Food Safety Risk Perceptions as a Tool for Market Segmentation: The U.S. Poultry Meat Market

Benjamin Onyango, Arbindra Rimal, Dragan Miljkovic, and William K. Hallman

This study explores the application of risk perceptions as a segmentation tool in the poultry meat market. Principal-component analysis is used to examine data from a 2006 survey on a potential avian influenza outbreak in the U.S. The results suggest that the perceived level of safety of poultry meat will drive consumption choices in the case of an avian influenza outbreak. Based on the perceived safety level, the poultry meat product market was categorized into those that are home cooked and from familiar brands, the technological/novel, and organic/fast food poultry products, with the first category being perceived as the safest and the third as the least safe. The results also show significant differences in public trust in the avian influenza information provided by the government, poultry producers, politicians, and the media.

The marketing literature is replete with psychographic approaches positioning products for uniquely separable consumer groupings (e.g., Kahle and Kennedy 1989; Novak and MacEvoy 1990). The motivation for marketing managers' consideration of market segmentation may be driven by expansionary or market retention efforts, new product introductions, and profit seeking, among other motivations. Segmentation involves splitting customers or potential customers in a market into different groups within which customers share a similar level of interest in 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 that the segments can be efficiently reached. Although many studies have tested the validity of VALS and LOV as a basis for market segments (e.g., Kahle and Kennedy 1989), studies relating to market segmentation based on the perceived safety of food products are limited. Recent exceptions are studies by Sans, Fontguyon, and Briz (2005); Díeza et al. (2006), and Gellynck, Verbek, and Vermiere (2006) that have used food safety perceptions as a market segmentation tool. Exploring safety perceptions becomes increasingly important given the current high profile of food safety incidents affecting food purchasing behavior (Buzby 2001; Calvin, Avendano, and Schwentesius 2004).

Food safety perceptions as a market segmentation tool are applied to the U.S. poultry market. The U.S. is the world's largest producer and exporter of poultry meat (FAO 2007). This is a market where consumption of poultry meat (broilers, other chicken, and turkey) is considerably higher than that of beef or pork, but it is less than total red meat consumption. Per capita red meat and poultry consumption increased by eight percent between 1980 and 2005 and now stands at 187.5 pounds per person on a boneless equivalent basis (NCBA 2006). According to the United States Department of Agriculture Economic Research Service (USDA-ERS n.d.), 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 the change in dietary trends and health concerns (Miljkovic and Mostad 2007); relative prices (Miljkovic and Effertz 2009); currency fluctuations, trade negotiations, and economic growth in the importing countries (e.g., Miljkovic, Brester, and Marsh 2003); and the food scares including the avian influenza (Taha 2007).

Poultry production is concentrated in the eastern half of the United States. Approximately 83 percent of the poultry production is 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

Onyango and Rimal are Assistant Professor and Associate Professor, respectively, Department of Agriculture at Missouri State University. Miljkovic is Professor, Department of Agribusiness and Applied Economics, North Dakota State University. Hallman is Director, Food Policy Research Institute, Rutgers-The State University of New Jersey.

represent 93 percent and three-quarters of the poultry production and sales, respectively (USDA-ERS n.d.). Organic poultry and egg sales are an increasingly growing segment of U.S. poultry production. The growth of this niche market has been fuelled by an overall increase in poultry consumption and by consumer perception that organic is a superior product on both health and safety grounds.

In the 1960s and 1970s, the 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 (Miljkovic and Mostad 2007; Moschini and Meilke 1989). Among other marketing innovations contributing to the poultry meat market expansion was the introduction of chicken products to nontraditional vendors such as fast food restaurants and frozen food sections at grocery stores. Fast food restaurants serve as outlets for 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.

This study extends the perception–preference relationship to identify segments in the poultry product market based on perceived food safety risk. The specific study objectives include identifying and classifying poultry meat products on the basis of safety perceptions and exploring the relationships between trust and safety associated with these poultry meat classifications.

This study uses data collected through a survey in the United States concerning public perceptions of the threat of Avian Influenza (AI) in the poultry supply (Condry et al. 2007), an issue of substantial importance to U.S. producers and consumers. For example, the outbreak of highly pathogenic H5N1 avian influenza in East and Southeast Asia in November 2003 had a clear negative effect on domestic supply and demand patterns and nearly caused the export market for poultry products from these countries to collapse. Thailand, for example, lost its position as the world's fifth largest exporter of poultry meat (McLeod et al. 2007; Tiensin,et al. 2005).

