if irradiated salad greens cost __c/bag more than regular non-irradiated salad greens, I'd still buy irradiated salad greens.

_____ No, if irradiated salad greens cost __c/bag more than regular non-irradiated salad greens, I'd choose to buy regular non-irradiated salad greens instead.

<Version 2>

Bird Flu

Avian influenza, commonly known as bird flu, is a contagious viral disease that affects wild birds and domestic poultry. A new outbreak of a dangerous type of bird flu (highly pathogenic avian influenza) was reported in Southern Asia in 2003 and had spread to 41 countries as of May 2007. In some circumstances, such as when people have close contact with infected birds, the disease can spread to humans. Since January 2003, the World Health Organization had confirmed 307 human cases of bird flu, of which 186 (60%) had resulted in death. More than half of the human cases have occurred in Vietnam or Indonesia.

This dangerous type of bird flu has not yet been found in the United States.

12. Which of the following best describes your familiarity with bird flu before receiving this survey? *Please mark only one answer.*

_____ I had never heard of bird flu until now

_____ I had heard of bird flu, but did not know much about it

_____ I knew quite a lot about bird flu

13. How concerned are you that you or someone else in your household will get sick from Bird Flu/Avian Influenza? *Please mark only one answer.*

_____ Concerned

_____ Moderately concerned

_____ Not concerned

<In Versions 2.1.A to 2.8.A, and 3.1.A to 3.8.A>
No additional information on Avian Influenza

OR
<In Versions 2.1.B to 2.8.B, and 3.1.B to 3.8.B>
Additional Information on Avian Influenza

According to food safety professionals, proper cooking kills the bird flu virus and would protect consumers if the disease was found in U.S. poultry.

14. If a single case of bird flu were found in a wild bird in Montana, would your consumption of poultry change? *Please mark only one answer.*

_____ No, our poultry consumption would probably remain as it is now

_____ Yes, we would probably consume less poultry than we do now

_____ Yes, we would probably stop consuming poultry altogether

<Version 3>

Use of Antibiotics in Animal Feed

The addition of low levels of antibiotics to animal feed can help keep animals healthier and results in faster animal growth rates. However, some scientists and consumer advocates are concerned that the use of antibiotics in animal feed can promote the development of harmful bacteria that are resistant to antibiotics.

15. Which of the following best describes your familiarity with the use of antibiotics in animal feed before receiving this survey? *Please mark only one answer.*

_____ I had never heard of antibiotics in animal feed until now

_____ I had heard of antibiotics in animal feed, but did not know much about it

_____ I knew quite a lot about antibiotics in animal feed

If the use of antibiotics in animal feed was banned, the cost of producing meat would increase. In this next question we want to find out whether you would pay more for beef produced without antibiotics.

<Versions 3.1, and 3.5 cost is $4 more >
<Versions 3.2, and 3.6 cost is $3 more>
<Versions 3.3, and 3.7 cost is $2 more>
<Versions 3.4, and 3.8 cost is $1 more>

16. If you were purchasing beef sirloin steak at your local grocery and you could choose between regular sirloin steak (at $8.99/lb) and sirloin steak from animals that had never been fed antibiotics ("antibiotic free" at $__.99/lb), which type of steak would you buy? Assuming both steaks are identical in all attributes – i.e., same brand, same freshness, same color, etc, I would …… (*Please mark only one of the six answers)*

_____ definitely buy the "antibiotic free" steak at $--.99/lb

_____ probably buy the "antibiotic free" steak at $-- .99/lb

_____ be undecided. I'd need to know more about antibiotics before deciding but would be inclined to buy the "antibiotic free" steak.

_____ definitely buy the regular steak at $8.99/lb

_____ probably buy the regular steak at $8.99/lb

_____ be undecided. I'd need to know more about antibiotics before deciding but would be inclined to buy the regular steak.

In this final part of the survey, we would like some background information about you. We would like to remind you that all of this information will be treated as confidential, and that the results of this survey will only be used in summary form.

17. What gender are you?

_____ Male _____ Female

18. What year were you born? *Fill in the blank.*

_____

19. What is your Race or Ethnicity? *Please mark only one response.*

_____	White	_____	Hispanic
_____	Black, African American	_____	Asian
_____	Native American	_____	Other *Please Specify*

20. What is the highest level of education you have completed? *Please mark only one response.*

_____	Some high school	_____	College Graduate
_____	High school graduate	_____	Post Graduate
	Some college		

21. In order to evaluate if we are getting a representative sample, we would like to know your approximate 2006 household income before taxes. *Please mark only one response.*

_____	Less than $20,000	____	$50,000 up to $70,000
_____	$20,000 up to $30,000	____	$70,000 up to $100,000
_____	$30,000 up to $40,000	____	$100,000 up to 150,000
_____	$40,000 up to $50,000	____	more than $150,000

22. Including yourself, how many people live in your household? *Please fill in the blank.*

_____ People

23. Do you and your family currently have health insurance?

_____ Yes _____ No

24. Are there any children living in your household? *Please circle*

a)	**under age 6?**	Yes	No
b)	**between 6 and 18?**	Yes	No

Please check the survey to ensure that you have answered all the questions and return it in the postage-paid envelope provided. Your contribution to this project is greatly appreciated.

Appendix D: Response Rate Results

First, Second, and Total Response Rates

A. FIRST MAILING

VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
Version 1	83	21	400	20.8%	21.9%
Version 2	166	29	800	20.8%	21.5%
Version 3	153	28	800	19.1%	19.8%
TOTAL	**402**	**78**	**2000**	**20.1%**	**20.9%**

B. SECOND MAILING

VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
Version 1	42	9	305	13.8%	14.2%
Version 2	89	15	617	14.4%	14.8%
Version 3	89	10	632	14.1%	14.3%
TOTAL	**220**	**34**	**1554**	**14.2%**	**14.5%**

C. BOTH MAILINGS

VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
Version 1	125	30	400	31.3%	33.8%
Version 2	255	44	800	31.9%	33.7%
Version 3	242	38	800	30.3%	31.8%
TOTAL	**622**	**112**	**2000**	**31.1%**	**32.9%**

First Mailing, Second Mailing, and Total Response Rate for Wichita.

