

Consumer Evaluations of Food Risk Management Quality in Europe

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In developing and implementing appropriate food risk management strategies, it is important to understand how consumers evaluate the quality of food risk management practices. The aim of this study is to model the underlying psychological factors influencing consumer evaluations of food risk management quality using structural equation modeling techniques (SEM), and to examine the extent to which the influence of these factors is country-specific (comparing respondents from Denmark, Germany, Greece, Slovenia, and the United Kingdom). A survey was developed to model the factors that drive consumer evaluations of food risk management practices and their relative importance ($n = 2,533$ total respondents). The measurement scales included in the structural model were configurally and metrically invariant across countries. Results show that some factors appear to drive perceptions of effective food risk management in all the countries studied, such as *proactive consumer protection*, which was positively related to consumers' evaluation of food risk management quality, while *opaque and reactive risk management* was negatively related to perceived food risk management quality. Other factors appeared to apply only in certain countries. For example, *skepticism in risk assessment and communication practices* was negatively related to food risk management quality, particularly so in the UK. *Expertise* of food risk managers appeared to be a key factor in consumers' evaluation of food risk management quality in some countries. However, *trust in the honesty of food risk managers* did not have a significant effect on food risk management quality. From the results, policy implications for food risk management are discussed and important directions for future research are identified.

KEY WORDS: Consumer evaluations; food risk management quality; trust

1. INTRODUCTION

The past occurrence of various food safety incidents has led to decreased public confidence in the safety of food and in the management of food-related hazards (Frewer & Salter, 2002; Verbeke *et al.*, 1999). Some of these food safety incidents have had international impact on consumer confidence in, and economic functioning of, the food chains affected (e.g., BSE and dioxin contamination; Verbeke, 2001), while others have been contained within national (e.g., honey contaminated by mold in Greece, Athens News, 2005a and 2005b) or regional (e.g., dioxin contamination of the food chain in Belgium; Verbeke,

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2001) boundaries. Recent public debate about different applications of biotechnology, such as genetic modification for food production, and other technological issues, such as food irradiation, also signals heightened public concern about food quality and safety and the effectiveness of food risk management (Verbeke, 2001). These concerns have contributed to changes in the governing principles that guide the practice of food risk management (FRM) and to changes in the institutional arrangements for food safety in Europe (Houghton *et al.*, in press) and beyond (Yasui, 2004).

The “crisis of trust” in science and risk regulation on the part of the public has led to a drive for greater openness and transparency in policy making, and other policy recommendations for increasing public trust (Byrne, 2002; Rowe & Frewer, 2000; Walls *et al.*, 2004). The terms of reference of the newly formed food safety agencies in many countries, as well as of the European Food Safety Authority (EFSA), encompass the concepts of openness and transparency, together with the precepts of independence, integrity, and putting the consumer first (Byrne, 2002; Wales, 2004). The introduction of such measures is explicitly aimed at improving public trust in government and regulators, and increasing public confidence in food safety.

It is unlikely; however, that increasing transparency in regulatory measures *in itself* will improve public confidence in risk analysis practices (Frewer, 2004). Increased transparency provides opportunities for increased public scrutiny of the values and activities included in the practice of risk analysis, including the values applied to risk management and risk assessment (Frewer, 2004; Jensen & Sandoe, 2002). In particular, there has been limited empirical investigation of the factors influencing public perceptions of what constitutes best practice in risk management (Houghton *et al.*, in press). If a systematic understanding of what the public *perceives* to be best practice in risk management can be incorporated into the practice of risk analysis, this should ultimately lead to increased confidence in FRM and the safety of food, and help to restore public trust in institutions with responsibility for consumer protection in the agri-food sector.

Various studies have found that public perceptions of risks, including food risks, differ from perceptions of “experts” (Slovic, 1987; Douglas & Wildavsky, 1982; Fischler, 1998). In relation to food risk management, these studies showed that experts tend to believe in the rationality of arguments, facts, and science, arguing that science in itself provides an adequate

strategy to control risks. In contrast, consumers tend to use factors such as (dis)trust in social actors, credibility of risk regulators, and the perceived controllability of risks (e.g., De Boer *et al.*, 2005) in assessing risks. Qualitative research has explored perceptions of the effectiveness of FRM practices held by both consumers and food risk professionals (Houghton *et al.*, 2006; Van Kleef *et al.*, 2006; Krystallis *et al.*, 2006). Understanding potential differences in perceptions of effective FRM between consumers and experts is important for designing appropriate FRM strategies, as a failure to integrate societal concerns and values into risk analysis procedures is one of the factors associated with the decline in public confidence in risk assessment and risk management (Renn & Rohrman, 2000; Frewer *et al.*, 2005). The results from this qualitative work were used to inform the development of a survey instrument, the findings from which are presented in this article. The aim of this study is to model the underlying psychological factors influencing consumer evaluations of FRM practices using structural equation modeling techniques (SEM), and to examine the extent to which the influence of these factors is country specific, sampling from a number of European Union member states. This will provide insights for the development of more effective and trusted FRM strategies, and will indicate whether implementation of a single European policy regarding FRM is feasible.

2. THEORETICAL BACKGROUND

Risk management is one of three primary activities in the current process of risk analysis, the other two being *risk assessment* and *risk communication* (FAO/WHO, 1996). As defined by the FAO/WHO (1997), the primary goal of food *risk management* is the protection of public health by controlling risks as effectively as possible through the selection and implementation of appropriate measures. It is within the remit of risk managers to consider the various legal, political, social, and economic issues, such as risk acceptability and policies for risk mitigation activities. *Risk assessment* focuses on estimating the risk that a hazardous event will negatively affect a population or subpopulation. *Risk communication* is defined as the interactive exchange of information and opinions concerning risk and risk management among risk assessors, risk managers, consumers, and other interested parties and, theoretically, interacts with both assessment and management.

Although much research has examined public perceptions of food hazards (Boholm, 1998;

Fife-Schaw & Rowe, 1996; Hansen *et al.*, 2003), and also the factors that determine optimal risk communication practices (e.g., Frewer *et al.*, 1996b; Frewer *et al.*, 1999; Verbeke, 2005), little research has considered public perceptions of what constitutes best practice in risk management (Houghton *et al.*, in press). One area in which consumers' views of FRM have been examined, albeit tangentially, has been in research on societal trust in regulatory institutions, although this has not focused explicitly on understanding public perceptions of effective food risk management.