As poultry demand dropped, prices plunged as exports rapidly and dramatically declined. However, the economic impact of the outbreak was felt globally (Suder and Inthavong 2008). Even in countries unaffected by the outbreak, consumers began to perceive poultry products as unsafe, leading to declines in demand and adversely affecting the trade in poultry products (McLeod et al. 2007; Verbiest and Castillo 2004; Moore and Morgan 2006; Blayney 2005). However, the poultry industry has been shown to be quite resilient and seems to have largely recovered. To cope with the changing demand arising from incidents of contamination, the poultry industry has reinvented itself to produce more processed and cooked products compared to raw or fresh meat (Taha 2007; Manning, Baines, and Chadd 2007).

This study will inform poultry marketers as to what attributes drive specific segments with implications for export market. The study findings may also be applied by the poultry marketers in the development and positioning of risk communication messages in an event of avian influenza (AI) outbreak in order to restore consumer confidence.

Literature Review

The marketing literature reviewed here is to be viewed within the context of the impact of food safety incidents and their effect on consumer behavior or demand in general. The literature shows that most studies that make reference to consumers' food choices do not go far enough to permit the application of the attributable stimuli (food contamination incidents—for example, *E-coli*, salmonella, and BSE) as a segmentation tool. However, running thorough these studies is indirect evidence of demand realignments that provide useful hints relevant to potential market segmentation.

Schroeder et al. (2007) examined beef consumption patterns in the United States, Canada, Mexico, and Japan based on different levels of consumer risk averseness. They found that consumer reactions to food safety events involving beef are strongly influenced by consumer food safety risk attitudes and risk perceptions, and that risk-averse consumers require high levels of food safety assurance, especially when food safety events occur. They also found that consumer risk aversiveness varies significantly across countries. Compared to their American and Canadian counterparts, Japanese and Mexican consumers perceive beef to be less safe to eat and consider consuming beef to involve greater food safety risks.

Oberholtzer, Greene, and Lopez (2006) compared conventional and organic poultry markets in the face of a disease occurrence. They found that consumers prefer organic poultry based on the perception that it is a superior product health-wise, consequently commanding premium prices. Yet Rodenburg, Van Der Hulst-Van Arkel, and Kwakkel (2004) suggest that the ease with which free-range poultry can contract such diseases as Campylobacter and Salmonella may work against the perceived superior health qualities of organic poultry. Indeed, under conditions of increased vulnerability to disease, such as avian influenza, the advantaged market position of organic poultry products may change in favor of conventional products.

Fielding et al. (2005) examined the relationship between perceptions of AI risk and the purchase and handling of live chickens from traditional "wet markets," behaviors that increase the risk of exposure to AI. They found that perceptions of risk associated with buying live chickens were only moderate, and that concerns about these risks did not predict either buying or touching habits. Moreover, reported purchasing behaviors were strongly predicted by the erroneous belief that simply cooking the poultry would be sufficient to protect oneself from avian influenza, effectively ignoring the risks posed by handling (and slaughtering) potentially infected live birds.

As AI infection and spread from live birds to humans is of particular concern, governments and industry in some countries have supported vaccination programs to reduce the risk of contamination (Capua 2007). Given the spread of Asian-lineage highly pathogenic avian influenza (HPAI) H5N1 to three continents (Asia, Europe, and Africa), vaccination is now being used on a wide scale under different conditions.

The application of food irradiation technologies to a wider group of foods could also produce significant public health benefits because many food-borne illnesses occur when consumers handle or eat meat or poultry contaminated by microbial pathogens. However, food manufacturers have been slow to adopt irradiation, partly because of the perception that relatively few consumers are willing to buy irradiated foods (Diehl 1995; Bruhn 1995; Frenzen et al. 2000).

Other studies that may fall under market segmentation but do not approximate our approach are those recognizing women in the workforce and the value of time. To this end, food marketers have made innovations reducing food preparation time, not only adding value to the product, but giving women more time to be devoted to other activities. For example the Spanish meat demand study by Manrique and Jensen (1998) underscores the importance of time in women's food preferences. Results from the study show that large, high-income families in which both partners work are more likely to consume convenience meat goods products and also to spend more than others on these products. This implies that economic incentives alone may not be as effective in maintaining or stimulating demand for food products as marketing campaigns highlighting the attributes of food that meet the demands of changing lifestyles. In the case of meat, examples may include identifying ways in which meat can be conveniently prepared or providing information about the nutritional value of meat. For prepared meals, focusing on quality and nutritional aspects could encourage consumption.

