Actual Purchase vs. Intended Purchase: Do Consumers Buy What They Say?

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Abstract

A bivariate probit model was used to examine the relationship between actual and intended purchase of irradiated beef. The likelihood ratio test rejected the equality of parameters affecting actual and intended purchase decisions. Actual purchases were affected by package labels and appearance, while purchase intentions were affected by attitude and demographics.

Key Words: beef irradiation, supermarket simulation, actual purchase, purchase intention, bivariate probit

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1. Introduction

Consumers' actual behavior is often inconsistent with their reported attitudes or concerns. This is particularly true with regard to health risks. Many consumers express concern about food safety, yet relatively few appear to be changing their food buying behavior in view of their concern (Lane and Bruhn,1991). For example, a survey by the NPD (National Panel Diary) group evaluating the gap between consumer attitude and behavior reported that people expressing concern about health problems associated with french fry consumption rose to 39% between 1985 and 1990, yet the number eating them at least once in two weeks declined just 7 percent (Bickley, 1991). In a national survey (Buzby and Skees, 1994) more than fifty percent of the respondents said they preferred to buy organically grown fresh fruits and vegetables, yet only a quarter said they actually bought them on a regular basis.

Many local and national surveys have revealed consumer concern regarding fat and cholesterol content of foods, pesticides, and microbial contamination. Such concerns are likely to translate into market behavior. Therefore, food industry and government policy makers will have to respond to consumers' health concerns without significantly increasing costs to the them (Kramer, 1990). In this regard, inconsistency in consumer attitude and behavior becomes particularly important. The Alar controversy associated with apples in 1989 and the post-Alar phenomenon revealed that although consumers expressed concern about food safety, they were not willing to pay a premium price for organically grown food or to accept cosmetic damage (Cook, 1991). This raises the question as to how the industry should respond to consumer safety concerns. Food irradiation, for example, is a likely response to consumers' safety concern that has not been widely adopted by the industry due to the uncertainty about consumer acceptance.

Previous studies on consumer acceptance of irradiated food have reported that consumers' attitude toward irradiation may be improved through education and information (Bruhn and Noell, 1987; Bord and Conner, 1989; Resurreccion and Galvez, 1999; Lusk et al., 1999). The majority of previous studies have concentrated on factors influencing the acceptance of irradiation. The question as to how much of a positive attitude or acceptance of irradiated products translates into actual purchase of the products is left unanswered. Also, consumer surveys and panels have been the primary source of studies on consumer acceptance of irradiated food products. Such studies may indicate consumers' attitude toward food safety and their willingness to purchase, but may not always reflect actual behavior in the marketplace. This study addresses these issues. In this study, inconsistency between consumers' actual purchase and their response to acceptance of irradiated beef products was investigated using a simulated supermarket setting (SSS).

2. Sample Data

An SSS test was conducted to evaluate health concerns expressed by consumers about beef products compared with their actual buying behavior, and to evaluate the impact of consumers' in-store experience with irradiation on their acceptance of irradiated beef products. A panel of 207 randomly selected consumers was asked to purchase two packages of each of the four cuts/forms of beef in traditionally labeled packages or in packages labeled as irradiated. The cuts/forms, which were selected based on consumer health concern and market segmentation, were ground beef, ground chuck, top round steak, and rib eye steak. Ground beef and ground chuck are often associated with

E-coli outbreaks and are subjects of recalls. An informative poster about the benefits of irradiation was placed in each of the four stations of the display case. Price effect was removed from the package selection process by keeping price per pound of both, irradiated and traditionally packaged products, the same. The participants were primarily 45 years of age or less (53%), female (81%), white (86%) and married (69%). About 60% had completed college or had a vocational degree, and 83% were employed (full or part time). Over fifty percent of the households had household income less than $40,000 annually and 90% of the households had four or fewer household members. Exit questions included knowledge of food safety, willingness to pay for irradiated beef, and demographics. Consumers indicating a willingness to purchase irradiated beef products in the exit survey were offered a range of price premiums and asked to select the premium they were willing to pay per pound of irradiated beef products.