Research into public trust and distrust in the risk arena has focused both on trust in information sources (credibility), and in regulatory institutions (social trust). Source credibility refers to people's perceptions of the motivations of institutions or individuals providing information to the public (Frewer *et al.*, 2003), while "social trust" refers to people's willingness to rely on those who have the responsibility for making decisions and taking actions related to the management of risks and technologies (Siegrist *et al.*, 2000). Trust in information sources is usually assumed to be multidimensional and dependent on both information source characteristics and the subject under consideration (Frewer *et al.*, 2003), whereas social trust has less frequently been modeled using multiple scales (but see Poortinga, 2003).

There is some evidence that public trust (or "social trust") in regulators and regulatory institutions may influence risk and benefit perceptions of new technologies and food hazards, such as GM technology in food production (Siegrist, 2000), the use of pesticides in agriculture (Siegrist *et al.*, 2000), the acceptability of food irradiation (Bord & O'Connor, 1990), and other technologies (Miles & Frewer, 2001). It is acknowledged that consumer decisions about food safety are often based on *heuristics* or cues associated with information or messages (Frewer *et al.*, 1997). Heuristic processing occurs when people use simple cues or decision rules to make judgments about the merits or otherwise of information, without recourse to thoughtful analysis of the information content (Chaiken, 1980; Eagly & Chaiken, 1993). In contrast, systematic in-depth processing occurs when people are motivated to process information in a thoughtful way, utilizing cognitive resources. In these latter circumstances, external cues providing information about the merits or otherwise of the information become less salient. Heuristic approaches are adopted because people often lack knowledge, motivation, capacity, or other resources to make decisions about the risks and benefits associated with a new technology

or food hazard, and people may then base their judgments about the acceptability of risks on assessments of those who are responsible for managing the hazard (Siegrist & Cvetkovich, 2000). Reliance on trust as a cue or "heuristic" regarding the motivation of individuals or regulatory institutions may help people to reduce concerns about risk uncertainty to an acceptable level, and to simplify decisions involving a large amount of information (Savadori *et al.*, 2004). Research into social trust has shown that *value similarity* is important for attributions of trust of those in charge of managing hazards (Cvetkovich & Löfstedt, 1999). In particular, people trust those regulatory institutions and risk management actors that they perceive to have similar values to themselves, and are therefore expected to follow the appropriate guidelines and general principles for setting goals and procedures (Siegrist *et al.*, 2000).

In addition, perceptions of personal controllability over exposure to a hazard can determine the extent to which consumers need to rely on institutional risk management (Frewer *et al.*, 2004; Van Kleef *et al.*, 2006). When people perceive little personal control over exposure, for example, in the case of pesticides or GM food, they perceive protection against these hazards as the responsibility of others (Van Kleef *et al.*, 2006), illustrating the importance of trust in institutional risk management under these circumstances. Such assessments are likely to be an important determinant of public perceptions of the effectiveness of FRM. Rather than assessing all relevant information, consumers may base their evaluations of FRM quality on their evaluations of the extent to which they can trust in those food chain actors with responsibility for consumer protection.

The formal institutional goal of FRM is to protect public health through application of appropriate control measures (FAO/WHO, 1997). However, in practice, decision making in the area of FRM involves optimizing outcomes in a number of areas, including the encouragement of innovation in the agri-food sector and the promotion of fair competition (Houghton *et al.*, in press), and making trade-offs between risk and benefit (e.g., in terms of potential economic effects, or impact on people's quality of life). In certain instances, interests in these areas may conflict, and in this way creates tensions within the risk management decision-making process. For example, people may start to distrust the motivations of regulatory institutions under conditions where consumers perceive regulatory activities to be promoting the interests of industry rather than public welfare. In the UK, for example, the "GM Nation?" debate revealed a high

degree of suspicion regarding the motives, intentions, and behavior of those making decisions about GM crops and foods (Gaskell, 2004; Horlick-Jones *et al.*, 2006). Multinational companies are seen to be motivated primarily by profit, rather than by any desire to serve the needs of society.

In a similar vein, research by Van Kleef *et al.* (2006) and Krystallis *et al.* (2006) focused on perceptions of FRM practices, suggests that consumers are not convinced that their interests are necessarily underpinning institutional activities related to FRM. In these qualitative studies, both consumer and expert participants agreed that consumer health protection *should* be prioritized. However, many consumer participants argued that the primary motivation of politicians or regulators is to protect industry and export markets, indicating that FRM is predominantly driven by economic interests. Although the expert participants maintained that the protection of consumer health is the primary focus of FRM, some agreed with the views expressed by the consumer participants in this respect.

When regulatory frameworks fail to take account of factors that are driving public concern, then the motives of those developing the frameworks appear suspect (Frewer *et al.*, 2004). The technical risk assessment process may conflict with value systems that dominate public discussion in a particular area, such as genetically modified foods (Grove-White *et al.*, 1997). Here the breadth and complexity of public views has shown itself to be at odds with the more circumscribed procedures of scientific risk assessment (Mayer & Stirling, 2004). Of course, decisions regarding risk acceptability and risk mitigation activities that involve trade-offs between economic, social, and political factors are not made by scientific analysis alone—"values" are involved in such decision making (Ball, 2002). Where the concerns and values of all sections of society are not obviously included in the process, then subsequent risk management activities may appear to promote particular vested interests. Since confidence in risk management institutions has been shown to be related to perceptions of promoting an unbiased view (Frewer *et al.*, 1996a) and having similar values or interests to those valued by society in general (Siegrist *et al.*, 2000), a more public discussion of the values applied to determining risk acceptability and risk management practices may have a positive impact on consumer confidence related to risk management (Van Kleef *et al.*, 2006). Indeed, there has been an increased interest in public participation in risk management

decision making as a mechanism to improve confidence in risk management (Frewer *et al.*, 2004; Rowe & Frewer, 2000). However, the effects of public participation on public confidence in risk management are presently unclear, and there is a need for evaluation of how such exercises are conducted and how they impact on policy development (Rowe & Frewer, 2000).