Earlier studies on market segmentation are those that evaluate the impact of information on demand (Herrmann, Warland, and Sterngold 1997; Dodd and Morse 1994). A recent study by Beach et al. (2008), follows this approach and explores the relationship between Italian meat demand and newspaper articles on avian influenza. The study revealed changes in demand, with the effect lasting only a few weeks. Gellynck, Verbeke, and Vermeire (2006), evaluated the effect of information from a demand signaling viewpoint. The study further evaluated consumer trust factors on food-product safety.

To alleviate the problem of consumer information overload, food marketers rely on consumer trust in regulatory agencies to ensure food safety. The regulatory agencies therefore have to put certain measures in place to enhance food safety. Consumers, therefore, can use this information to discriminate among products. In the wake of the AI incidents in Asia and their aftermath effects, certification of poultry products has become a very important mechanism of safety. Ifft et al. (2009) identify product certification as a systemic remedy to create virtuous quality cycles, combining risk reduction with higher product value along supply chains of low-income market participants in East Asia.

While the current study focuses on hypothetical food contamination by AI in the United States, real contamination cases in other countries provide insights on the poultry meat market effects resulting from an actual AI event. Some of the areas that were heavily devastated included central Thailand and Hong Kong. Some of the changes include a switch from fresh poultry products to more cooked and frozen products to minimize contamination. However, it may take time for consumers to switch to substitute products as a result of contamination. A study by Heft-Neal et al. (2009) shows that Thailand consumers still have strong preferences for local poultry raised by smallholders and are willing to pay more for their choices, and suggests formulation of socially effective and sustainable H5N1 strategies if avian influenza becomes endemic.

To a large extent, consumers cannot themselves judge 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 Hanf 2000; Green, Draper, and Dowler 2003). The extent to which consumers trust regulatory institutions and the food industry to protect consumer interests, as opposed to seeking their own economic and political interests, may affect food safety perceptions immensely (Frewer, Hedderly, and Shepherd 1996). Public trust drives social expectations, thus enabling people to tolerate increasing uncertainties. In the absence of personal experience and lacking expertise, lay people rely on information provided by science; politics; regulatory bodies; industry, environmental, and consumer organizations; and the media in their evaluation of innovative technologies.

Klein (2008) views trust in terms of consumer confidence in the food supply chain arising from manufacturers, retailers and government regulators meeting part of their mandates with respect to food safety. Not surprisingly, consumer trust in food safety has also been found to be dependent on the institution. For example, consumers view and therefore rate government agencies and media differently (Buzby and Ready 1996). Sapp and Bird (2003) add more insight by evaluating how social trust affects consumers' food safety opinions. Results from this study show support for a conceptual distinction between food safety worry and concern, which, respectively, reflect emotional and cognitive consumer risk assessments. Social trust significantly affected worry but not concern. Lang, O'Neill, and Hallman (2003) underscore the importance of perceptions on trustworthiness of the institutions and experts providing information for effectiveness of risk communication. Lang and Hallman (2005) identify lack of trust in the organizations with the greatest resources and responsibilities for ensuring the safety of genetically modified food, which should be seen as an important obstacle to the adoption of the technology.

Data and Methodology

Pioneering studies that have investigated the general relationship between perception and preference and used this relationship as a basis for market segmentation were made by Glazer (1984) and Beckwith and Lehmann (1975). We used their ideas to develop and explain the association between consumers' food safety perceptions and their preferences for 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.

Specific approaches for market segmentation may be preferred based on the need and sophistication of the market. For example, one can simply use geographic location identified by consumers' residence as away to regionally segment a market. More often, market segmentation relies on demographic attributes of consumers such as age, gender, education, and income. Moreover, market segmentation may be accomplished using psychographics/lifestyles to group consumers on the basis of their opinions, interests, and lifestyles. Finally, segmentation may be based on basis of a benefit or attribute consumers expect to derive from some good or service (the conjoint approach).

In fact, principal component/factor analysis (PCA) and conjoint analysis are offshoots of psychographic and attribute-based segmentation strategies. In conjoint analysis one seeks to understand tradeoffs consumers make to determine what is critical for a particular market segment. However, the PCA approach is based on eliciting attitudes toward products and using the analysis to reduce the constructs represented by these opinions to a manageable number of interpretable dimensions.