Data obtained from exit questionnaires indicated that 60 percent would buy irradiated beef products. The SSS test, however, found that only 21.7 percent bought all irradiated products (Table 1). Of those who reported that they intended to purchase irradiated beef, only 11.1 percent actually purchased all irradiated packages, while 10.2 percent of those who reported that they would never purchase irradiated beef in the exit survey had purchased all irradiated packages. Given this gap between the actual purchase and intended purchase of the irradiated beef products, it is important to develop a model that examines such potential conflict.

3. Conceptual Model

Fishbein's basic multi-attribute model of consumer attitude states that a person's attitude toward a product is determined by the sum of the beliefs that the person has about the consequences or attributes of the object weighted by how they are evaluated (Fishbein, 1963). A variation of

Fishbein's model has been used in several studies involving consumer buying behavior. Hamastra (1991) put forward two determinants of consumer acceptance of genetically engineered food: consumer characteristics and product characteristics. Consumer characteristics include demographic characteristics and consumer knowledge about the products, whereas product characteristics include consumers' perception of individual products. In the present study, consumer acceptance of irradiated beef products was measured at two stages: consumers' actual purchase (AP) and when asked whether they would purchase beef that was treated by irradiation, which is defined as intended purchase (IP). Both AP and IP depend on an underlying value of irradiation benefits to consumers. If such value is the same, then the parameters affecting the intended and actual purchase have to be statistically the same. Although both AP and IP may be affected by product characteristics and consumer characteristics, there may be considerable discrepancy in their impact such that not all consumers who said they will buy irradiated beef products actually buy them. Our task is, first of all, to test the equality of parameters affecting the two types of acceptance. We will then analyze individual factors affecting actual purchase and those affecting intended purchase.

For our model we assume that each participant in the supermarket simulation has some unobserved value (negative if perceived to be harmful) of irradiation of beef products. Let this unobserved value be y_{1i}. Let the price of packages of each cut of beef displayed in the display case be denoted by t_{1i} or the threshold value. If the unobserved value of the beef package including the underlying premium (discount) for the irradiation is equal to or greater than the actual price shown on the packages, $y_{1i} \geq t_i$, the individual will reveal his/her preference by buying the irradiated package in all purchase occasion for all cuts of beef (I_{1i}=1). They will reveal their preference for traditional or mixed packages (none preference for all irradiated packages) if $y_{1i} < t_i$ in all purchase occasion for all cuts of beef (I_{1i}=0). Now let the unobserved valuation of irradiated beef package, y_{1i}, consist of a systematic component, $x'_{1i}\beta_i$, which is a function of vector x'_{1i} of actual and perceived product attributes and attributes of the participant in the experiment, and an unobservable random component, ϵ_{1i} (distributed N(0, σ_i^2)), which absorbs all unmeasured determinants of the value of irradiation to this individual.

Adopting similar notations for the data pertaining to the intended purchase, let y_{2i} be the participants' underlying valuation of irradiation of beef at the moment when they were asked whether they would buy irradiated beef. Note that unit prices of both irradiated and unirradiated beef were the same and are known to the respondents at the time they actually buy the products and at the time they state their intention to buy. Thus, any intention to buy irradiated beef revealed the respondents underlying valuation of the irradiation process. The indicator variable, $I_{2i,}$ will be one if $y_{2i} \geq t_{i}$, and zero if $y_{2i} < t_i$. The valuation will again be assumed to consist of systematic components, $x'_{2i}\beta_2$ and a random unobservable component, $\epsilon_{2i.}$ Since participants in the experiment were asked about their intention to buy irradiated beef immediately after they were actually exposed to the simulated situation, there is likely to be a relationship between these two stages of acceptance of irradiated beef products. Thus, error terms ϵ_{2i} is correlated with $\epsilon_{1i.}$

The two types of responses explained can be modeled using a bivariate binary choice model (see Greene, 1993), which is

$$y^*_1 = x'_1\beta_1 + \epsilon_{1,} \qquad y^*_1 = 1 \text{ if } y_{1i} \geq t_i \quad \text{(1)}$$
$$= 0 \text{ otherwise}$$
$$y^*_2 = x'_2\beta_2 + \epsilon_{2,} \qquad y^*_2 = 1 \text{ if } y_{2i} \geq t_i \quad \text{(2)}$$
$$= 0 \text{ otherwise}$$

where $E(\epsilon_1)=E(\epsilon_2)=0$, $Var(\epsilon_1)= Var(\epsilon_2)=1$ and $Cov(\epsilon_1\ \epsilon_2) = \rho$.