While there is skepticism about industry's motives, and suspicion that regulators are vulnerable to influence and lobbying, the public is also not a passive receiver of the views of those that claim to serve the public interest, such as nongovernmental organizations (NGOs) and the media. An analysis of public attitudes to biotechnology in Europe found that NGOs are also seen to have their own "vested interests," such as in raising funds (Marris, 2001). However, these groups are perceived positively by the public in that they ask difficult questions of politicians and regulators and raise issues that might not otherwise be brought to public attention. They are therefore seen to have more concern for consumer welfare or the protection of environmental or societal interests than industry and regulators. Similarly, Houghton *et al.* (2006) and Van Kleef *et al.* (2006) found that consumer organizations were perceived to have consumers' interests at heart and therefore regarded as more likely to provide unbiased information.

The media is regarded as having a significant influence on consumers' perceptions of risk and risk management activities (see, for example, Pidgeon *et al.*, 2003). As a pervasive and easily accessible force, the media is obviously an important source of information on food safety issues and the view in some expert circles is that a sensationalist press is responsible for fuelling public concern (Frewer, 2003; Krystallis *et al.*, 2006; Van Kleef *et al.*, 2006). Other research (e.g., Krystallis *et al.*, 2006; Marris, 2001; Van Kleef *et al.*, 2006) suggests that the public has a more complex view of the media. On the one hand, consumers acknowledge that the primary interest of the media is to make money and not to protect the public, on the other, consumers recognize that the media may have a positive influence on FRM because organizations such as food retailers are wary of adverse publicity (and its impact on profits), and this serves to enhance consumer health protection (Jones *et al.*, 2000; Van Kleef *et al.*, 2006).

Research on risk perception has shown that consumers are concerned about the controllability of hazards (both in terms of their own exposure to them, and by regulatory authorities more generally), and

that perceptions of controllability and whether they perceive that they are involuntarily exposed to a hazard are important determinants of risk acceptability (e.g., Fischhoff *et al.*, 1978). Perceptions of effective FRM are therefore likely to be related to whether the authorities develop and maintain systems of control, and are transparent regarding the development of these systems and their performance (Van Kleef *et al.*, 2006). Indeed, consumer participants in the study by Van Kleef *et al.* (2006) indicated that they perceived food risks to be well managed when control measures are in place to contain the risks, when these measures are rigorously enforced, and when people are aware of the measures.

In a similar vein, in a study on the needs of consumers regarding the labeling of genetically modified foods, results indicated that labeling was not perceived as effective by consumers unless there was an effective traceability system (Miles *et al.*, 2005). While labeling enables consumers to make an informed choice under conditions where they otherwise lack personal control over exposure, respondents in the survey indicated that perception of scientific and regulatory inability to trace GM foods acts to reduce public confidence in food safety (Frewer *et al.*, 2004; Miles & Frewer, 2002), illustrating the importance of effective control measures for evaluations of FRM. Hobbs *et al.* (2005) report that consumers' willingness to pay increased when labeling of beef and pork was coupled with traceability information. The authors argued that traceability information may act as a credibility signal to consumers, maintaining consumer confidence in industry. Yet, increased value to consumers happens only when building traceability with quality insurance. Consumer perceptions of effective FRM appear to be related to the development of proactive measures to prevent large-scale food crises and scandals, rather than adopting a strategy to deal with a problem after it has occurred. As a consequence, transparent and proactive communication with consumers about emerging food safety problems, and what is being done to mitigate emerging risks, may increase confidence in risk management practices and evaluations of FRM (Van Kleef *et al.*, 2006).

As these studies illustrate, risk communication activities have obvious implications for the perception of risks and the evaluation of risk management. It is important to note, however, that in the food arena, several studies have also shown that consumers often do not find labeling information and traceability codes on food products to be helpful, as it does not address their particular needs or expectations (Salaun

& Flores, 2001; Verbeke, 2005). Consumers claim that information is often inconsistent, confusing, and difficult to understand (Van Kleef *et al.*, 2006) and this can contribute to a lack of confidence in the safety of the product (Verbeke, 2005), and even to distrust of the risk management actors. In the case of BSE, the failure to communicate uncertainty was associated with a decline in public trust of risk regulators (Miles & Frewer, 2003). The consumer perception that there is excessive precautionary labeling of peanuts as a potential allergen in food products is seen only to serve industry's interests by offering protection against litigation (Cornelisse-Vermaat *et al.*, in press). Indeed, risk communication activities have historically been promoted by institutions based on the need to correct a "knowledge deficit" on the part of consumers. The expert view is that consumers lack awareness of food safety issues, and as such there is a need for further public information and education campaigns. On the other hand, consumers feel they are reaching a situation of "information overload" in terms of the quantity of risk information they receive—and thus it is the *quality*, rather than *quantity*, of risk information that is important (Krystallis *et al.*, 2006). These findings illustrate the importance of targeting risk communication to the actual needs and concerns of consumers.

To summarize, previous research has identified several factors of importance in the evaluation of FRM. Research on trust has identified some factors that may underpin perceptions of effective FRM, as well as factors that predict trust in individuals or institutions providing food related information to the public. This research has shown the need to integrate societal concerns and values more efficiently into risk assessment and risk management procedures, as well as to optimize risk communication based on this type of knowledge (Van Kleef *et al.*, 2006). Based on the results of previous qualitative studies (Houghton *et al.*, 2006; Krystallis *et al.*, 2006; Van Kleef *et al.*, 2006), a survey was developed to model the factors that drive consumer evaluations of FRM practices and their relative importance. An additional aim of this study is to assess the extent to which these factors are subject to cross-cultural variation in different European member states, which have experienced differential impacts of various food scares and have been managed by different institutional arrangements (Denmark, Germany, Greece, Slovenia, and the United Kingdom; Houghton *et al.*, in press). In the next section the development of the survey measures will be discussed.

3. METHODS

3.1. Measure Development Procedure

3.1.1. Item Generation and Initial Refinement

All measures (except the “trust in food risk managers” scale) were initially developed on the basis of the results of previous focus group studies on FRM perceptions (Houghton *et al.*, 2006; Van Kleef *et al.*, 2006). In this exploratory qualitative work, the following key themes were identified as important in relation to consumers’ evaluations of FRM practices: (1) efforts made by the responsible authorities to manage food risks, (2) responsibility for prevention and management of food risks, (3) how priorities are established within regulatory systems, (4) scientific progress and its implications for FRM, (5) media attention and food safety incidents, and (6) trust in food risk managers. Frequently mentioned discussion topics were converted into relevant items. We included a series of items as an overall evaluation of FRM. The researchers constructed these items to represent the first five themes relating to food risk management quality (FRMQ) evaluations as described above. An adapted version of the scale developed by Frewer *et al.* (1996a) was used to measure trust in food risk managers. This trust-scale has been cross-culturally validated in previous research (Frewer *et al.*, 2003). Frewer and colleagues examined trust in information about food related risks and therefore it was necessary to alter the items to the present context of FRM (see also, Frewer *et al.*, 2005). To ensure that all respondents used the same frame of reference when responding to these items, the following description headed the questionnaire: “with a ‘food risk manager’ we mean: a person who is in some way responsible for protecting consumers from food risks. These food risk managers may work in a variety of organizations (e.g., industry, local or central government).”