A natural progression of PCA is to then associate particular demographic variables with the resulting factors.

The study uses data collected in 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 all fifty of the United States. Working non-business numbers were called a minimum of 15 times to try to reach potential respondents. The cooperation rate was 60 percent and the sampling error was ±2.8 percent. The survey took an average of 21 minutes to complete. The resulting data were weighted by gender, age, race, ethnicity, and education to approximate the United States Census figures.

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, Hedderly, and Shepherd 1996; Dosman, Adamowicz, and Hrudey 2001). Along these lines, one section of the survey was devoted to gathering information on the socio-economic and value characteristics of the respondents including age, gender, ethnicity, education, income, family size, employment status, religious practice, and political views. Also collected was information on the respondents' awareness of AI, knowledge about AI transmission and spread, prevention, food handling procedures to minimize contamination, likelihood of infection and worry, food safety, consumption behavior, and respondents' trust in institutional information about AI. Respondents were made aware that the survey they were undertaking was hypothetical (how they might respond to an outbreak of the highly pathogenic avian influenza (HPAI) H5N1 either in poultry or wild birds in the United States).

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 "although there are different types of influenza or flu viruses, for these questions we are specifically talking about bird flu. We are only talking about the type of bird flu caused by H5N1, also known as highly pathogenic bird flu." The respondents were then asked a series of questions regarding their knowledge of and opinions about avian influenza, its risks, modes of transmission, and prevention (see Condry et al. 2007).

Within this context, and having been provided no information about the actual status of AI in poultry in the United States (no highly pathogenic H5N1has been found in domestic poultry in the U.S.) the respondents were told, "Now, I'd like to ask you about how safe you think it is to eat cooked chicken products in the United States. So, *thinking about the bird flu* and using a scale of 0 to 10, where 0 is not at all safe and 10 is completely safe, how safe would you think it is to *eat*. . . ."

Under this scenario, the respondents evaluated the safety of eight different poultry products including "cooked chicken prepared from chickens certified as organic," "chicken from a fast food restaurant," "fresh chicken you cook at home," "cooked chicken that had been frozen first," "chicken that's been vaccinated against the bird flu," "chicken that was cooked to the recommended internal temperature," "chicken that was a familiar brand," and "chicken that's been irradiated."

When necessary, the interviewers clarified such terms as irradiation by adding the statement "by irradiating chicken we mean the process of exposing chicken to controlled amounts of radiation, which can reduce disease-causing germs in chicken meat. We DO NOT mean microwaving; we mean irradiating chicken at the factory before it is sold."

A similar approach was used to elicit responses to the question of how much trust consumers are willing to put in advice given about AI by various institutions. Thus respondents were asked, "On a scale of 0 to 10, where 0 means no trust at all and 10 means complete trust, how much would you say you trust the advice about bird flu given by. . . ." In this way the respondents evaluated their trust in ten potential sources of advice, including: "President Bush," "Supermarkets," "The U.S. Department of

Agriculture," "Farmers in the U.S. who raise chickens," "The Food and Drug Administration," "The Department of Homeland Security," "The Centers for Disease Control," "The World Health Organization," "Chicken processors like Purdue and Tysons," and "The news media."

Results

Risk Perceptions

Table 1 presents the mean, standard deviation, and factor loadings from the principal component factor analysis obtained after varimax rotation on the perceived safety of eating the various chicken products. 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 of the various poultry meat products. The estimated means for each category of the poultry meat products was greater than 5 (on a scale of 0–10, where 0 is "not at all safe to eat" and 10 is "completely safe to eat"), suggesting that, in general, the meats were perceived as safe for consumption. However, the factor analysis results indicate differentiated poultry products based on safety perceptions. The results suggest that especially in the event of a disease outbreak, consumers would not view poultry meat as a homogenous product. Three dimensions based on safety perception of poultry meat products were obtained explaining 76 percent of the variance, as detailed below.

Factor 1: Familiar/Home-Cooked Chicken Products. This dimension explains 32 percent of the variance and includes "fresh chicken you cook at home," "chicken that was cooked to the recommended internal temperature," "cooked chicken that had been frozen first," and "chicken that was a familiar brand." These products have in common a sense of consumer familiarity and control over the presumed risks of AI that these products may pose. Indeed, the perception of personal control exercised by the consumer (own preparation and confidence in brands of the product they have purchased in the past) likely contributed to the mean rating of about 7 across the four poultry products.