The model is developed in the context of a joint distribution of (ϵ_1, ϵ_2). A bivariate normal distribution, BVN ($x'_{1i}\beta_i$, $x'_{2i}\beta_2$, $\sigma_1^{\,2}$, $\sigma_2^{\,2}$, ρ), is used for these two implicit valuations of irradiation. There are four possible pairs of responses: (I_{1i}, I_{2i})= (1,1), (1,0), (0,1), and (0,0). The likelihood function model is given by Greene (1995):

$$\ln L\ (\beta_1, \beta_2, \rho) = \Sigma_i \ln \Phi_2\ [q_{i1}\ \beta'_1\ X_{i1},\ q_{i2}\ \beta'_2\ X_{i2}, q_{i1}\ q_{i2}\ \rho] \qquad (3)$$

where q_{ij} = 2Y_{ij} - 1, j= 1, 2; and Φ_2 is the bivariate normal cumulative distribution function. The parameter estimates for β_1, β_2, and ρ that maximize equation (3) are obtained via the LIMDEP program (Greene, 1995).

Among the several approaches available in the literature for testing the equality of intended behavior (IP) and actual behavior (AP), the test of equality of parameters of two equations in the bivariate model is used. According to this method, both intended and actual behavior depend on the estimated coefficients in the behavioral equations. The likelihood ratio (LR) test is used to test for equality of the coefficients. The null hypothesis for the LR test is: B(IP)=B(AP), where B(IP) and B(AP) are the coefficients in the bivariate probit equations for intended and actual purchase. The test is carried out by comparing the log likelihood of restricted bivariate probit (estimated with the restriction that B(IP)=B(AP)) and unrestricted bivariate probit. The LR test follows a chi-square distribution with degrees of freedom equal to the sum of the number of coefficients in the restricted model.

4. Empirical Model

The following two equations are specified for the empirical bivariate probit model:

AP_i = f(Label-safety, Label-Handling, Appearance-Fat content, Income, Sex, Age, Household size, Knowledge, Safety premium, freshness) where i=Ground Beef, Ground Chuck, Top Round, and Rib Eye.

IP = f(Label-safety, Label-Handling, Appearance-Fat content, Income, Sex, Age, Household size, Knowledge, Safety premium, freshness)

In the above formulation, AP_i represents actual purchase of irradiated packages of four cuts/forms of beef products. IP represents intended purchase of irradiated beef as reported by the participants in the exit survey. AP_i is 1 if the participants actually purchased all irradiated packages for each cut/form of beef and 0 otherwise. IP is 1 if they intended to purchase irradiated beef and 0 otherwise. The explanatory variables used in the regression models are defined in Table 2. Following Hamastra (1991) independent variables were of two categories. First, consumer characteristics included consumers' general knowledge about food safety, attitude about premium for beef irradiation, and demographic characteristics of participants. A measure of the consumer's knowledge of food safety was developed based on the responses to four factual statements with "true", "false," and "don't know" answer options. Responses to these statements were translated to item scores and were coded so that 1 indicated a correct answer and 0 indicated a wrong answer or a don't know response. To construct a general knowledge variable, the item scores for each respondent were first summed up to get a total score. The total general knowledge scores were then expressed as an index ranging from zero to 1. An index value of 1 correspond to the highest possible score of four or highest level of knowledge about food safety. The arithmetic mean of this constructed general knowledge index was 0.45 corresponding to an average level of general knowledge about food safety among sample participants.

Second, product characteristics included actual appearance of products such as fat content and information on package labels regarding safety and handling. Participants reported one or more of the product characteristics as reasons for choosing a particular beef package. Similar to the general knowledge, indices were created for product characteristics. A participant scoring an index value of one for label-safety chose safety information on the package label as the reason for selecting both packages. A score of 0.50 means he/she cited label-safety for choosing only one of the packages.