A. FIRST MAILING

VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
Version 1	64	6	200	32.0%	33.0%
Version 2	129	12	400	32.3%	33.2%
Version 3	119	7	400	29.8%	30.3%
TOTAL	**312**	**25**	**1000**	**31.2%**	**32.0%**

B. SECOND MAILING

VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
Version 1	25	1	135	18.5%	18.7%
Version 2	59	1	264	22.3%	22.4%
Version 3	47	1	282	16.7%	16.7%
TOTAL	**131**	**3**	**681**	**19.2%**	**19.3%**

C. BOTH MAILINGS

VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
Version 1	89	7	200	44.5%	46.1%
Version 2	188	13	400	47.0%	48.6%
Version 3	166	8	400	41.5%	42.3%
TOTAL	**443**	**28**	**1000**	**44.3%**	**45.6%**

First Mailing, Second Mailing, and Total Response Rate for Los Angeles.

A. FIRST MAILING

VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
Version 1	19	15	200	9.5%	10.3%
Version 2	37	17	400	9.3%	9.7%
Version 3	34	21	400	8.5%	9.0%
TOTAL	**90**	**53**	**1000**	**9.0%**	**9.5%**

B. SECOND MAILING

VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
Version 1	17	8	170	10.0%	10.5%
Version 2	30	14	353	8.5%	8.8%
Version 3	42	9	350	12.0%	12.3%
TOTAL	**89**	**31**	**873**	**10.2%**	**10.6%**

C. BOTH MAILINGS

VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
Version 1	36	23	200	18.0%	20.3%
Version 2	67	31	400	16.8%	18.2%
Version 3	76	30	400	19.0%	20.5%
TOTAL	**179**	**84**	**1000**	**17.9%**	**19.5%**

Number of Responses by Version and by Postcard/No Postcard Test for Wichita, Los Angeles and Total for Both States Combined.

WICHITA

TREATMENT	VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
POST CARD	Version 1	49	1	100	49.0%	49.5%
	Version 2	104	8	200	52.0%	54.2%
	Version 3	91	4	200	45.5%	46.4%
	TOTAL	**244**	**13**	**500**	**48.8%**	**50.1%**
NO POST CARD	Version 1	40	6	100	40.0%	42.6%
	Version 2	84	5	200	42.0%	43.1%
	Version 3	75	4	200	37.5%	38.3%
	TOTAL	**199**	**15**	**500**	**39.8%**	**41.0%**

LOS ANGELES

TREATMENT	VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
POST CARD	Version 1	22	10	100	22.0%	24.4%
	Version 2	37	14	200	18.5%	19.9%
	Version 3	44	19	200	22.0%	24.3%
	TOTAL	**103**	**43**	**500**	**20.6%**	**22.5%**
NO POST CARD	Version 1	14	23	100	14.0%	18.2%
	Version 2	30	31	200	15.0%	17.8%
	Version 3	32	30	200	16.0%	18.8%
	TOTAL	**76**	**84**	**500**	**15.2%**	**18.3%**

BOTH MAILINGS

TREATMENT	VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
POST CARD	Version 1	71	11	200	35.5%	37.6%
	Version 2	141	22	400	35.3%	37.3%
	Version 3	135	23	400	33.8%	35.8%
	TOTAL	**347**	**56**	**1000**	**34.7%**	**36.8%**
NO POST CARD	Version 1	54	29	200	27.0%	31.6%
	Version 2	114	36	400	28.5%	31.3%
	Version 3	107	34	400	26.8%	29.2%
	TOTAL	**275**	**99**	**1000**	**27.5%**	**30.5%**

Number of Responses for the First Mailing by Incentive Size for Both States Combined.

INCENTIVE	VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
$0	Version 1	20	6	100	20.0%	21.3%
	Version 2	51	7	200	25.5%	26.4%
	Version 3	34	10	200	17.0%	17.9%
	TOTAL	**105**	**23**	**500**	**21.0%**	**22.0%**
$1 Promise to Red Cross	Version 1	22	2	100	22.0%	22.4%
	Version 2	42	5	200	21.0%	21.5%
	Version 3	33	5	200	16.5%	16.9%
	TOTAL	**97**	**12**	**500**	**19.4%**	**19.9%**
$3 Promise to Red Cross	Version 1	22	5	100	22.0%	23.2%
	Version 2	34	7	200	17.0%	17.6%
	Version 3	37	8	200	18.5%	19.3%
	TOTAL	**93**	**20**	**500**	**18.6%**	**19.4%**
$5 Promise to Red Cross	Version 1	19	8	100	19.0%	20.7%
	Version 2	39	10	200	19.5%	20.5%
	Version 3	49	5	200	24.5%	25.1%
	TOTAL	**107**	**23**	**500**	**21.4%**	**22.4%**

First Mailing Number of Responses by Incentive Size for Wichita and Los Angeles.

WICHITA

INCENTIVE	VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
$0	Version 1	16	1	50	32.0%	32.7%
	Version 2	41	3	100	41.0%	42.3%
	Version 3	32	2	100	32.0%	32.7%
	TOTAL	**89**	**6**	**250**	**35.6%**	**36.5%**
$1 Promise to Red Cross	Version 1	18	1	50	36.0%	36.7%
	Version 2	31	2	100	31.0%	31.6%
	Version 3	26	1	100	26.0%	26.3%
	TOTAL	**75**	**4**	**250**	**30.0%**	**30.5%**
$3 Promise to Red Cross	Version 1	15	2	50	30.0%	31.3%
	Version 2	25	3	100	25.0%	25.8%
	Version 3	28	3	100	28.0%	28.9%
	TOTAL	**68**	**8**	**250**	**27.2%**	**28.1%**
$5 Promise to Red Cross	Version 1	15	2	50	30.0%	31.3%
	Version 2	32	4	100	32.0%	33.3%
	Version 3	33	1	100	33.0%	33.3%
	TOTAL	**80**	**7**	**250**	**32.0%**	**32.9%**

LOS ANGELES

INCENTIVE	VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
$0	Version 1	4	5	50	8.0%	8.9%
	Version 2	10	4	100	10.0%	10.4%
	Version 3	2	8	100	2.0%	2.2%
	TOTAL	**16**	**17**	**250**	**6.4%**	**6.9%**
$1 Promise to Red Cross	Version 1	4	1	50	8.0%	8.2%
	Version 2	11	3	100	11.0%	11.3%
	Version 3	7	4	100	7.0%	7.3%
	TOTAL	**22**	**8**	**250**	**8.8%**	**9.1%**
$3 Promise to Red Cross	Version 1	7	3	50	14.0%	14.9%
	Version 2	9	4	100	9.0%	9.4%
	Version 3	9	5	100	9.0%	9.5%
	TOTAL	**25**	**12**	**250**	**10.0%**	**10.5%**
$5 Promise to Red Cross	Version 1	4	6	50	8.0%	9.1%
	Version 2	7	6	100	7.0%	7.4%
	Version 3	16	4	100	16.0%	16.7%
	TOTAL	**27**	**16**	**250**	**10.8%**	**11.5%**

Second Mailing Number of Responses by Incentive Size for Both States Combined.