Factor 2: Novel/Technological Chicken Products. This dimension explained 23 percent of the variance, and includes two products: "chicken that's been vaccinated against the bird flu," and "chicken that's been irradiated." Thus these are products that may be viewed as new and/or resulting from some technological innovation designed to minimize 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 to the second tier of products in terms of perceived safety. This factor may in part be capturing a sense that these disease-control measures are beyond the control of individual consumers.

Factor 3: Organic and Fast Food Chicken Products. The last dimension identified in the PCA, accounting for 21 percent of the variance, pulls together "cooked chicken prepared from chickens certified as organic," and "chicken from a fast food restaurant" into same dimension. In light of an AI outbreak, and given the organic poultry production system, it increases the odds for AI compared to mainstream poultry production systems that are assumed to have strong sanitary conditions. One reason the public considered organic poultry similar in safety to fast foods chicken may be due to the consumer viewing responsibility for the safety of the products as being in the hands of third parties. The particularly low ratings given to the safety of "fast food chicken" may be influenced by consumers' poor views of the overall "healthiness" of fast food, as well as more general food safety concerns related to fast food products (such as contamination by salmonella or *E. coli*, that go beyond specific concerns about AI.

Trust Dimensions: Advice on AI

Although no contamination of poultry by highly pathogenic H5N1 AI has occurred in the U.S., at the time the data for the survey were collected, AI was very much in the news as the result of contamination incidents in other parts of the world. Thus consumers were concerned about the threat of AI (see Condry et al. 2007). As such, the ability of consumers to trust in organizations and institutions to offer truthful advice is critical. 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 institutions were

Table 1. Varimax-Rotated Factor Loadings on Poultry Meat Risk Perception: Opinions on Potential AI in the U.S.

	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	6.83	2.57			0.837
Fast food chicken	5.87	2.84			0.594
Percentage 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: (No Trust at all = 0, Complete trust = 10)						
CDC	7.21	2.47	0.8553			
WHO	6.50	2.60	0.7550			
FDA	6.18	2.78	0.7379			
Department of Agriculture	6.37	2.59	0.6941			
Factor 2: Trust producers: (No Trust at all = 0, Complete trust = 10)						
US chicken farmers	6.37	2.59		0.8605		
Chicken processors	6.37	2.59		0.7854		
Supermarkets advice	4.17	2.63		0.6672		
Factor 3: Trust politicians: (No Trust at all = 0, Complete trust = 10)						
President Bush	4.25	3.45			0.9007	
Department of Homeland Security	4.63	3.05			0.7228	
Factor 4: Trust media: (No Trust at all = 0, Complete trust = 10)						
News media advice trusted on bird flu	4.63	3.05				0.8820
Percentage of variance explained			26.82	21.76	17.36	11.62

presented and evaluated on a scale of 0–10 where 0 is "no trust at all" and 10 is "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 advice given. The estimated means in each of the respective agency of exceed 4, suggesting 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 percent of the variance.

Factor 1: Trust Regulators Advice. This dimension explains about 27 percent 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 Table 2 shows, the means and factor loadings for each of the agencies are high and closely correlated, with the Centers of Disease Control (CDC) and the World Health Organization (WHO) advice being ranked highest, followed by the U.S. Department of Agriculture (USDA) and Food and Drug Administration (FDA). In particular, the CDC and WHO are internationally reputed health organizations 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 appears to be more trusted than other sources. 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. The mainstream poultry supply chain is highly concentrated vertically. Inevitably, the farmers and processors are assumed to be knowledgeable about threats that may affect the industry, including diseases such as the AI. However, in terms of trust, they are ranked below the health agencies such as the CDC and WHO. The mean score is lower than that of health-related institutions (Factor 1). While farmers and processors ranked highly (mean greater than six), the supermarket mean was about 4, suggesting less trust. As simple retailers of chicken products, consumers may view supermarkets as not in a position to offer trusted advice concerning AI. The results may also show that the public can hold 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 percent of the variation.

Factor 3: Trust Politicians' Advice. Lumped together is the advice from the U.S. President and the Department of Homeland Security, with a mean score of about 4, explaining 17 percent of the variance. Though the Department of Homeland Security is very important in overseeing terrorism, it may seem that the public places has little confidence in it on matters relating to diseases such as AI. Similarly, the public seemed to have less confidence in the President's advice on such technical issues as well. The standard deviation (greater than three) is reflective of lack of agreement amongst the public on this group as a source of advice.