Redundant, ambiguous, and difficult to understand items were eliminated during initial screening. A seven-point Likert-type response format ranging from “strongly disagree” to “strongly agree” was used for all items. “Don’t know” was also offered as a response option. The presentation order of the items was randomized to help overcome fatigue effect. About half of the items were reversed in polarity to control for respondent response bias (Herche & Engelland, 1996). Personal and demographic characteristics of the respondents were also measured. Additional scales were included, but will be reported elsewhere.

In the non-English speaking countries, the questionnaire was first translated by a native language-speaking member of the research team and reviewed for linguistic equivalence. The resulting questionnaire was then backtranslated into English. Following this process, the foreign-language questionnaires were refined so that they were comprehensible to Slovenian, German, Greek, and Danish native speakers, while being equivalent to the English version. The questionnaire was subsequently pretested in two rounds. In each country a small-scale informal pretest was carried out with 10 consumer respondents. The primary purpose of this first pretest was to make certain that the questions were clear and understandable for respondents. Based on the results of this pretest, the questionnaire was modified slightly.

3.1.2. Scale Refinement: Pilot Study on Small Consumer Sample

During initial data collection, 47 items were used. Additional scale refinements were carried out following a pilot study in the five countries included in the research (Denmark, $n = 52$; Germany, $n = 70$; Greece, $n = 70$; Slovenia, $n = 50$; UK, $n = 65$). The respondents in this pretest sample were randomly chosen consumers. Exploratory factor analysis and reliability assessment were performed on the data set ($n = 307$ in total). These analyses resulted in eight scales containing 46 items in total that showed sufficient reliability. To ensure content validity, some of these items were rephrased to make sure that they would measure the same construct.

3.1.3. Scale Refinement After Final Data Collection

All scales were subjected to a refinement process involving exploratory factor analysis and a reliability (i.e., Cronbach’s Alpha) assessment of the initially proposed constructs using the data collected in the main study (to be described later on). This resulted in the retention of 33 items (see Table I). Items that did not explain a sufficient portion of variance were eliminated. Some of the preliminary study constructs (i.e., priorities, responsibility, and the role of the media) were not supported in this process. The final items used to measure the six remaining constructs are presented in Appendix A. The names of these scales have been adapted slightly compared to the original themes proposed initially to ensure a proper representation of the construct measured.

Table I. Descriptive Statistics, Number of Items, and Coefficients of Reliability and Correlation Coefficients for the Six Final Scales*

Scale	Mean	Standard Deviation	Number of Items	Cronbach's Alpha	1	2	3	4	5	6
1 Food Risk Management Quality (FRMQ)	11.89	3.89	3	0.79	1					
2 Proactive Consumer Protection (PCP)	17.80	4.84	4	0.80	0.75	1				
3 Opaque and Reactive Risk Management (ORR)	27.07	7.06	6	0.82	-0.72	-0.75	1			
4 Skepticism in Risk Assessment and risk management practices (SCEP)	22.54	3.06	4	0.69	-0.39	-0.16	0.44	1		
5 Honesty of food risk managers TRUSTH	48.49	11.03	11	0.89	-0.68	0.58	-0.48	-0.05	1	
6 Expertise of food risk managers TRUSTE	23.55	4.69	5	0.66	0.72	-0.54	0.66	0.38	-0.66	1

*These statistics are based on the entire sample ($n = 2,533$).

The following scales showed reasonable to good reliability in the initial analysis (see Table I for descriptive statistics): (1) food risk management quality (FRMQ; Cronbach's alpha 0.79), (2) proactive consumer protection (PCP; Cronbach's alpha 0.80), (3) opaque and reactive risk management (ORR; Cronbach's alpha 0.82), (4) skepticism in risk assessment and risk management practices (SCEP; Cronbach's alpha 0.69), (5) trust in honesty of food risk managers (TRUSTH; Cronbach's alpha 0.89), and (6) trust in expertise of food risk managers (TRUSTE; Cronbach's alpha 0.66).

The dependent construct "Food risk management quality" (FRMQ) was measured using three items that reflect consumers' evaluation of the regulatory system in place to manage food hazards: "food risks are very well managed in our country," "when I buy food, I am certain that it is safe to eat," and "I trust the regulatory system to protect me from food risks". "Proactive consumer protection" (PCP) is defined as the management systems that consumers perceive to be functioning with respect to food safety. The construct was measured using items that reflect consumers' perceptions of whether there is an established system for controlling food risks, the rapidity of responses to food safety problems, the effort made in order to prevent food risks occurring, and the efficient enforcement of food safety laws by the authorities.

The "opaque and reactive risk management"-scale (ORR) captures the concepts of responsiveness to food safety problems. The items concentrate on negative measures taken or lack of management actions taken in food safety. Other research has suggested that transparency and promptness of actions is of extreme importance (Halkier & Holm, 2006). "Skepticism about risk assessment and risk communication" (SCEP) comprises items that capture consumers' doubts about food safety assessment and the uncertainties surrounding this. The adapted version of the trust-scale developed by Frewer *et al.* (1996a) in-

corporated two dimensions—honesty and expertise. These two dimensions are treated as two separate scales: trust in the honesty of food risk managers (TRUSTH) and trust in the expertise of food risk managers (TRUSTE). Appendix A shows the items in the different measurement scales.

3.2. Data Analysis Procedure

The structural equation modeling approach was selected to model and test the impact of the psychological factors on perceived FRMQ (LISREL 8.72; Jöreskog & Sörbom, 1999). Covariance matrices were computed for each country, in which each covariance was based on the full number of cases with complete data for each pair of variables (e.g., pairwise deletion of missing values). Finally, a comprehensive structural model was estimated that included all six constructs (Fig. 1). A systematic stepwise approach to testing the cross-country differences in path coefficients was applied. The goal of this analysis is to find the model that best fits the data and obtain an understanding of where path coefficients are invariant across countries and where they are not.