INCENTIVE	VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
$0	Version 1	13	7	162	8.0%	8.4%
	Version 2	22	9	336	6.5%	6.7%
	Version 3	29	7	337	8.6%	8.8%
	TOTAL	**64**	**23**	**835**	**7.7%**	**7.9%**
$1	Version 1	11	1	70	15.7%	15.9%
	Version 2	24	3	141	17.0%	17.4%
	Version 3	33	2	151	21.9%	22.1%
	TOTAL	**68**	**6**	**362**	**18.8%**	**19.1%**
$2	Version 1	18	1	73	24.7%	25.0%
	Version 2	43	3	140	30.7%	31.4%
	Version 3	27	1	144	18.8%	18.9%
	TOTAL	**88**	**5**	**357**	**24.6%**	**25.0%**

Number of Responses for the Second Mailing by Incentive Size for Wichita and Los Angeles.

WICHITA

INCENTIVE	VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
$0	Version 1	9	1	73	12.3%	12.5%
	Version 2	17	0	141	12.1%	12.1%
	Version 3	16	1	152	10.5%	10.6%
	TOTAL	**42**	**2**	**366**	**11.5%**	**11.5%**
$1	Version 1	6	0	30	20.0%	20.0%
	Version 2	14	0	61	23.0%	23.0%
	Version 3	21	0	67	31.3%	31.3%
	TOTAL	**41**	**0**	**158**	**25.9%**	**25.9%**
$2	Version 1	10	0	32	31.3%	31.3%
	Version 2	28	1	62	45.2%	45.9%
	Version 3	10	0	63	15.9%	15.9%
	TOTAL	**48**	**1**	**157**	**30.6%**	**30.8%**

LOS ANGELES

INCENTIVE	VERSION	RECEIVED	UNDELIVERABLE	SENT	GROSS RESPONSE RATE	NET RESPONSE RATE
$0	Version 1	4	6	89	4.5%	4.8%
	Version 2	5	9	195	2.6%	2.7%
	Version 3	13	6	185	7.0%	7.3%
	TOTAL	**22**	**21**	**469**	**4.7%**	**4.9%**
$1	Version 1	5	1	40	12.5%	12.8%
	Version 2	10	3	80	12.5%	13.0%
	Version 3	12	2	84	14.3%	14.6%
	TOTAL	**27**	**6**	**204**	**13.2%**	**13.6%**
$2	Version 1	8	1	41	19.5%	20.0%
	Version 2	15	2	78	19.2%	19.7%
	Version 3	17	1	81	21.0%	21.3%
	TOTAL	**40**	**4**	**200**	**20.0%**	**20.4%**

Appendix E: Survey Costs

Total Costs for the Survey for Both Mailings

Cost Description	First Mailing Costs	Second Mailing Costs		Savings
		Identifying Households	Without Identifying Households	
Postage Costs				
Postcards	$ 130.00			
Postage Regular Envelope	$ 164.00			
Postage Big Envelope	$ 1,552.00	$ 1,505.44	$ 1,940.00	$ 434.56
Received Questionnaires	$ 71.38	$ 18.06	$ 18.06	$ -
Envelope Costs				
Regular Envelope	$ 84.93			
Big Envelope	$ 339.71	$ 329.52	$ 424.64	$ 95.12
Return Envelopes	$ 399.60	$ 310.09	$ 399.60	$ 89.51
Printing Materials				
Paper for Questionnaires				
Version 1	$ 7.87	$ 6.00	$ 7.87	$ 1.87
Version 2	$ 15.74	$ 12.14	$ 15.74	$ 3.60
Version 3	$ 20.99	$ 16.58	$ 20.99	$ 4.41
Letter Head Paper	$ 430.40	$ 333.99	$ 430.40	$ 96.41
Toner	$ 107.23	$ 107.23	$ 107.23	
First Mail Incentives				
$1 Red Cross	$ 97.00			
$3 Red Cross	$ 279.00			
$5 Red Cross	$ 535.00			
Second Mail Incentives				
$1		$ 362.00	$ 500.00	$ 138.00
$2		$ 714.00	$ 1,000.00	$ 286.00
Returned Incentives		$ (34.00)	$ (34.00)	
Total	**$ 4,234.86**	**$ 3,681.06**	**$ 4,864.54**	**$ 1,149.48**

Appendix F: Logit Regression Results

First Mailing	Coefficients	Marginal Effects
Intercept	-2.493	-0.354
	(4.766)	(0.672)
WICHITA	2.053	0.297
	(5.598)	(0.827)
PC	0.396	0.056
	(1.123)	(0.159)
DRC1	0.345	0.052
	(1.710)	(0.270)
DRC3	0.487	0.075
	(1.670)	(0.274)
DRC5	0.573	0.089
	(1.648)	(0.277)
PAGES	-0.654	-0.009
	(0.736)	(0.104)
WICHCARD	0.056	0.008
	(1.318)	(0.191)
WICHRC1	-0.603	-0.073
	(1.961)	(0.202)
WICHRC3	-0.883	-0.100
	(1.934)	(0.170)
WICGRC5	-0.736	-0.086
	(1.903)	(0.181)
WICHPGS	0.003	0.0004
	(0.867)	(0.123)
Log Likelihood Function	-36.479	
χ^2	30.240^{***}	
Pseudo-R^2	0.716	

Standard Errors are in parenthesis

*, **, and *** are significant at the 10%, 5%, and 1% level respectively.