Factor 4: Trust Media's Advice. Although the media serves the important roles of informing the public, it may at the same time 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, Raats, and Shepherd 1993). They find that media attention may negatively influence consumer perceptions on food safety while at the same increasing consumer concerns on food generally. In turn, 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 (Siegrist and Cvetkovich 200; Slovic 1993).The public seems divided on media as source of advice on AI, judging from the standard deviation on the score (greater than three) and a mean of about 4. The variation explained by this dimension is about 12 percent.

Conclusions and Study Implications

The results from this study show that consumers can clearly differentiate poultry products based on a scale of perceived safety. As such, risk perceptions may be a potential tool for segmenting the food market. The results of this study also demonstrate that risk perception is a multifaceted phenomenon influenced by individual food-handling responsibilities, trust and confidence. Three separate but not discrete markets were identified: home-cooked and familiar brands; the technological/novel; and organic/fast food poultry products. As the literature revealed, the poultry meat market has undergone some realignment; these results show which products could expand their market shares. The results further show differential public trust in AI advice across institutions. This result implies a need for accountability from those who communicate information about a negative food safety incident in order to restore consumer confidence. Trust therefore becomes central to the process of risk communication, which is related intrinsically to market demand. Marketers and policy makers should be fully aware of where, when, and to whom to communicate food contamination incidents; at stake is the market that may have taken time and resources to build. Food safety scares such as AI may also present a new set of opportunities for producers, processors, and retailers to reposition their products in the aftermath of the scare. As a result, they may be able to expand their market share by taking advantage of the inevitable market realignment.

As food-borne illnesses continue to present themselves in ever increasing complex forms, safety perceptions will become increasingly important in differentiating food markets alongside economic variables such as price. In the case of new technologies designed to make food safer, such as vaccination and irradiation, the role of institutions will be critical to improving public acceptance. Trust in those institutions is therefore of tremendous importance.

References

Beach, R. H., F. Kuchler, E. Leibtag, and C. Zhen. 2008. "The Effects of Avian Influenza News on Consumer Purchasing Behavior: A Case Study of Italian Consumers' Retail Purchases." U.S. Department of Agriculture, Economic Research Report Number 65. August.

Beckwith, N. E. and D. R. Lehmann. 1975. "The Importance of Halo Effects in Multi-Attribute Attitude Models." *Journal of Marketing Research* 12:265–275.

Bocker, A. and C. H. Hanf. 2000. "Confidence Lost and Partially Regained: Consumer Response to Food Scares." *Journal of Economics Behavior & Organization* 43:471–485.

Blayney, D. 2005 "Disease-Related Trade Restrictions Shaped Animal Product Markets in 2004 and Stamp Imprints on 2005 Forecasts." LDP-M133-01. Washington, DC: U.S. Department of Agriculture, Economic Research Service.

Buzby, J. C. 2001. "Effects of Food-Safety Perceptions on Food Demand and Global Trade." In *Changing Structure of Global Food Consumption and Trade*, A Regmi, ed. Washington, DC: U.S. Department of Agriculture, Economic Research Service, Market and Trade Economics Division.

Buzby, J. C and R. C. Ready. 1996. "Do Consumers Trust Food-Safety Information?" *Food Review* January–April:46–49.

Bruhn, C. M. 1995. "Consumer Attitudes and Market Responses to Irradiated Foods." *Journal of Food Protection* 58(2):175–81.

Capua, I. 2007. "Vaccination for Notifiable Avian Influenza in Poultry." *Scientific and Technical Review* 26(1):217–227.

Calvin, L., B. Avendano, and R. Schwentesius. 2004. "The Economics of Food Safety: The Case of Green Onions and Hepatitis A Outbreaks." USDA Publication VGS-305-01. December.

Condry, S. C., W. K. Hallman, M. Vata, and C. L. Cuite. 2007. "Avian Influenza in Poultry: Americans' Knowledge, Perceptions, and Responses." Food Policy Institute, Rutgers-the State University of New Jersey. Publication RR-0507-014.

J. Díeza, J. J. del Coza, A. Bahamondea, C. Sañudob, J. L. Olletab, S. Macieb, M. M. Campob, B. Paneac, and P. Albertíc. 2006. "Identifying Market Segments in Beef: Breed, Slaughter

Weight and Ageing Time Implications." *Meat Science* 74(4) 667–675

Diehl, J. F. 1995. *Safety of Irradiated Foods*, 2nd ed. New York: Marcel Dekker, Inc.