3.2.1. Cross-National Validity of Measurement Instrument

Before testing our structural model, the measurement model was tested for invariance across countries. Equality of factor structure and loadings is necessary to make comparisons between countries (Anderson & Gerbing; 1988; Steenkamp & Baumgartner, 1998) and ensures that scales can be interpreted in the same way in the five countries included in the study.

The scale of measurement for the constructs was established by fixing one of the factor loadings of each scale to 1.0. Measurement equivalence was tested in increasingly rigorous steps: configural, metric, and scalar invariance. Results are shown in Table II.

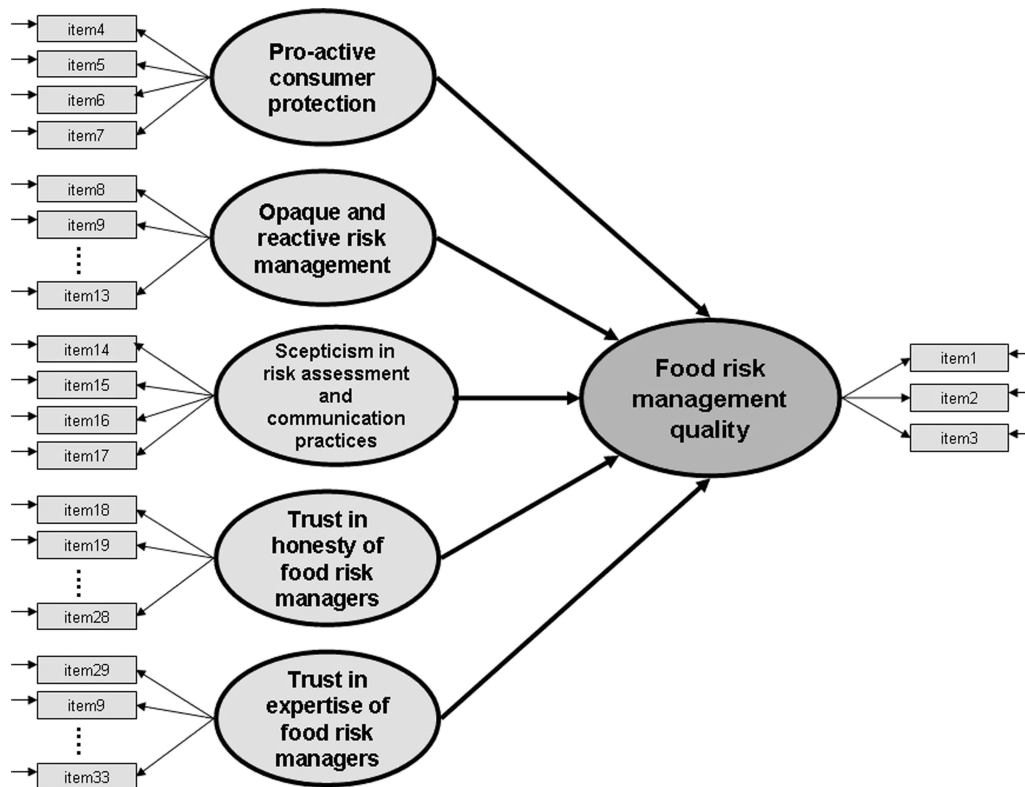


Fig. 1. Structural model for evaluations of food risk management quality.

Assessment of model fit was based on the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA). The CFI is a fit index, which ranges from 0 to 1. A greater value indicates a better fit, but in any case the CFI must exceed 0.90 if the model fit is to be acceptable (Schermelleh-Engel *et al.*, 2003). The chi-square statistic with corresponding degrees of freedom was also included in order to compare the models. We first assessed *configural invariance* of the measurement model. Configural invariance (also called *pattern invariance*) means that the same underlying constructs are measured in all countries. In other words, configural invariance indicates that the same pattern of zero and nonzero factor loadings can be found across countries, implying that similar latent constructs are present in all the countries. Configural invariance was supported as the

CFI and RMSEA demonstrated good fit to the data (CFI = 0.95, RMSEA = 0.07). Inspection of the factor loadings showed that most of them were rather high, except item 8 of the scale “perceived honesty of food risk managers,” which was low in Greece.

Second, *metric invariance* was assessed. Metric invariance indicates that the way in which the items in a questionnaire relate to underlying constructs is the same across countries. In other words, items have the same loadings across countries. If a scale satisfies the requirement of metric invariance, difference scores on the items can be meaningfully compared across countries (O’Sullivan *et al.*, 2005). Metric invariance was tested by comparing the fit of a six-factor model with factor loadings that were constrained to be equal across countries, to the fit of the configural invariance model (in which only the pattern of zero and non-zero loadings need to be the same across countries). Metric invariance was supported ($\chi^2_{(2508)} = 8669, p < 0.01; RMSEA = 0.07$).

Finally, *scalar invariance* was tested by specifying factor loadings and item intercepts to be invariant across groups. This resulted in a large decrement in fit ($\chi^2_{(2643)} = 12964, p < 0.01; RMSEA = 0.097$) indicating that item intercepts can not be assumed to be

Table II. Goodness-of-Fit Statistics

Model	χ^2	df	RMSEA	CFI
Configural invariance	7,835	2,400	0.070	0.95
Metric invariance	8,669	2,508	0.073	0.95
Scalar invariance	12,964	2,643	0.097	0.91

Table III. Characteristics of Study Participants

Characteristic	Germany	Greece	Denmark	Slovenia	UK	Total Sample
Gender						
Male	263	246	262	242	221	1234 (48.7%)
Female	206	257	301	265	270	1299 (51.3%)
Total	469	503	563	507	491	2533 (100%)
Age (mean, <i>SD</i>)	39.5 (14.1)	38.4 (13.1)	49.8 (14.2)	44.3 (15.9)	50.0 (15.4)	44.6 (15.3)
Educational level* (%)						
Low	26	9	15	54	6	22
Middle	37	65	27	32	69	46
High	37	26	58	14	25	32

*Low educational level equals “not completed primary (compulsory) education” or “primary education” or “first stage of basic education.” Middle educational level equals “lower level secondary education” or “second stage of basic education” or “upper secondary education”. High educational level equals “post-secondary, non tertiary education” or “first stage of tertiary education” or “second stage of tertiary education research.”

invariant across countries and therefore the means of the countries cannot be compared across countries. However, as the aim of this study is not to compare the means of the constructs, but rather the magnitude of the path coefficients, scalar noninvariance is seen as a less serious problem (e.g., Scholderer *et al.*, 2004).