Second Mailing	Coefficients	Marginal Effects
Intercept	-3.650	-0.474
	(2.503)	(0.317)
WICHITA	2.084	0.279
	(3.145)	(0.438)
PC	0.225	0.029
	(0.565)	(0.073)
ONEDOL	1.074	0.158
	(0.878)	(0.140)
TWODOL	1.585*	0.246*
	(0.840)	(0.142)
PAGES	0.087	0.011
	(0.380)	(0.049)
WICHPC	-0.023	-0.003
	(0.720)	(0.093)
WICHONE	0.019	0.002
	(1.072)	(0.140)
WICHTWO	-0.370	-0.044
	(1.039)	(0.112)
WICHPGS	-0.187	-0.024
	(0.481)	(0.062)
Log Likelihood Function	-104.394	
χ^2	84.594***	
Pseudo-R^2	0.750	

Standard Errors are in parenthesis
*, **, and *** are significant at the 10%, 5%, and 1% level respectively.

Appendix G: Survey Results by Question

CONSUMER SURVEY

Kansas State University
Department of Agricultural Economics

We are interested in your perceptions and opinions about various food safety issues. This survey is in multiple-choice and fill-in-the-blank format and will take only 8 to 15 minutes to complete (depending on the length of the questionnaire). Please have the person responsible for most of your household's food purchasing decisions complete the survey and return it in the enclosed postage paid envelope. Thank you for assisting us with this research.

1. Approximately how often does your household consume <u>beef</u> products? *Mark one answer*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
almost every day	81	13.15%	73	16.67%	8	4.49%
3-4 times a week	234	37.99%	199	45.43%	35	19.66%
about once or twice a week	180	29.22%	118	26.94%	62	34.83%
less than once a week	92	14.94%	39	8.90%	53	29.78%
never - we do not consume beef products	29	4.71%	9	2.05%	20	11.24%
Total	**616**	**100.00%**	**438**	**100.00%**	**178**	**100.00%**

2. Approximately how often does your household consume <u>poultry</u> (chicken, turkey) products?

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
almost every day	52	8.44%	34	7.76%	18	10.11%
3-4 times a week	262	42.53%	182	41.55%	80	44.94%
about once or twice a week	245	39.77%	180	41.10%	65	36.52%
less than once a week	46	7.47%	36	8.22%	10	5.62%
never - we do not consume poultry products	11	1.79%	6	1.37%	5	2.81%
Total	**616**	**100.00%**	**438**	**100.00%**	**178**	**100.00%**

3. Approximately how often does your household consume fresh vegetables?

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
almost every day	269	43.67%	165	37.67%	104	58.43%
3-4 times a week	171	27.76%	128	29.22%	43	24.16%
about once or twice a week	117	18.99%	93	21.23%	24	13.48%
less than once a week	50	8.12%	45	10.27%	5	2.81%
never - we do not consume fresh vegetables	9	1.46%	7	1.60%	2	1.12%
Total	**616**	**100.00%**	**438**	**100.00%**	**178**	**100.00%**

Spinach and E-coli

You may recall that in August 2006, fresh spinach contaminated with *E.coli* bacteria caused an outbreak of food poisoning. More than 200 people became ill and 100 were hospitalized. At least three people died. For several weeks fresh spinach was removed from grocery stores.

We are interested in how your consumption of fresh spinach was affected by that event.

4. Prior to the *E.coli* contamination, how often did your household consume fresh spinach?

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
almost every day	4	0.65%	2	0.46%	2	1.13%
3-4 times a week	21	3.42%	13	2.97%	8	4.52%
about once or twice a week	96	15.64%	56	12.81%	40	22.60%
about once or twice a month	227	36.97%	142	32.49%	85	48.02%
never - fresh spinach had not been part of our diet ' (Skip to Question 6)	266	43.32%	224	51.26%	42	23.73%
Total	**614**	**100.00%**	**437**	**100.00%**	**177**	**100.00%**

5. Did your household's consumption of fresh spinach change after the *E.coli* contamination? (Mark the response that best describes how your consumption changed)

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
We stopped consuming fresh spinach and now we do not purchase any.	59	16.71%	35	16.36%	24	17.27%
For a few months after fresh spinach came back to the store we didn't buy any, but we gradually consumed more as time went by	119	33.71%	66	30.84%	53	38.13%
Our consumption didn't really change - when fresh spinach came back to the store we continued to purchase about as much as before the contamination.	175	49.58%	113	52.80%	62	44.60%
Total	**353**	**100.00%**	**214**	**100.00%**	**139**	**100.00%**

6. How often does your household consume fresh spinach now?

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
almost every day	4	0.65%	1	0.23%	3	1.69%
3-4 times a week	19	3.10%	10	2.30%	9	5.08%
about once or twice a week	71	11.60%	39	8.97%	32	18.08%
about once or twice a month	222	36.27%	142	32.64%	80	45.20%
never – we don't eat fresh spinach	296	48.37%	243	55.86%	53	29.94%
Total	**612**	**100.00%**	**435**	**100.00%**	**177**	**100.00%**

Food Irradiation

Food irradiation is a process that can eliminate disease-causing bacteria in many food products. It can be used to control bacteria such as *E.coli* in spinach and other vegetables without affecting the nutritional quality of the food. The Food and Drug Administration is now considering approving irradiation for that purpose.

Irradiation does not make foods radioactive – in the same way that X-rays used for airport security don't make your suitcase radioactive. Agencies such as the *Centers for Disease Control,* the *American Medical Association,* the *American Dietetic Association* and the *World Health Organization* have concluded that irradiated food is safe and wholesome.

How are foods irradiated?

Irradiation Information Set, Gamma Rays
<In Versions 1.1, 1.3, 1.5, and 1.7>

Irradiation involves exposing food to ionizing energy. One type of ionizing energy commonly used for food irradiation is gamma rays.

In a gamma-ray irradiation facility, food is passed on a conveyer system in front of a source of gamma rays. The most common source is the radioactive isotope cobalt 60. Gamma rays pass through food in a manner similar to the way an X-ray would pass through your body. The gamma-rays interfere with bacteria's DNA, destroying its ability to reproduce and rendering it harmless.

Gamma ray irradiation does not use any chemical additives and leaves no residue. It does not significantly change the temperature of the food, and does not alter the appearance, taste or chemical makeup of the food product or its packaging.

Gamma ray irradiation is a safe process. While ionizing radiation is present when the source is exposed, workers in the facility are protected by thick concrete walls. When not in use the radioactive source is stored in a pool of water which absorbs the radiation harmlessly and completely.

OR

Irradiation Information Set, E-beam
<In Versions 1.2, 1.4, 1.6, and 1.8>

Irradiation involves exposing food to ionizing energy. One type of ionizing energy commonly used for food irradiation is a beam of accelerated electrons.

