Food safety risk perceptions as a tool for market segmentation: The USA poultry meat market

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Abstract:

This study uses data from a 2006 survey on potential AI outbreak in USA to explore application of risk perceptions as a segmentation tool in the poultry meat market. Preliminary results from principal component analysis (PCA) suggest that the poultry meat specific safety level will drive people consumption choices in AI outbreak. Based on the perceived safety level, poultry meat product market was categorized into: (1) the home cooked and familiar brands; (2) the technological/novel; and (3) organic/fast food poultry products. The results further show differential public trust AI advice across institutions.

Introduction:

Marketing literature is replete of psychographic approaches positioning products for uniquely separable consumer groupings. The groupings may be identified in terms of demographics, income, occupation and education. The motivation for marketing managers' consideration of market segmentation may be driven by expansionary or market retention efforts, new products introduction, profit seeking, among others. Segmentation involves splitting customers or potential customers in a market into different groups within which customers share a similar level of interest in the same comparable sets of needs satisfied by a marketing proposition. Market segmentation exploits group differences in response to specific market variables representing values and lifestyles (VALS) (Mitchell, 1983) and list of values (LOV) (Novak and MacEvoy, 1990). It works on the premise that these differences exist, can be identified and are reasonably stable over time and the segments can be efficiently reached. Although many studies have tested the validity of VALS and LOV as basis for market segments, studies relating to market segmentation based on the perceived safety of food products are limited. Recent exceptions are studies by (Pierre Sans et al, 2005; Xavier 2006) that have used food safety perceptions as a market segmentation tool. Exploring safety perceptions becomes increasingly important given the current highly profile food safety incidents, of necessity impacting food purchasing behavior (Buzby, 2001; Calvin, Avendano, and Schwentesius, 2004).

In this study, the perception preference relationship is extended to identify segments in the poultry product market based on perceived food safety risk. The specific study objectives include: (i) to identify and classify poultry meat products on basis of

safety perception and (ii) to explore the relationships between the identified poultry meat classifications and consumer socioeconomic characteristics and value attributes. The study will inform poultry marketers as to what attributes drive specific segments with implication for export market. The study findings will also be applied in developing and positioning of risk communication messages in an event of avian influenza (AI) outbreak in order to restore consumer confidence.

Data and Methodology

Previous studies have investigated the relationship between perception and preference, and used such relationship as a basis of market segmentations (Glazer, 1984; Beckwith and Lehmann, 1975). A theoretical model was developed to explain the association between consumers' food safety perception and their preference of various types of poultry products available in the market. Principal component analysis (PCA) is used to reduce the broad poultry meat products into separable dissimilar but not discrete products based on safety perception.

The study uses data collected on a national survey on public knowledge, attitudes, intentions, and behaviors related to the threat of avian influenza (AI) in the food supply. Computer assisted telephone interviews (CATI) were conducted with a nationally representative sample of 1,200 non-institutionalized American adults (aged 18 and over) between May 3, 2006 and June 5, 2006. Proportional random digit dialing was used to select survey participants from the fifty United States. Working non-business numbers were called a minimum of 15 times to try to reach potential respondents. The cooperation rate was 60% and the sampling error was ± 2.8%. The survey took an average of 21 minutes to complete. The resulting data were weighted by gender, age, race, ethnicity,

and education to approximate United States Census figures. Prior to commencing the interview, all participants were informed that the survey questions focused on highly pathogenic avian influenza. As the term “bird flu” is most commonly used in the media when referring to the avian influenza virus, this term was used throughout the majority of the interview. Specifically, respondents were told that the interviewer would “like to ask [them] some questions about avian influenza or bird flu” and “though there are different types of influenza or flu viruses, for these questions we’re specifically talking about bird flu. We’re only talking about the type of bird flu caused by H5N1, also known as highly pathogenic bird flu.”

Production and Consumption Trends: The USA Poultry Industry

USA is the world's largest producer and exporter of poultry meat (FAO, 2007). U.S. consumption of poultry meat (broilers, other chicken, and turkey) is considerably higher than beef or pork, but it is less than total red meat consumption. Per capita red meat and poultry consumption increased by 8 % between 1980 and 2005 and now stands at 187.5 pounds per person on a boneless equivalent basis (NCBA, 2006). According to the USDA Economic Research Service (ERS), poultry is gaining market share compared to total red meat consumption, which has declined from 131.9 pounds per capita in 1970 to 111.9 pounds per capita in 2003. The factors driving overall poultry industry performance include currency fluctuations, trade negotiations, and economic growth in the importing countries as well as the food scares including Avian Flu.