Dodd, T. H. and S. Morse. 1994. "The Impact of Media Stories Concerning Health Issues on Food Product Sales: Management Planning and Responses." *Journal of Consumer Marketing* 11(2):17–24.

Dosman, D. M., W. L. Adamowicz, and S. E. Hrudey. 2001. "Socioeconomic Determinants of Health- and Food Safety-Related Risk Perceptions." *Risk Analysis* 21(2):307–318.

FAO. 2007. "FAO Statistics." http://www.fao.org/corp/statistics/en/. Accessed May 2009.

Fielding, R., W. W. T. Lam, E. Y.Y. Ho, T. H. Lam, A. J. Hedley, and G. M. Leung. 2005. "Avian Influenza Risk Perception, Hong Kong." *Emerging Infectious Diseases* 11(5). http://www.cdc.gov/ncidod/EID/vol11no05/04-1225.htm

Frenzen, P. D., A. Majchrowicz, J. C. Buzby, and B. Imhoff. 2000. "FoodNet Working Group Consumer Acceptance of Irradiated Meat and Poultry Products." Agriculture Information Bulletin No. 757/August. Washington, DC: U.S. Department of Agriculture, Economic Research Service.

Frewer, L. J., D. Hedderley and R. Shepherd. 1996. "What Determines Trust in Information About Food-Related Risks? Underlying Psychological Constructs." *Risk Analysis* 16(4):473–486.

Frewer, L. J., M. M. Raats, and R. Shepherd. 1993. "Modelling the Media: The Transmission of Risk Information in the British Quality Press." *IMA Journal of Mathematics Applied in Business & Industry* 5:235–47.

Gellynck, X., W. Verbeke, and B. Vermeire. 2006. "Pathways to Increase Consumer Trust in Meat as a Safe and Wholesome Food." *Meat Science* 74(1):161–171.

Glazer, R. 1984. "Multiattribute Perceptual Bias as Revealing of Preference Structure." *The Journal of Consumer Research* 11(1):510–521.

Green, J. M., A. K. Draper, and E. A. Dowler. 2003. "Short Cuts to Safety: Risk and 'Rules of Thumb' in Accounts of Food Choice." *Health, Risk and Society* 5(1):33–52.

Heft-Neal, S., F. Kahrl, J. Otte, and D. Roland-Holst. 2009. "HPAI Risk Reduction and Smallholder Poultry Supply Chains—The Case of Thailand." HPAI Research Brief No. 14. www.fao.org/ag/pplpi.html.

Herrmann, R.O., Warland, R. H., and A. Sterngold. 1997. "Who Reacts to Food Safety Scares?: Examining the Alar Crisis" *Agribusiness* 13(5): 511–520.

Ifft, J., J. Otte, D. Roland-Holst, and D. Zilberman. 2007. "Demand-Oriented Approaches to HPAI Risk Management." FAO. http://www.fao.org/ag/againfo/programmes/en/pplpi/docarc/rep-hpai_demandside.pdf.

Kahle, L. R., and P. Kennedy. 1989. "Using the List of Values (LOV) to Understand Consumers." *Journal of Consumer Marketing* 6(3):5–12.

Kasperson, R. E., O. Renn, P. Slovic, H. S. Brown, J. Emel, R. Goble, J. X. Kasperson, and S. Ratick. 1988. "The Social Amplification of Risk: A Conceptual Framework." *Risk Analysis* 8(2): 177–87.

Klein, H. 2008. *Food Safety—Delivering Compliance and Trust*. Redwood Shores, CA: Oracle Corporation.

Lang, J. T. and W. K. Hallman. 2005. "Who Does the Public Trust? The Case of Genetically Modified Food in the United States." *Risk Analysis* 25(5):1245–1252.

Lang, J. T., K. M. O'Neill, and W. K. Hallman. 2003. "Expertise, Trust, and Communication about Food Biotechnology." *AgBioForum* 6(4): 185–190.

Manning, L., R. N. Baines, and S. A. Chadd. 2007. "Trends in the Global Poultry Meat Supply Chain." *British Food Journal* 109(5):332–342.

Manrique. J. and H. H. Jensen. 1998. "Spanish Household Demand for Convenience Meat Products." *Agribusiness* 13(6):579–586.