In an electron beam (E-beam) irradiation facility, food is passed on a conveyer system underneath a beam of electrons. E-beam technology is similar to what is used in a cathode ray tube in a TV set. Electron beams pass through food in a manner similar to the way an X-ray would pass through your body. The electron beam interferes with bacteria's DNA, destroying its ability to reproduce and rendering it harmless.

Electron beam irradiation does not use any chemical additives and leaves no residue. It does not significantly change the temperature of the food, and does not alter the appearance, taste or chemical makeup of the food product or its packaging.

Electron beam irradiation is a safe process. While ionizing radiation is present when the machine is on, workers in the facility are protected by thick concrete walls. However, when the machine is switched off, the ionizing radiation stops, just like in a TV set.

7. Which of the following best describes your knowledge of food irradiation before receiving this survey? *Please mark only one answer.*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
I had never heard of food irradiation until now	237	38.73%	170	38.99%	67	38.07%
I had heard of food irradiation, but did not know much about it	324	52.94%	231	52.98%	93	52.84%
I knew quite a lot about food irradiation	51	8.33%	35	8.03%	16	9.09%
Total	**612**	**100.00%**	**436**	**100.00%**	**176**	**100.00%**

Choice	Overall			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
I had never heard of food irradiation until now	109	36.45%	128	40.89%
I had heard of food irradiation, but did not know much about it	163	54.52%	161	51.44%
I knew quite a lot about food irradiation	27	9.03%	24	7.67%
Total	**299**	**100.00%**	**313**	**100.00%**

Choice	Wichita			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
I had never heard of food irradiation until now	84	37.67%	86	40.38%
I had heard of food irradiation, but did not know much about it	118	52.91%	113	53.05%
I knew quite a lot about food irradiation	21	9.42%	14	6.57%
Total	**223**	**100.00%**	**213**	**100.00%**
Average Answer	**1.6904**			

Choice	Los Angeles			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
I had never heard of food irradiation until now	25	32.89%	42	42.00%
I had heard of food irradiation, but did not know much about it	45	59.21%	48	48.00%
I knew quite a lot about food irradiation	6	7.89%	10	10.00%
Total	**76**	**100.00%**	**100**	**100.00%**
Average Answer	**1.7102**			

8. a) <u>Before receiving this survey</u>, how would you have characterized your attitude to food irradiation? *Please circle one number*

very negative		neutral		very positive
1	2	3	4	5

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	78	13.02%	53	12.44%	25	14.45%
2	78	13.02%	44	10.33%	34	19.65%
3	362	60.43%	275	64.55%	87	50.29%
4	51	8.51%	32	7.51%	19	10.98%
5	30	5.01%	22	5.16%	8	4.62%
Total	**599**	**100.00%**	**426**	**100.00%**	**173**	**100.00%**

Choice	Overall			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
1	43	14.58%	35	11.51%
2	34	11.53%	44	14.47%
3	178	60.34%	184	60.53%
4	23	7.80%	28	9.21%
5	17	5.76%	13	4.28%
Total	**295**	**100.00%**	**304**	**100.00%**

Choice	Wichita			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
1	30	13.64%	23	11.17%
2	25	11.36%	19	9.22%
3	135	61.36%	140	67.96%
4	16	7.27%	16	7.77%
5	14	6.36%	8	3.88%
Total	220	100.00%	206	100.00%
Average Answer	**2.8263**			

Choice	Los Angeles			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
1	13	17.33%	12	12.24%
2	9	12.00%	25	25.51%
3	43	57.33%	44	44.90%
4	7	9.33%	12	12.24%
5	3	4.00%	5	5.10%
Total	75	100.00%	98	100.00%
Average Answer	**2.7168**			

b) <u>Having read the information above</u>, how would you now characterize your attitude to food irradiation? *Please circle one number*

very negative neutral very positive

1 2 3 4 5

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	40	6.55%	29	6.67%	11	6.25%
2	56	9.17%	27	6.21%	29	16.48%
3	202	33.06%	147	33.79%	55	31.25%
4	188	30.77%	139	31.95%	49	27.84%
5	125	20.46%	93	21.38%	32	18.18%
Total	**611**	**100.00%**	**435**	**100.00%**	**176**	**100.00%**

Choice	Overall			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
1	19	6.38%	21	6.71%
2	28	9.40%	28	8.95%
3	101	33.89%	101	32.27%
4	92	30.87%	96	30.67%
5	58	19.46%	67	21.41%
Total	**298**	**100.00%**	**313**	**100.00%**

Choice	Wichita			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
1	13	5.86%	16	7.51%
2	18	8.11%	9	4.23%
3	74	33.33%	73	34.27%
4	71	31.98%	68	31.92%
5	46	20.72%	47	22.07%
Total	**222**	**100.00%**	**213**	**100.00%**
Average Answer	**3.5517**			

Choice	Los Angeles			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
1	6	7.89%	5	5.00%
2	10	13.16%	19	19.00%
3	27	35.53%	28	28.00%
4	21	27.63%	28	28.00%
5	12	15.79%	20	20.00%
Total	**76**	**100.00%**	**100**	**100.00%**
Average Answer	**3.3523**			

9. If you were purchasing a package of pre-washed salad greens at your local grocery and you could choose between regular pre-washed salad greens (at $2.49 for a 10oz bag) and pre-washed salad greens that were treated with irradiation to control *E. coli* and other harmful bacteria (also at $2.49 for a 10oz bag), which type of pre-washed salad greens would you buy? Assuming both bags were identical in all attributes – i.e., same brand, same freshness, same color, etc, I would …… (*Please mark only one of the six answers)*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
definitely buy regular non-irradiated salad greens	52	9.17%	29	7.20%	23	14.02%
probably buy the regular non-irradiated salad greens. Go to Q10	70	12.35%	40	9.93%	30	18.29%
be unsure - I'd need to know more about irradiation, but I think I'd buy the non-irradiated salad greens	114	20.11%	75	18.61%	39	23.78%
definitely buy irradiated salad greens	93	16.40%	68	16.87%	25	15.24%
probably buy the irradiated salad greens	148	26.10%	117	29.03%	31	18.90%
be unsure - I'd need to know more about irradiation, but I think I'd buy the irradiated salad greens	90	15.87%	74	18.36%	16	9.76%
Total	**567**	**100.00%**	**403**	**100.00%**	**164**	**100.00%**