3.3. Sample

Data were collected from nationally representative samples of consumers in Germany, Greece, Denmark, Slovenia, and the United Kingdom. These countries were selected on the basis of Hofstede values (Hofstede, 1991) to be culturally differentiated in terms of uncertainty avoidance and risk taking aversion. Professional survey research companies were used to collect the data. Participants were selected to be representative of the national population as a whole in relation to age, gender, and educational level (Table III). Of the total sample of 2,533 respondents, 51.3% were women. In the total sample, the mean age of participants was 44.6 years (*SD* = 15.3). Data were collected by means of an Internet questionnaire in all countries, except Slovenia. The Internet has some

major benefits in data collection, such as cost advantages and high speed of data collection (Sitka & Sargis, 2006). However, Internet usage in Slovenia was not sufficient to ensure a representative sample and data were collected by means of telephone interviews.

4. RESULTS

4.1. Estimating Country Differences in Regression Coefficients

A series of nested structural models was tested. Goodness-of-fit indices and model comparison statistics are shown in Table IV. First, a baseline model was tested including *all* paths specified in Fig. 1 and in which the path coefficients are constrained to be invariant across countries. The results of this analysis showed that the fit of this model to the data is acceptable ($\chi^2_{(2420)} = 8,429, p < 0.01; RMSEA = 0.07$). This model has a R-square value of 0.83 which indicates that 83% of the variance is explained by the five explanatory constructs. We then fitted progressively less restrictive nested models, in which the sequence of models was based on an initial inspection of differences across unstandardized regression coefficients.

Table IV. Test for Equality of Regression Coefficients Across Countries

Model	χ^2	<i>df</i>	RMSEA	CAIC	NNFI	CFI	$\Delta\chi^2$	Δdf
1. Equality constraints on regression coefficients	8,429	2,420	0.0701	11,831	0.95	0.95		
2. Relax constraints on PCP	8,382	2,416	0.0699	11,820	0.95	0.95	47	4*
3. Relax constraint on SCEP	8,352	2,412	0.0698	11,825	0.95	0.95	30	4*
4. Relax constraint on TRUSTE	8,337	2,408	0.0698	11,846	0.95	0.95	15	4*
5. Relax constraint on TRUSTH	8,335	2,404	0.0699	11,879	0.95	0.95	2	4(ns)
6. Relax constraint on ORR (i.e., Model without constraints)	8,333	2,400	0.0699	11,912	0.95	0.95	2	4(ns)

**p* < 0.01.

Table V. Results for Five Countries (Unstandardized Regression-Coefficients)

Path	Across Countries
Honesty of food risk managers → FRMQ	0.01*
Opaque and reactive risk management → FRMQ	-0.11*

* $p < 0.05$.

Model 2 allowed the path between PCP and FRMQ to vary across countries, which caused a significant decrease in chi-square in comparison with Model 1 ($\Delta\chi^2_{(4)} = 47, p < 0.01$). The third Model additionally allowed the path between SCEP and FRMQ to vary across countries, resulting again in a model fit improvement ($\Delta\chi^2_{(4)} = 30, p < 0.01$). Model 4 allowed, in addition, the path between TRUSTE to vary across countries, also resulting in model fit improvement ($\Delta\chi^2_{(4)} = 15, p < 0.01$). In Model 5, all regression coefficients except one (ORR) were allowed to vary across countries. This did not result in model fit improvement ($\Delta\chi^2_{(4)} = 2, p = ns$). Finally, the model without any constraint on regression coefficients across countries (Model 6) did not result in improved model fit in comparison to the previous Model 5 ($\Delta\chi^2_{(4)} = 2, p = ns$). In addition, the RMSEA of the model with equality constraints on all regression coefficients (0.0701) was slightly higher than that of the model without equality constraints (0.0699). The six models may all be acceptable based on the same value for CFI (0.95). However, the less constrained models have a higher CAIC value than does the most constrained baseline model (Model 1). The CAIC value is used to compare two or more models estimated from the same data. Smaller values indicate a better fit. The relaxed models, Models 2 and 3 show a decrease in CAIC, supporting the relaxation of the constraints. From Model 4 the CAIC start to increase again, indicating the model is no longer improving by additional relaxation of constraints. However, although CAIC indicates that Model 3 is most optimal, significant improvement indicated by χ^2 changes ($\Delta\chi^2_{(4)} = 15, p < 0.01$), indicates that Model 4 is the most optimal

model. In this article we follow the χ^2 change indicator and adopt Model 4 as most optimally reflecting the data.

These results indicate that there are no country differences in the effects of ORR and TRUSTH on FRMQ. This implies as well that different models explain consumer evaluations in the five countries regarding PCP, SCEP, and TRUSTE. Tables V and VI give the more detailed results for Model 4.

4.2. Estimating Regression Coefficients Between Independent Constructs and Dependent Construct FRMQ

The analysis above showed that it is not justified to assume that there are country differences regarding the effect of TRUSTH and ORR on FRMQ. Perceived honesty of food risk managers did not have a significant impact on food risk management quality perceptions across the five countries. However, opaque and reactive food risk management was significantly negatively related to perceptions of food risk management quality across the five countries (Table V).

The nested model analysis showed that it is justified to assume that countries differ in their relations between PCP, SCEP, and TRUSTE and FRMQ. Table VI shows the results. Proactive consumer protection (PCP) had a strong impact on consumers' evaluations of food risk management quality across all countries. Results show that this relation is particularly strong in Greece. Skepticism regarding risk management is negatively related to FRMQ in all countries, although the effect is not significant in Denmark. For the perceived expertise of food risk managers' paths, significant relations were found in all countries, except Greece.

5. DISCUSSION

The aim of this study was to model the underlying psychological factors influencing consumer evaluations of FRM practices, and to examine the extent to which these factors are subject to cross-cultural

Path	Germany	UK	Denmark	Slovenia	Greece
Proactive consumer protection → FRMQ	0.27*	0.45*	0.51*	0.57*	1.97*
Skepticism in risk assessment & communication practices → FRMQ	-0.34*	-0.71*	-0.22	-0.16*	-0.30*
Expertise of food risk managers → FRMQ	0.99*	0.94*	0.57*	0.87*	0.30

* $p < 0.05$.