If the error terms in the probit model do not have a constant variance (i.e., not homoscedastic) the model produces not only inconsistent (baised) estimates for standard error but also inconsistent parameter estimates (e.g., Godfrey, 1988). Yatchew and Griliches (1985) and Davidson and MacKinnon (1984) have considered the effects of specific forms of heteroscedasticity in the probit models and suggested test procedures for multiplicative heteroscedasticity. The following hypotheses are compared:

$$H_o: \sigma = 1; H_o: \sigma = \exp(\gamma, Z_i)$$

where Z is row vector of independent variables, and γ is a parameter vector. In the case of a univariate probit, the test consists of the comparison of the models

$$H_o: p(Y=1) = \phi(X\beta); H_o: p(Y=1) = \phi(X\beta/\exp(\gamma, Z_i))$$

The testing procedure employed in this study follows the heteroscedastic model framework (Green, 1995). Test results, presented in Table 3, failed to reject the hypothesis homoscedatic error terms of all the estimated models.

5. Results and Discussion

Likelihood ratio test results examining equality of parameters affecting two stages of consumer acceptance, intentions to purchase (IP) and actual purchase (AP), are reported in Table 4.

The main research hypothesis was that if the intention to purchase irradiated beef packages translated into actual purchase, then parameters affecting intentions to purchase and actual purchases were the same. The test results show that this hypothesis is rejected for all cuts/forms of beef at the 0.01 level of significance.

Bivariate probit model results are reported in Table 5. The overall model for each cut/form is significant at the 0.01 level. Also, the estimated rho for each cut/form indicating the relationship between the error terms in the two equations is statistically significant at the 0.01 level.

The types of variables that affected actual purchase decisions were different from those affecting intention to purchase. In general, actual purchase was mainly influenced by product attributes such as the information regarding safety and handling instructions on package labels and appearance, i.e. fat content. Those who selected packages because of the safety information on the package labels were statistically more likely to select irradiated packages of all four cuts/forms. In addition, product attribute variables, particularly safety information, were strong for ground beef and ground chuck. This result is highly consistent with the fact that consumer concerns of *E-coli* outbreaks are linked mainly to ground beef. Safety information on the package labels had significant impact on purchase intention for ground beef as reported during the exit survey. Few demographic variables such as sex and age of respondents influenced actual purchase decisions. None of the attitude variables such as general knowledge about food safety and willingness to pay for "safety" assurance through irradiation had statistically significant impact on actual purchase of irradiated packages. Contrary to that, intention to purchase (IP) was mostly influenced by demographic and attitude variables. Overall, none of the three variables relating to physical characteristics of the product as displayed in the supermarkets such as fat content, safety and handling information on the package labels influenced intention to purchase decisions. Income, sex, household size, general knowledge about food safety, and willingness to pay for safety assurance through irradiation had statistically significant impact on intention to purchase irradiated packages. High income households were more likely to report intention to purchase irradiated beef; female respondents and large size households were less likely to have intention to purchase irradiated beef.

6. Conclusions and Implications

Using a supermarket simulation test on irradiated beef products, this study reveals further evidence of inconsistency between actual and intended purchase behavior of consumers. Actual purchases were mainly affected by product attributes such as package labels and appearance, while purchase intentions were mainly affected by attitude and demographic variables. Consumers based their actual purchase, particularly of the ground form of beef, on safety information on the package labels and appearance. Safety was also important to enhance the intention to purchase irradiated ground beef implying the need of using safety information in promoting irradiated beef.

Table 1: Consumer purchase of all irradiated beef packages in the simulated supermarket setting (percentage of participants).

Cuts/Forms	Intended/Actual[1]	Not Intended/Actual[2]	Total Actual[3]
Ground Beef	28.5	6.3	34.8
Ground Chuck	24.6	2.9	27.5
Top Round	26.1	5.8	31.9
Rib Eye	28.9	7.3	36.2
All	11.6	10.2	21.7

[1] Percentage of participants who actually purchased all irradiated packages and also reported in the exit survey that they intend to purchase irradiated beef. [2] Percentage of participants who actually purchased all irradiated packages but reported in the exit survey that they did not intend to purchase irradiated beef. [3] Sum of 1 and 2.

Table 2: Description and sample statistics of independent variables used in the regression models.