Choice	Overall			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
definitely buy regular non-irradiated salad greens	25	9.26%	27	9.09%
probably buy the regular non-irradiated salad greens. Go to Q10	38	14.07%	32	10.77%
be unsure - I'd need to know more about irradiation, but I think I'd buy the non-irradiated salad greens	53	19.63%	61	20.54%
definitely buy irradiated salad greens	45	16.67%	48	16.16%
probably buy the irradiated salad greens	70	25.93%	78	26.26%
be unsure - I'd need to know more about irradiation, but I think I'd buy the irradiated salad greens	39	14.44%	51	17.17%
Total	**270**	**100.00%**	**297**	**100.00%**

Choice	Wichita			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
definitely buy regular non-irradiated salad greens	16	7.92%	13	6.47%
probably buy the regular non-irradiated salad greens. Go to Q10	21	10.40%	19	9.45%
be unsure - I'd need to know more about irradiation, but I think I'd buy the non-irradiated salad greens	37	18.32%	38	18.91%
definitely buy irradiated salad greens	35	17.33%	33	16.42%
probably buy the irradiated salad greens	60	29.70%	57	28.36%
be unsure - I'd need to know more about irradiation, but I think I'd buy the irradiated salad greens	33	16.34%	41	20.40%
Total	**202**	**100.00%**	**201**	**100.00%**
Average Answer	**4.0273**			

Choice	Los Angeles			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
definitely buy regular non-irradiated salad greens	9	13.24%	14	14.58%
probably buy the regular non-irradiated salad greens. Go to Q10	17	25.00%	13	13.54%
be unsure - I'd need to know more about irradiation, but I think I'd buy the non-irradiated salad greens	16	23.53%	23	23.96%
definitely buy irradiated salad greens	10	14.71%	15	15.63%
probably buy the irradiated salad greens	10	14.71%	21	21.88%
be unsure - I'd need to know more about irradiation, but I think I'd buy the irradiated salad greens	6	8.82%	10	10.42%
Total	**68**	**100.00%**	**96**	**100.00%**
Average Answer	**3.4695**			

10. If you chose the regular non-irradiated salad greens in question 9, would you still buy regular non-irradiated salad greens if they cost 10c per bag more (i.e. $2.59/bag) than irradiated salad greens?

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Yes, if regular non-irradiated salad greens cost __c/bag more than irradiated salad greens, I'd still buy regular non-irradiated salad greens.	183	68.28%	112	65.88%	71	72.45%
No, if regular non-irradiated salad greens cost __c/bag more than irradiated salad greens, I'd choose to buy irradiated salad greens instead.	85	31.72%	58	34.12%	27	27.55%
Total	**268**	**100.00%**	**170**	**100.00%**	**98**	**100.00%**

Choice	Overall			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
Yes, if regular non-irradiated salad greens cost __c/bag more than irradiated salad greens, I'd still buy regular non-irradiated salad greens.	91	65.47%	92	71.32%
No, if regular non-irradiated salad greens cost __c/bag more than irradiated salad greens, I'd choose to buy irradiated salad greens instead.	48	34.53%	37	28.68%
Total	**139**	**100.00%**	**129**	**100.00%**

Choice	Wichita			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
Yes, if regular non-irradiated salad greens cost __c/bag more than irradiated salad greens, I'd still buy regular non-irradiated salad greens.	57	61.96%	55	70.51%
No, if regular non-irradiated salad greens cost __c/bag more than irradiated salad greens, I'd choose to buy irradiated salad greens instead.	35	38.04%	23	29.49%
Total	**92**	**100.00%**	**78**	**100.00%**
Average Answer	**1.3412**			

Choice	Los Angeles			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
Yes, if regular non-irradiated salad greens cost __c/bag more than irradiated salad greens, I'd still buy regular non-irradiated salad greens.	34	72.34%	37	72.55%
No, if regular non-irradiated salad greens cost __c/bag more than irradiated salad greens, I'd choose to buy irradiated salad greens instead.	13	27.66%	14	27.45%
Total	**47**	**100.00%**	**51**	**100.00%**
Average Answer	**1.2755**			

11. If you chose the <u>irradiated salad greens</u> in question 9, would you still buy irradiated salad greens if they cost 10c per bag <u>more</u> (i.e. $2.59/bag) than regular non-irradiated salad greens?

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Yes, if irradiated salad greens cost __c/bag more than regular non-irradiated salad greens, I'd still buy irradiated salad greens	250	58.28%	185	57.63%	65	60.19%
No, if irradiated salad greens cost __c/bag more than regular non-irradiated salad greens, I'd choose to buy regular non-irradiated salad greens instead	179	41.72%	136	42.37%	43	39.81%
Total	**429**	**100.00%**	**321**	**100.00%**	**108**	**100.00%**

Choice	Overall			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
Yes, if irradiated salad greens cost __c/bag more than regular non-irradiated salad greens, I'd still buy irradiated salad greens	116	54.72%	114	52.53%
No, if irradiated salad greens cost __c/bag more than regular non-irradiated salad greens, I'd choose to buy regular non-irradiated salad greens instead	96	45.28%	103	47.47%
Total	**212**	**100.00%**	**217**	**100.00%**

Choice	Wichita			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
Yes, if irradiated salad greens cost __c/bag more than regular non-irradiated salad greens, I'd still buy irradiated salad greens	92	55.42%	93	60.00%
No, if irradiated salad greens cost __c/bag more than regular non-irradiated salad greens, I'd choose to buy regular non-irradiated salad greens instead	74	44.58%	62	40.00%
Total	**166**	**100.00%**	**155**	**100.00%**
Average Answer	**1.4237**			

Choice	Los Angeles			
	Gamma Rays		E-beam	
	Frequency	Percentage	Frequency	Percentage
Yes, if irradiated salad greens cost __c/bag more than regular non-irradiated salad greens, I'd still buy irradiated salad greens	24	52.17%	21	33.87%
No, if irradiated salad greens cost __c/bag more than regular non-irradiated salad greens, I'd choose to buy regular non-irradiated salad greens instead	22	47.83%	41	66.13%
Total	**46**	**100.00%**	**62**	**100.00%**
Average Answer	**1.3981**			

Bird Flu

Avian influenza, commonly known as bird flu, is a contagious viral disease that affects wild birds and domestic poultry. A new outbreak of a dangerous type of bird flu (highly pathogenic avian influenza) was reported in Southern Asia in 2003 and had spread to 41 countries as of May 2007. In some circumstances, such as when people have close contact with infected birds, the disease can spread to humans. Since January 2003, the World Health Organization had confirmed 307 human cases of bird flu, of which 186 (60%) had resulted in death. More than half of the human cases have occurred in Vietnam or Indonesia.