McLeod, A. N. Morgan, A. Prakash, and J. Hinrichs. 2007. "Economic and Social Impacts of Avian Influenza." FAO (AGAL and ESCB). FAO Emergency Centre for Transboundary Animal Diseases Operations (ECTAD).

Miljkovic, D. and C. Effertz. 2009. "Analyzing Consumer Behavior and the Demand for Broilers: A Reference Point Approach." *British Food Journal* Forthcoming.

Miljkovic, D. and D. Mostad. 2007. "Obesity and Low-Carb Diets in the United States: A Herd Behavior Model." *Agribusiness* 23(3):421–434.

Miljkovic, D., G. W. Brester, and J. M. Marsh. 2003. "Price Discrimination, Exchange Rate Pass-Through, and U.S. Meat Export Prices."

Applied Economics 35(6):641–650.
Mitchel, A, 1983. *The Nine American Life Styles*. New York: Warner.
Moore, T. and N. Morgan. 2006. "Avian Influenza: Trade Issues." CAST Commentary QTA 2006-2. Ames IA: Council for Agricultural Science and Technlogy.
Moschini, G., and K. D. Meilke. 1989. "Modeling the Pattern of Structural Change in U.S. Meat Demand." *American Journal of Agricultural Economics* 71(2): 253–261.
National Cattlemen's Beef Association (NCBA). 2007. "Beef Market at a Glance." http://www.beefusa.org/newsindustrystatistics.aspx. Accessed December, 2007.
Novak, T. P. and B. MacEvoy. 1990. "On Comparing Alternative Segmentation Schemes: The List of Values (LOV) and Values and Life Styles." *The Journal of Consumer Research* 17(1): 105–109.
Oberholtzer, L., C. Greene, and E. Lopez. 2006. "Organic Poultry and Eggs Capture High Price Premiums and Growing Share of Specialty Markets." LDP-M-150-01. U.S. Department of Agriculture, Economic Research Service.
Rodenburg., T. B. M. C. Van Der Hulst-Van Arkel, and R. P. Kwakkel. 2004. "Campylobacter and Salmonella Infections on Organic Broiler Farms." *NJAS Wageningen Journal of Life Sciences* 52(2):101–108.
Sans, P., G. de Fontguyon, and J. Briz. 2005. "Meat Safety as a Tool of Differentiation for Rretailers: Spanish and French Examples of Meat 'Supply Chain Brands'." *International Journal of Retail & Distribution Management* 33(8):618–635.
Sapp, S. G. and S. R. Bird 2003. "Effects of Social Trust on Consumer Perceptions of Food Safety." *Social Behavior and Personality* 31:413–422.
Schroeder, T. C. G. T. Tonsor, J. M. E. Pennings, and J. Mintert. 2007. "Consumer Food Safety Risk Perceptions and Attitudes: Impacts on Beef Consumption across Countries." *The B.E. Journal of Economic Analysis & Policy*7(1): Article 65. http://www.bepress.com/bejeap/vol7/iss1/art65.
Siegrist, M. and G. Cvetkovich. 2001. "Better Negative than Positive? Evidence of a Bias for Negative Information about Possible Health Dangers." *Risk Analysis* 21(1):199–206.
Slovic, P. 1993. "Perceived Risk, Trust, and Democracy." *Risk Analysis* 13(6):675–682.
Suder, G. and S. Inthavog. 2008. "New Health Risks and Sociocultural Contexts: Bird Flu Impacts and Consumers and Poultry Business in Lao PDR." *Risk Analysis* 28(1):1–12.
Taha, F. 2007. "How Highly Pathogenic Avian Influenza (H5N1) Has Affected World Poultry-Meat Trade." U.S. Department of Agriculture, Economic Research Report # LDP-M-159-02.
Tiensin, T., P. Chaitaweesub, T. Songserm, A. Chaisingh, W, Hoonsuwan, C. Buranathai, T. Parakamawongsa, S. Premashthira, A. Amonsin, M. Gilbert, M. Nielen, and A. Stegeman. 2005. "Highly Pathogenic Avian Influenza H5N1, Thailand, 2004." *Emerging Infectious Diseases* 11(11):1664–1672.
USDA-Economic Research Service. No Date. "Broiler Farms. Organization, Management, and Performance." Publication AIB-748.
Verbiest, J-P. A. and C. N. Castillo. 2004. "Avian Flu: An Economic Assessment for Selected Developing Countries in Asia." ERD Policy Brief No 24, Economics and Research Department, Asian Development Bank. March.