Poultry production is concentrated in the eastern half of the United States. Approximately 83 percent are found in the Northeast, Appalachian, Southeast, Delta, and Corn Belt regions. The industry consists of relatively a small number of large companies

vertically integrated in all aspects from hatchery to processing. Broilers represent 93 percent and three quarters of poultry production and sales. Organic poultry and egg sales are an increasingly growing segment of the US poultry production. The growth of this niche market has been fuelled by overall increase in poultry consumption and consumer perception that organic is a superior product on both health and safety grounds.

In the 60-70s growth in chicken consumption was stimulated by a declining chicken price from one-half that of beef to about one-sixth and by the introduction of popular new products, such as tray packs. Health concerns including lower saturated animal fats and cholesterol levels have also recently fueled increases in poultry meat (Moschini and Meilke, 1989). Among other marketing innovations contributing to the poultry meat market expansion was the introduction of the chicken products to nontraditional vendors, such as fast food restaurants and frozen food sections at grocery stores. The fast food restaurants serve as outlets of large quantities of chicken in many forms; including breaded chicken parts, nuggets, patties, breast filets, tenders, and popcorn chicken. Marinated whole birds have become popular items for takeout meals at both fast food restaurants and supermarket delis.

Results

What risks do consumption poultry meat present: Opinions on potential AI outbreak

Individual and societal perceptions of food-related health risks are multidimensional and complex. Social, political, psychological, and economic factors interact with technological factors to affect perceptions in complex ways. Previous research found that the significant determinants of risk perceptions include socioeconomic and behavioral variables (Frewer, et al., 1996; Dosman, et al., 2001).

In order to explore the impact of risk of AI on consumption, a hypothetical question on the outbreak of the disease on a US farm was used to elicit information. The public evaluated the eight different poultry products on safety determining their likelihood of consumption given a potential AI outbreak on a US farm. The responses were evaluated on scale of 0-10 where 0=definitely will not eat chicken and 10=definitely will eat chicken).

Table 1 presents the mean, standard deviation and factor loadings from the principal component factor analysis obtained after varimax rotation on the public responses likelihood of eating chicken. The factors (poultry categorizations) are ranked in order of the proportion of the variance explained and are labeled to reflect the latent stimuli underlying public food safety perception on the various poultry meat products. The estimated means for each category of the poultry meat products was >5 suggesting that in general the meats were safe for consumption. The factor analysis results indicate differentiated poultry products based on safety perception. The results suggest that in an event of a disease outbreak, consumers will no longer view poultry meat as a homogenous product. Three poultry dimensions based on safety perception were obtained

explaining 76% of the variation of poultry meat products on safety perception as detailed below.

Factor 1: Home cooked and familiar chicken products (scale of 0-10, where 0=no at all safe to eat and 10=completely safe to eat)**.** This dimension explains 32% variation in overall poultry meats safety perception. Common characteristics for poultry products under this dimension are that the meats are self cooked at home in addition to being a familiar brand. The mean rating of about 7 across the four poultry products underlie a sense of control the consumers have over the presumed risks they may pose. The four meat products cooked at home load highly suggesting consistency and relatedness presenting minimum risk exposure given personal control over food preparation. In view of control exercised by the consumer (own preparation and confidence in brands of the product they experienced in the past) contributed to the higher safety rating presenting minimum risk for microbial or any other foodborne contamination. The high safety rating under this dimension is manifestation of people's acceptance of those risks they have control of as opposed they don't have any control.

Factor 2: Novel/Technological chicken products (scale of 0-10, where 0=no at all safe to eat and 10=completely safe to eat)**.** In the second tier of poultry meat safety perceptions are products that may be viewed as new and/or resulting from some technological innovation advances minimizing food contamination. Irradiation is now a proven and mandated approach to minimize food contamination. However, due to negative consumers' perceptions, irradiated and vaccinated products have been relegated below products in the first dimension. This factor may also be capturing partially disease control measures beyond the control of individual consumers. This may suggest that consumers

may have interpreted the technologically preserved poultry products to be a step lower in terms of safety. The dimension explained 32% of consumers' perception about the safety of these products.