Table VI. Results for Five Countries (Unstandardized Regression-Coefficients)

variation across the different European member states included in the study.

The results showed that some factors appear to drive perceptions of effective food risk management in *all* of the countries considered in the study. For example, proactive consumer protection is positively related to consumers' evaluation of food risk management quality in all of the countries studied, although the magnitude of this effect varies between countries. For example, in Greece, the use of proactive risk management strategies appears to be more important compared to the other countries included, perhaps because of consumer experience with past incidences of poorly handled reactive risk management. Independent of cross-national differences in the strength of the effect of proactive risk management, the results presented here would suggest that in all of the countries included in the study, effective food risk management requires communication to consumers about what is being done to proactively protect consumers from different food hazards before the risks have actually occurred. In other words, confidence in risk management practices is determined by adoption of a proactive approach to consumer protection, and communication to consumers about how this proactive approach is applied. Adopting a responsive communication approach (i.e., informing consumers about what has been done to mitigate risks after they have occurred) is unlikely to generate consumer confidence in risk management activities *per se*. Rather than communicating on an *ad hoc* basis, with a short-term focus, communication about risk management practices should be strongly and coherently embedded in the risk analysis process. This conclusion has been further strengthened by the observation that the positive effect of proactive consumer protection is associated with a negative effect of opaque and reactive risk management. Although this effect is small, it shows that consumers across the countries surveyed would like to see a focus on preventing the occurrence of food safety incidents problems rather than dealing with these after they have occurred. A transparent process of risk management regarding how these activities are initiated and conducted is also important to consumers. Communication about how safety is maintained—through application of food safety systems, prompt responses on the part of risk managers if potential hazards are detected, and how food safety is enforced, is needed to develop and maintain consumer confidence in food safety. This finding is in accordance with the hypothesis that it is better to promote positive policy information (e.g., “we always do

this”) rather than positive events (e.g., “look how well we did in this instance”) (White & Eiser, 2005). In other words, providing the public with policy information is more likely to build confidence than providing the public with information about specific instances of good performance, because continuous policy information reflects patterns of performance over time. This in turn sends an unambiguous message to consumers about the food risk manager's intentions and general approach.

Other factors appear to contribute to consumer confidence in risk management practices in certain of the countries sampled in the study. For example, skepticism in risk assessment and communication is negatively related to food risk management quality in all countries except Denmark, although this negative effect is significantly stronger in the UK. This may be because Danish consumers evaluate local risk communication practices more positively, or indeed reflect better risk communication practices in Denmark, and so the items are not relevant to Danish consumers. In addition, it is likely that consumers' skepticism regarding the efficacy of food management will be affected by national or regional food safety incidents. Hence, it is possible that, if consumer trust and confidence is high, skepticism will not contribute to perceptions of effective risk management. This is because it becomes irrelevant as a *predictive* construct, despite the scales themselves being reliable. There is some evidence for this conclusion from the existing literature. Poppe and Kjærnes (2003) found a relatively high level of consumer trust in public authorities responsible for food safety in Denmark, possibly a consequence of transparent information about hygiene standards in specific restaurants and catering outlets (Nielsen, 2006).

In modern societies, risk assessment and management have become more contentious at a societal level, and have become the focus of societal debate, an effect characterized by more polarized views and controversies across and within different communities (Slovic, 1993). It might be predicted that these cross-cultural differences are mainly linked to different political and economical contexts. There is no reason to assume that perceptions of risk management are not influenced by such socioeconomic impacts, although further research would be useful in order to establish if common elements in risk perception, and perceptions of what constitutes effective risk management, can be identified across different cultural contexts. Of course, some analysis of cross-cultural differences in risk perceptions have been conducted, whether in

specific food hazard domains such as genetically modified food (Frewer *et al.*, 2004), or through applying the psychometric approach to risk perception in different cultures (Renn & Rohrmann, 2000). However, research has, to date, primarily focused on occidental cultures, and so the identification of cross-cultural universals is not possible at the present time.

While trust in the expertise of food risk managers was an important determinant of food risk management quality, perceived honesty of food risk managers, did not predict consumer confidence in food risk management. It is likely that the perceived honesty of food risk managers relates closely to perceived sincerity and openness in information provision and communication, and this is not related to consumers' general evaluations of food risk management. The perceived expertise of food risk managers is related to their competence and knowledge in food safety management. The results of the research presented here suggest that this factor is seen as a prerequisite for successful food safety management more generally. That is, consumers see the expertise of food risk managers as a key factor in their evaluations of food risk management quality. Thus, in addition to communication about proactive risk management activities, communication might also usefully focus on provision of information about the expertise upon which risk management systems are based (e.g., *who* decides what is done, and what is the basis of their authority). This reflects a finding from the Eurobarometer study of 2005: citizens across Europe tend to have high esteem for scientists' judgments and believe therefore that policymakers should consult them for their expertise (European Commission, 2005, p. 90).

While the results suggest that a centralized policy on food risk management, and communication about food risk management, may potentially make a contribution to increased consumer confidence in regulatory activities focused on consumer protection, some national differences have also been identified, implying that, for some EU member states, additional information and greater customization to the local cultural environment may be required. For example, communicating to people who are already skeptical about risk management (such is the case in the UK) is much more challenging. When there is already societal distrust regarding the confidence and motivation of risk managers, information that they provide about positive events may be discounted by consumers. Consumer biases in processing may lead to information about negative events being differentially processed by consumers, as information about poor management is

consonant with existing perceptions regarding managerial competence and motives, and leads to the reinforcement of existing beliefs (Cvetkovich *et al.*, 2002).

The results from this study are relevant in showing how important it is to understand the consumers' point of view before providing information aimed at "educating" them toward a particular managerial perspective. Understanding consumer preferences for risk management strategy can contribute to a more participatory democratic approach to food risk analysis, assuming due account is taken of consumer opinion (e.g., Rowe & Frewer, 2000; Dreyer & Renn, 2007). Jensen (2006) has noted that increased consumer and citizen input into risk management may increase consumer trust in risk management practices, assuming communication about how consumer opinion has been utilized is fed back to consumers (Rowe & Frewer, 2005). Transparency may further be increased by greater stakeholder involvement and public engagement in the risk management process, but unless the way these inputs are proved and included is also communicated back to society, transparency is unlikely to be enhanced (Rowe & Frewer, 2000). For example, BSE was an example of how the government mismanaged to promote transparency and proactiveness, which in turn led to skepticism among consumers (Frewer & Salter, 2002).