This dangerous type of bird flu has not yet been found in the United States.

12. Which of the following best describes your familiarity with bird flu <u>before</u> receiving this survey? *Please mark only one answer.*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
I had never heard of bird flu until now	9	1.86%	1	0.29%	8	5.76%
I had heard of bird flu, but did not know much about it	275	56.70%	208	60.12%	67	48.20%
I knew quite a lot about bird flu	201	41.44%	137	39.60%	64	46.04%
Total	**485**	**100.0%**	**346**	**100.00%**	**139**	**100.0%**

13. How concerned are you that you or someone else in your household will get sick from Bird Flu/Avian Influenza? *Please mark only one answer.*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Concerned	92	19.01%	53	15.32%	39	28.26%
Moderately Concern	155	32.02%	126	36.42%	29	21.01%
Not Concerned	237	48.97%	167	48.27%	70	50.72%
Total	**484**	**100.0%**	**346**	**100.0%**	**138**	**100.0%**

<In Versions 2.1.A to 2.8.A>
No additional information on Avian Influenza

<u>OR</u>
<In Versions 2.1.B to 2.8.B>
Additional Information on Avian Influenza

According to food safety professionals, proper cooking kills the bird flu virus and would protect consumers if the disease was found in U.S. poultry.

14. If a single case of bird flu were found in a wild bird in Montana, would your consumption of poultry change? *Please mark only one answer.*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
No, our poultry consumption would probably remain as it is now	311	64.39%	242	69.94%	69	50.36%
Yes, we would probably consume less poultry than we do now	125	25.88%	77	22.25%	48	35.04%
Yes, we would probably stop consuming poultry altogether	47	9.73%	27	7.80%	20	14.60%
Total	**483**	**100.0%**	**346**	**100.0%**	**137**	**100.0%**

Choice	Overall			
	Bird Flu Satement		No Bird Flu Satement	
	Frequency	Percentage	Frequency	Percentage
No, our poultry consumption would probably remain as it is now	151	65.37%	160	63.49%
Yes, we would probably consume less poultry than we do now	57	24.68%	68	26.98%
Yes, we would probably stop consuming poultry altogether	23	9.96%	24	9.52%
Total	**231**	**100.00%**	**252**	**100.00%**

Choice	Wichita			
	Bird Flu Satement		No Bird Flu Satement	
	Frequency	Percentage	Frequency	Percentage
No, our poultry consumption would probably remain as it is now	119	71.69%	123	68.33%
Yes, we would probably consume less poultry than we do now	32	19.28%	45	25.00%
Yes, we would probably stop consuming poultry altogether	15	9.04%	12	6.67%
Total	**166**	**100.00%**	**180**	**100.00%**
Average Answer	**1.3786**			

Choice	Los Angeles			
	Bird Flu Satement		No Bird Flu Satement	
	Frequency	Percentage	Frequency	Percentage
No, our poultry consumption would probably remain as it is now	32	49.23%	37	51.39%
Yes, we would probably consume less poultry than we do now	25	38.46%	23	31.94%
Yes, we would probably stop consuming poultry altogether	8	12.31%	12	16.67%
Total	**65**	**100.00%**	**72**	**100.00%**
Average Answer	**1.6423**			

Use of Antibiotics in Animal Feed

The addition of low levels of antibiotics to animal feed can help keep animals healthier and results in faster animal growth rates. However, some scientists and consumer advocates are concerned that the use of antibiotics in animal feed can promote the development of harmful bacteria that are resistant to antibiotics.

15. Which of the following best describes your familiarity with the use of antibiotics in animal feed before receiving this survey? *Please mark only one answer.*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
I had never heard of antibiotics in animal feed until now	49	20.50%	35	21.34%	14	18.67%
I had heard of antibiotics in animal feed, but did not know much about it	131	54.81%	96	58.54%	35	46.67%
I knew quite a lot about antibiotics in animal feed	59	24.69%	33	20.12%	26	34.67%
Total	**239**	**100.00%**	**164**	**100.00%**	**75**	**100.00%**

<In Versions 3.1.A to 3.8.A>
No additional information on Antibiotics in Animal Feed

OR
<In Versions 3.1.B to 3.8.B>
Additional Information on Antibiotics in Animal Feed

If the use of antibiotics in animal feed was banned, the cost of producing meat would increase. In this next question we want to find out whether you would pay more for beef produced without antibiotics.

16. If you were purchasing beef sirloin steak at your local grocery and you could choose between regular sirloin steak (at $8.99/lb) and sirloin steak from animals that had never been fed antibiotics ("antibiotic free" at $12.99/lb), which type of steak would you buy? Assuming both steaks are identical in all attributes – i.e., same brand, same freshness, same color, etc, I would …… (*Please mark only one of the six answers)*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
definitely buy the "antibiotic free" steak at $11.99/lb	53	26.24%	25	17.99%	28	44.44%
probably buy the "antibiotic free" steak at $11.99/lb	26	12.87%	19	13.67%	7	11.11%
be undecided. I'd need to know more about antibiotics before deciding but would be inclined to buy the "antibiotic free" steak.	41	20.30%	29	20.86%	12	19.05%
definitely buy the regular steak at $8.99/lb	28	13.86%	24	17.27%	4	6.35%
probably buy the regular steak at $8.99/lb	30	14.85%	26	18.71%	4	6.35%
be undecided. I'd need to know more about antibiotics before deciding but would be inclined to buy the regular steak.	24	11.88%	16	11.51%	8	12.70%
Total	**202**	**100.00%**	**139**	**100.00%**	**63**	**100.00%**

In this final part of the survey, we would like some background information about you. We would like to remind you that all of this information will be treated as confidential, and that the results of this survey will only be used in summary form.