Variables	Description	Mean	Std. Deviation
Label- Safety (Ground Beef)	Index (0 to 1)	0.66	0.44
Label-Handling (Ground Beef)	Index (0 to 1)	0.57	0.47
Appearance-Fat content (Ground Beef)	Index (0 to 1)	0.49	0.48
Label- Safety (Ground Chuck)	Index (0 to 1)	0.52	0.47
Label-Handling (Ground Chuck)	Index (0 to 1)	0.58	0.48
Appearance-Fat content (Ground Chuck)	Index (0 to 1)	0.52	0.47
Label- Safety (Top Round)	Index (0 to 1)	0.54	0.48
Label-Handling (Top Round)	Index (0 to 1)	0.57	0.47
Appearance-Fat content (Top Round)	Index (0 to 1)	0.54	0.48
Label- Safety (Rib Eye)	Index (0 to 1)	0.64	0.46
Label-Handling (Rib Eye)	Index (0 to 1)	0.59	0.47
Appearance-Fat content (Rib Eye)	Index (0 to 1)	0.60	0.45
General Knowledge about food safety	Index (0 to 1)	0.45	0.50
Premium for safety through "irradation"	Binary (0,1)	0.27	0.44
Age (Less than 45=1; Else=0)	Binary (0,1)	0.53	0.50
Sex (Female=1; Male=0)	Binary (0,1)	0.81	0.39
Education Level (College or vocational degree=1; Else=0)	Binary (0,1)	0.60	0.49
Income Level (More than $40,000=1; Else=0)	Binary (0,1)	0.42	0.49
Household Size (More than 4=1; Else=0)	Binary (0,1)	0.10	0.29

Table 3: Results of the tests of heteroscedasticity using Lagrange Multiplier (LM) statistics

Cuts/Forms	LM statistics	P-Value	Test Result
Ground Beef	12.21	0.28	Fail to reject*
Ground Chuck	10.28	0.42	Fail to reject*
Top Round	8.69	0.57	Fail to reject*
Rib-Eye	10.78	0.47	Fail to reject*

*Test result at .05 significance level for the null hypotheses that models are homoscedastic

Table 4: Results of the likelihood ratio tests for the equality of parameters

Cuts/Forms	LR statistics	Test Result
Ground Beef	59.12	Reject*
Ground Chuck	76.56	Reject*
Top Round	56.28	Reject*
Rib-Eye	37.34	Reject*

*Test result at .01 significance level for the null hypotheses that models are parameters are equal in two equations.

Table 5: Unrestricted bivariate probit model results.

Variables	Ground Beef		Ground Chuck		Top Round		Rib Eye	
	AP	IP	AP	IP	AP	IP	AP	IP
Label-Safety	1.2001***	0.5613**	1.0012***	0.3273	0.5247**	0.2942	0.8850***	0.2734
Label-Handling Instructions	-0.5471**	-0.2107	-0.5302*	0.0657	-0.3410	0.2604	-0.3198	-0.0642
Appearance-Fat Contents	-0.4029*	0.1534	-0.5178***	0.0237	0.3715	0.1336	-0.4413	0.0074
Household Income	-0.0291	0.6634***	0.1892	0.5787***	-0.1644	0.5636***	0.1140	0.5651***
Sex of respondents	-0.3905*	-0.6055***	-0.3455	-0.5791***	-0.4186*	-0.6603***	-0.6899***	-0.5512***
Household Size	-0.1865	-0.8771**	-0.2059	-0.9323***	-0.4045	-0.9330***	-0.4914	-0.9569***
Education	-0.0968	-0.1839	-0.4615**	-0.0595	-0.2791	-0.0814	-0.1291	-0.0596
Age of respondents	-0.3666*	0.0443	-0.4042*	0.0835	-0.1395	0.0854	0.0439	0.0789
General knowledge about food safety	-0.0560	0.4189**	0.0553	0.5135***	0.1419	0.5105***	0.2608	0.5275***
Premium for safety through "irradiation"	0.1137	0.8978***	0.4859**	0.7929***	0.3024	0.8441***	0.4228*	0.8691***
Rho	0.489***		0.618***		0.503***		0.386***	
Likelihood function	-223.46***		-214.09***		-232.62***		-231.29***	

*significant at 0.10; **significant at 0.05; ***significant at 0.01

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