How best to operationalize transparency in a way, which is useful for society in general is, of course, an ongoing topic of societal discussion. Transparency may not in itself contribute to increased citizen trust in risk management practices unless what is made transparent in risk management aligns with societal preferences regarding how risk management activities are operationalized. The results presented here suggest, for example, that proactive risk management activities being developed to mitigate food risks operate as important indicators that the process of risk management meets citizen preferences for risk management practices. How best to communicate proactive risk management activities, is, however, a topic that merits further research.

There are several limitations in this study. The research aims to measure consumers' evaluation of various factors relating to food risk management quality. The resulting model still needs to be tested against independent data as our study used structural equation modeling in an exploratory manner. The results suggest that the scales used in the survey demonstrated acceptable construct reliability and are comparable across countries. However, we could only reliably measure a limited number of factors relating

to consumers' evaluation of food risk management quality. Although our cross-national model explained a large percentage of variance, our earlier qualitative work indicated additional factors as important for consumer evaluations of food risk management, which may be country or culture specific (Houghton *et al.*, 2006; Van Kleef *et al.*, 2006). Hence, future research could further investigate the relevance of these factors utilizing, for example, as case study approach.

The new constructs developed in the research presented here can serve as a foundation for further investigation, how varying the context of FRMQ (e.g., for potential hazards associated with different levels of risk and benefit) against the factors identified in the current research might influence consumer perceptions of FRMQ. This might be conducted in an experimental situation, or by application of a case study approach to existing or emerging food risks. Systematic cross-cultural comparison would facilitate the development of harmonized international policy regarding risk management options, while at the same time facilitating the identification of areas where additional information needs to be provided in line with national cultural preferences.

It is possible that consumers have no preexisting opinion regarding some aspects of food risk management, or are not skeptical beforehand, but form these opinions only in response to the questions asked by the researcher. The measurement process could lead respondents to form judgments they would otherwise not form (see, for example, the self-generated validity theory: Feldman & Lynch, 1988). The evidence from the focus groups would suggest this is not the case, as participants voiced spontaneous concerns. Certainly skepticism in itself did not emerge as a cross-cultural universal, which would suggest that this was not the case in all of the countries included in the study. Thus one might conclude that UK consumers are more skeptical about food risk management practices specifically compared to other consumers in the other countries sampled, or are more skeptical about regulatory activities in general, or are more likely to form judgments as a consequence of being asked questions about a specific topic. As there is no reason to suggest that the latter occurred from the qualitative phase of the study, it is suggested that the higher levels of skepticism in UK represented a true cross-cultural difference, possibly a consequence of sociopolitical influences differentially affecting the UK participants in the study. The potential causes of this may be an interesting topic of further research.

There may be a bias in our study due to the different modes of data collection used in this study. In Slovenia, participants were randomly called by the market research agency, while in the other countries participants were part of an internet panel. Although Internet data collection is now regarded as a gold standard by some researchers for research of this type (Fricker & Schonlau, 2002), it could be that consumer respondents interviewed by telephone responded differently to the questions posed. However, the stability of the model suggests that this was not a major issue.

The survey approach utilized in the research presented here was directly developed from previous qualitative analysis (Van Kleef *et al.*, 2006; Houghton *et al.*, 2006). A full discussion of the advantages and disadvantages of quantitative and qualitative methodological approaches is beyond the scope of this article. The interested reader is referred to Van Kleef *et al.* (2005). While the qualitative phase provides insights into important determinants of consumer perceptions regarding risk management quality, the subsequent survey has provided the means to assess cause and effect relationships between the different determinants, as well as provide the basis for an extension of the analysis to nationally representative samples.

Despite these limitations, the empirical research into consumers' evaluations of food risk management quality shows how important it is for policy makers dealing with food safety to incorporate consumers' points of view into risk management practices.

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APPENDIX A

Measurement Scales

Proactive consumer protection (PCP)

1. There is an established system for controlling food risks.
2. The authorities will respond quickly if a food safety problem appears.

3. The authorities put a lot of effort into preventing food risks.
4. Food safety laws are stringently enforced by the authorities.

Opaque and reactive risk management (ORR)

1. There is no proper management of food hazards by the responsible authorities.
2. The authorities do nothing to protect consumers from food risks until a food safety crisis occurs.
3. The BSE crisis has shown that the food risk management system is inadequate.
4. The authorities do not listen to consumer concerns about food safety.
5. The food safety controls that do exist are frequently ignored by food producers.
6. The authorities are hiding information about food hazards from consumers.

Skepticism in risk assessment and communication practices (SCEP)

1. The more research that is conducted, the more food safety problems are uncovered.
2. Scientists should be open with consumers if they are uncertain about a food hazard.
3. The authorities need to learn more about food safety in order to manage food hazards.
4. The authorities should tell us what they do not know when they give advice about food safety.

Honesty of food risk managers (TRUSTH)

1. Food risk managers are biased when making decisions about food risk management.
2. Food risk managers distort information about food risk management.
3. Food risk managers do not provide factual information about food risk management.
4. Food risk managers do not have good track record in protecting the public.
5. Food risk managers have been proven wrong in the past in their handling of food safety matters.
6. Food risk managers are not concerned about public welfare.
7. Food risk managers protect themselves and their own interests rather than consumers.
8. Food risk managers provide sensationalized information about food hazards.
9. Food risk managers are not trustworthy.

10. Food risk managers have a vested interest in promoting a particular view about food hazards.
11. Food risk managers are withholding information about food safety from the public.

Expertise of food risk managers (TRUSTE)

1. Food risk managers are accountable to others (e.g., regulatory bodies) if mistakes are made.
2. Food risk managers are experts in food risk management.
3. Food risk managers have the freedom to provide information to the public about food hazards.
4. Food risk managers are knowledgeable about food safety.
5. Food risk managers are responsible when it comes to managing food risks.

Food risk management quality (FRMQ)

1. Food risks are very well managed in our country.
2. When I buy food, I am certain that it is safe to eat.
3. I trust the regulatory system to protect me from food risks.

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