Factor 3: Organic and fast food chicken products (scale of 0-10, where 0=no at all safe to eat and 10=completely safe to eat)**.** The last dimension identified in factor analysis pulls together organic poultry and fast food chicken into same dimension. The mean score rating of about 5 suggests average safety. In the light of an AI outbreak, and given the organic poultry productions system, increases the odds for AI compared to mainstream poultry production systems that are assumed to have strong sanitary conditions. One reason why the public considered organic poultry similar in safety to fast foods chicken may be due to the consumer viewing the two products to present same level of contamination risks. Additionally, the recent incident of e-coli food poisoning in one of the taco bell group of restaurants may have reinforces consumer's opinions (New York Times, December, 2006). These and other factors indicate that whenever control is transferred to third parties, risk tolerance decreases compounding negative perceptions. Asymmetric information seemed also to play part in shaping perceptions compounded by product credence attributes, which are difficult to measure until after consumption. This factor accounted for about 21% of the variance.

Trust Dimensions: Advice on AI

Consumers to large extent cannot judge themselves whether food is safe during the course of normal purchase or consumption, they therefore have to rely upon others, such as regulators and the food industry, to develop and maintain effective consumer protection activities (Bocker and Hnaf, 2000; Green, et al., 2003). The extent to which

consumers trust regulatory institutions and food industry to protect their interests, as opposed to seeking their economic and political interests may impact food safety perceptions immensely (Frewer et al., 1996). Public trust drives social expectations thus enabling people to tolerate increasing uncertainties. Although data used in this study was a product of a hypothetical experiment, the news of AI spread was up in the air, and the consumers had a legitimate reason for fear, and their reliance on organizations or institutions to offer truthful advice was apparent. Results below demonstrate dependency of the public on institutions to offer accurate advice about the disease.

Table 2 presents the mean, standard deviation and factor loadings from the principal component factor analysis obtained after varimax rotation of the public responses to how much they could trust a specific source of advice on bird flu outbreak. Ten different institutions were presented to the public and they evaluated each of them on a scale of 0-10 where 0= no trust at all and 10= complete trust of their respective advice. The factors are ranked in order of the proportion of the variance explained and are labeled to reflect the latent stimuli underlying public trust in the advise given. The estimated means in each of the respective agency of >4 suggest the relatedness of the agencies in terms of how much their AI advice can be relied on. Four dimensions were identified in terms of overall trust, together the dimensions explained about 78% of the variance as explained below:

Factor 1: Trust regulators Advice (scale of 0-10, where 0=no trust at all and 10=complete trust)**.** This dimension explains about 27% of the variation in overall public AI advice trust. While it may not be obvious, it seems that that the public understands that AI is a technical issue and it may be necessary to seek scientific advice from those

with expertise and competence. In this respect, the agency must be seen as credible to provide truthful information on such matters to guide the public in decision-making. As table1 shows, the means and factor loadings for each of the agencies are high and closely correlated, with Centers of disease control (CDC) and World Health Organization (WHO) advice being ranked highest followed by the US department of agriculture (USDA) and FDA. The CDC and WHO are internationally reputed institutions that may be relied on to provide credible information on spread of infectious diseases such as AI; it is no surprise therefore that their advice will be more valued compared to other sources. In addition, advice from health related agencies falling may be seen as presenting a lesser risk compared to 'non-tested' agencies in case such advice turns out to be untrue. Almost all the factors loaded highly, with all individual means above 6, indicating the confidence people attach to advice provided by health related organizations.

Factor 2: Trust producers' advice (scale of 0-10, where 0=no trust at all and 10=complete trust)**.** The main stream poultry supply chain is highly concentrated vertically, inevitably the farmers and processors are assumed to be knowledgeable about threats that may impact the industry including diseases such as AI. However, when rated on technical expertise, they are ranked below agencies such as CDC in factor 1. The dimension mean score is relatively lower than that of health related institutions in factor1. While ranking farmers and processors highly (mean>6) the supermarkets mean was about 4, suggesting less trust. The fact that the disease may have originated elsewhere may totally escape the supermarkets knowledge, therefore may not to be in a position to offer advice. The results may also show that the public can hold the farmers and processors accountable as first handlers of the poultry and poultry meat. However, the factor loading

for this group is high indicating relatedness in terms of value of the advice they may give. The advice given by these players was second most important explaining 22% of the variation

Factor 3: Trust politicians' advice (scale of 0-10, where 0=no trust at all and 10=complete trust)**.** Lumped together is the advice from the US President and Department of Homeland Security with a mean score of about 4 in result explaining 17% of the variation. Though the Department of Homeland Security is very important in overseeing terrorism, it may seem that the public place has little confidence in it on matters relating to diseases such as AI. Similarly, the public seemed to have less confidence on the President advice on such technical issues as well. The standard deviation (>3) is reflective of lack of agreement amongst the public on this group as a source of advice.