17. What gender are you?

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Male	230	37.77%	148	34.26%	82	46.33%
Female	379	62.23%	284	65.74%	95	53.67%
Total	**609**	**100.0%**	**432**	**100.0%**	**177**	**100.0%**

18. What year were you born? *Fill in the blank.*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Less than 21	2	0.34%	0	0.00%	2	1.16%
21-30	33	5.59%	23	5.50%	10	5.81%
31-40	85	14.41%	49	11.72%	36	20.93%
41-50	108	18.31%	75	17.94%	33	19.19%
51-60	146	24.75%	111	26.56%	35	20.35%
More than 60	216	36.61%	160	38.28%	56	32.56%
Total	**590**	**100.0%**	**418**	**100.0%**	**172**	**100.0%**

19. What is your Race or Ethnicity? *Please mark only one response.*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
White	475	78.64%	392	90.95%	83	47.98%
Black, African American	51	8.44%	18	4.18%	33	19.08%
Native American	10	1.66%	6	1.39%	4	2.31%
Hispanic	40	6.62%	8	1.86%	32	18.50%
Asian	19	3.15%	4	0.93%	15	8.67%
Other	9	1.49%	3	0.70%	6	3.47%
Total	**604**	**100.00%**	**431**	**100.00%**	**173**	**100.00%**

20. What is the highest level of education you have completed? *Please mark only one response.*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Some high school	27	4.48%	13	3.03%	14	8.05%
High school graduate	108	17.91%	85	19.81%	23	13.22%
Some college	166	27.53%	123	28.67%	43	24.71%
College graduate	180	29.85%	129	30.07%	51	29.31%
Post graduate	122	20.23%	79	18.41%	43	24.71%
Total	**603**	**100.00%**	**429**	**100.00%**	**174**	**100.00%**

21. In order to evaluate if we are getting a representative sample, we would like to know your approximate 2006 household income before taxes. *Please mark only one response.*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Less than $20,000	69	12.06%	38	9.45%	31	18.24%
$20,000 up to $30,000	62	10.84%	47	11.69%	15	8.82%
$30,000 up to $40,000	75	13.11%	56	13.93%	19	11.18%
$40,000 up to $50,000	64	11.19%	49	12.19%	15	8.82%
$50,000 up to 70,000	91	15.91%	70	17.41%	21	12.35%
$70,000 up to 100,000	88	15.38%	62	15.42%	26	15.29%
$100,000 up to 150,000	79	13.81%	53	13.18%	26	15.29%
more than $150,000	44	7.69%	27	6.72%	17	10.00%
Total	**572**	**100.00%**	**402**	**100.00%**	**170**	**100.00%**

22. Including yourself, how many people live in your household? *Please fill in the blank.*

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	168	27.32%	116	26.48%	52	29.38%
2	239	38.86%	173	39.50%	66	37.29%
3	91	14.80%	58	13.24%	33	18.64%
4	70	11.38%	54	12.33%	16	9.04%
5	31	5.04%	26	5.94%	5	2.82%
6	10	1.63%	6	1.37%	4	2.26%
7	4	0.65%	4	0.91%	0	0.00%
8	2	0.33%	1	0.23%	1	0.56%
Total	**615**	**100.00%**	**438**	**100.00%**	**177**	**100.00%**

23. Do you and your family currently have health insurance?

Choice	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Yes	560	92.11%	408	94.23%	152	86.86%
No	48	7.89%	25	5.77%	23	13.14%
Total	**608**	**100.00%**	**433**	**100.00%**	**175**	**100.00%**

24. Are there any children living in your household? *Please circle*

a) under age 6?

Under 6	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Yes	70	11.36%	52	11.87%	18	10.11%
No	546	88.64%	386	88.13%	160	89.89%
Total	**616**	**100.00%**	**438**	**100.00%**	**178**	**100.00%**

b) between 6 and 18?

Between 6 and 18	Overall		State			
			Wichita		Los Angeles	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Yes	134	21.75%	103	23.52%	31	17.42%
No	482	78.25%	335	76.48%	147	82.58%
Total	**616**	**100.00%**	**438**	**100.00%**	**178**	**100.00%**

Please check the survey to ensure that you have answered all the questions and return it in the postage-paid envelope provided. Your contribution to this project is greatly appreciated.

Appendix H: Multinomial Logit Results for Spinach Consumption during the *E. coli* Outbreak

Variable	All Observations		First Mail Observations	
	Spinach2	**Spinach3**	**Spinach2**	**Spinach3**
Female	-0.248	-0.401	-0.513	-0.561
	(0.262)	(0.371)	(0.347)	(0.551)
RaceEth	-0.002	-0.315**	0.049	-0.381
	(0.101)	(0.159)	(0.138)	(0.318)
Educ	0.107	-0.601***	0.152	-0.448*
	(0.122)	(0.176)	(0.165)	(0.253)
Income	0.011	-0.272***	0.005	-0.251*
	(0.069)	(0.100)	(0.093)	(0.149)
Hhsize	0.036	0.097	0.038	-0.466
	(0.136)	(0.171)	(0.189)	(0.352)
Kids	-0.086	0.033	-0.081	-0.005
	(0.417)	(0.564)	(0.527)	(0.913)
Age	0.000	-0.022**	0.015	-0.011
	(0.007)	(0.009)	(0.010)	(0.012)
Spnow	0.019	1.077***	-0.166	1.063***
	(0.140)	(0.213)	(0.186)	(0.301)
Log Likelihood	-291.42		-166.44	
χ^2	61.68***		35.40	
Num. Observations	317		194	

Standard Errors are in parenthesis
*, **, and *** are significant at the 10%, 5%, and 1% respectively.

where: Spinach1 = For a few months after fresh spinach came back to the store we didn't buyany, but we gradually consume more as time went by.
Spinach2 = Our consumption didn't really change when fresh spinach came back to the store we continued to purchase about as much as before the contamination.
Spinach3 = We stopped consuming fresh spinach and now we don't purchase any.

Marginal Effects for All Observations and First Mailing Observations

Variable	All Observations			First Mailing		
	Spinach1	Spinach2	Spinach3	Spinach1	Spinach2	Spinach3
Female	0.060	-0.030	-0.030	0.109	-0.085	-0.024
RaceEth	0.016	0.022	-0.037**	0.006	0.032	-0.038
Educ	0.012	0.067**	-0.079***	-0.009	0.059	-0.050**
Income	0.012	0.022	-0.033***	0.009	0.015	-0.024*
HHSize	-0.011	0.002	0.009	0.011	0.034	-0.046
Kids	0.012	-0.022	0.010	0.014	-0.018	0.004
Age	0.001	0.002	-0.003***	0.002	0.004*	-0.002
Spnow	-0.056*	0.071**	0.127***	0.012	-0.097**	0.109***

Standard Errors are in parenthesis

*, **, and *** are significant at the 10%, 5%, and 1% respectively.