Factor 4: Trust media's advice (scale of 0-10, where 0=no trust at all and 10=complete trust)**.** In as much as the media serves the important role of informing the public, it may at the same time it may misinform and scare the public.

At stake is AI as a possible contaminant of the food supply, in such circumstances the public may be skeptical of the media messages. Studies have shown that media attention focusing on food safety can influence the extent to which people perceive the riskiness of a particular food. Frewer et al., (1993), study finds that media attention may negatively influence consumer perceptions on food safety while at he same increasing consumer concerns on food generally. In result media attention focusing on food safety can influence the extent to which people perceive the riskiness of a particular food. A theoretical perspective on food safety is provided in the application of the social

amplification theories on risk framework (Kasperson et al., 1988). The theory posits that external events and increased availability of risk information can increase public risk perceptions (risk amplification), which, in turn, might lead to a decrease in consumer confidence in food safety. Risk amplification is thought to occur because both individuals and the media give greater weight and attention to negative events compared to positive events, and because negative information is seen as more credible than positive information (Siegreist and Cvetkovich, 2001; Slovic, 1993).The public seems divided on media as source of advice on AI judging from the standard deviation on the score (>3) and a mean of about 4. The variation explained by this dimension was about 12%.

Discussion

Risk perception may be a potential tool for segmenting the food market. The results also demonstrate that risk perception is a multifaceted phenomenon influenced by individual food handling responsibilities, trust and confidence. Three separate but not discrete distinct markets were identified: the home cooked and familiar brands; the technological/novel; and organic/fast food poultry products. The results further show differential public trust AI advice across institutions.

As foodborne illness continue to present itself in ever increasing complex forms safety perceptions will become increasingly important in differentiating food markets alongside economic variables such as price. Poultry meat marketers may use our results based on their perceived safety record to enhance their image a result that can be replicated across other foods. In case of new technologies to make food safer (vaccination and irradiation), the role of institutions will be critical, in publicity and consumer confidence assurances to increase acceptance. The results show that such consumer

confidence may partially pave way for increased purchases. The results further suggest that foodborne illness may contribute to the rapid diffusion of the technologies minimizing contamination.

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Table 1: Varimax Rotated Factor Loadings on Poultry Meat Risk Perception: Opinions on Potential AI In the US

	Mean	SD	Factor 1	Factor 2	Factor 3
Factor 1: Familiar cooked Chicken products : (Not at all safe to eat =0, Completely safe to eat =10)					
Fresh home-cooked chicken	7.43	2.43	0.815		
Cooked to right temp chicken	7.52	2.27	0.784		
Previously frozen first cooked chicken	6.81	2.65	0.682		
Familiar brand chicken	6.94	2.44	0.648		
Factor 2: Novel/Technological chicken products : (Not at all safe to eat =0, Completely safe to eat =10)					
Vaccinated chicken	6.71	2.73		0.801	
Irradiated chicken	6.04	2.89		0.779	
Factor 3: Organic and fast food chicken products : (Not at all safe to eat =0, Completely safe to eat =10)					
Certified organic chicken safe to eat	6.83	2.57			0.837
Fast food chicken safe to eat	5.87	2.84			0.594
percent of variance explained			32.19	23.21	20.94

Table 2: Varimax Rotated Factor Loadings on Trust Advice about Bird Flu(AI)

	Mean	SD	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1: Trust Regulators : (Not Trust at all=0, …Complete trust =10)						
CDC advice trusted on bird flu	7.21	2.47	0.8553			
WHO advice trusted on bird flu	6.50	2.60	0.7550			
US FDA advice trusted on bird flu	6.18	2.78	0.7379			
Dept of Ag advice trusted on bird flu	6.37	2.59	0.6941			
Factor 2: Trust Producers : (Not Trust at all=0, …Complete trust =10)						
US chicken farmers advice trusted on bird flu	6.37	2.59		0.8605		
Chicken processors advice trusted on bird flu	6.37	2.59		0.7854		
Supermarkets advice trusted on bird flu	4.17	2.63		0.6672		
Factor 3: Trust Politicians : (Not Trust at all=0, …Complete trust =10)						
Bush advice trusted on bird flu	4.25	3.45			0.9007	
Homeland Security advice trusted on bird flu	4.63	3.05			0.7228	
Factor 4: Trust Media : (Not Trust at all=0, …Complete trust =10)						
News media advice trusted on bird flu	4.63	3.05				0.8820
percent of variance explained			26.82	21.76	17.36	11.62