How Safe is Eating Chicken?
A Study on the Impact of Trust
and Food Risk Communication
on Consumer Behaviour
in the European Union

Edited by

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and

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BSE	Bovine spongiform encephalitis
CA	Cluster analysis
COI	Cost of ignorance
EC	European Commission
EFSA	European Food Safety Authority
EPA	Environment Protection Agency
EU	European Union
FDA	Food and Drug Administration
FG	Focus group
GM	Genetically modified
GMOs	Genetically modified organisms
PCA	Principal components analysis
SARS	Severe acute respiratory syndrome
TPB	Theory of planned behaviour
TRA	Theory of reasoned action
WP	Work package

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1. Why a project on food risk communication and consumers' trust in the food chain?

Donato Romano

1.1. Why a project on food risk communication and consumers' trust

On October 25th 2005, in a context characterised by the increasing concern about the impacts of the incoming bird flu on European citizens' health and by the spasmodic quest for H5N1 virus within the EU, a top officer of the European Food Safety Authority (EFSA), that is the institution responsible for food risk assessment and communication in the EU, released the following statement:

> "We don't have any evidence that the virus can be transmitted through food. But we can't exclude it either".

> (Herman Koeter, EFSA Scientific Director, quoted from the *Financial Times*, 25th October 2005)

This statement caused immediate commotion and concerns throughout the EU, especially with reference to the possible transmission of avian flu through the consumption of raw eggs. A briefing was promptly called by the European Commission (EC), that is the institution responsible for risk management in the EU, to react to the above EFSA statement. The main message was the following:

> "Veterinary controls on the farm and at the slaughter, and the flow of information from stable to table, protect European consumers against any potential risk (…) These measures ensure that poultry products on sale in the European Union do not pose a risk for consumers (…) We wouldn't advise everybody to eat raw eggs. We don't think there is a risk of avian flu from the consumption of eggs whether raw or cooked".

> (Philip Tod, spokesman of the EU Commissioner to Health and Consumer Protection, quoted from Reuters, 26th October 2005, 2:24 p.m.)

On October 26th, EFSA played down comments by its Scientific Director, sending out an official press release that updated its recommendations on avian flu and food safety:

"The European Food Safety Authority advises that there is no evidence to suggest to date that avian influenza can be transmitted to humans through the consumption of food, notably poultry and eggs. The European Food Safety Authority further confirms that there should be no change to longstanding food safety advice that poultry products be properly cooked in order to protect consumers from possible risks of food poisoning".

(EFSA press release, 26th October 2005)

The impact on egg consumption of these rather contrasting statements was immediate and raw egg consumption fell dramatically. For example, despite later reassuring statements by both the EFSA and the EU Commission, one week later the average drop of raw egg consumption was around -10% at EU level, which translated into a non trivial drop of egg prices that ranged between -5% in Belgium and -10% in the Netherlands.

This is a paradigmatic example of how food risk communication can have dramatic impacts if not properly managed. But this example tells also something more. It is the story of something intangible, difficult to build, but very easily to loose, which can have long-lasting effects on consumer behaviour and is at the root of any effective food risk communication strategy: consumers' trust. Consumers' trust is in fact a key factor in dealing with rising concerns about food safety and food quality and it strongly affects public responses to food-related hazard management. More specifically, it is clear that, as good risk communication may be, without consumers' trust it will fail. Trust thus emerges as a key factor for any risk communication programme.

Quite surprisingly, despite a number of studies have dealt with consumer attitudes and choices towards food safety issues, virtually none of them has tried to model the process of consumer response to food risk communication and trustful market relationship building. This is why the EC decided to list, under the Key Action 1 on "Food, Nutrition and Health" of the Fifth Framework Programme for Research and Technological Development, a priority – namely, priority 1.3.1 on "Consumer needs, attitudes and responses with regard to food products, food processing and labelling" – which aims at developing strategies to better interpret consumer demands, attitudes and perceptions and communicating issues surrounding food risk to consumers more effectively.

The contributions collected in this volume report the main findings of a project financed under this programme – the so-called TRUST project[1] – aimed at analysing and assessing trust along the food chain, its relationship with food risk communication, and the impact of alternative institutional arrangements on it. More specifically, the TRUST project investigates the antecedents of trust in information sources and risk management along the food chain and the mechanisms that determine the social diffusion of trust, examining the interplay of the various psychological, sociological, demographic and economic factors at individual, market, and social level. It focuses on the evaluation strategies brought about by consumers in assessing the reliability

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[1] The project "TRUST – Food Risk Communication and Consumers' Trust in the Food Supply Chain", was financed by the EC under the last call for proposals of the Fifth Framework Programme 1998-2002, in January 2002. The project activities started on December 1st 2002 and ended on November 30th 2005.

of the message, the way consumers process risk information with regards to different food hazards, and the cultural gaps between professional risk managers and laypeople. Eventually, it assesses the welfare impact of alternative food risk communication policies on consumers and producers and on the society as a whole.

1.2. THE STATE OF THE ART OF RESEARCH ON TRUST AND FOOD RISK COMMUNICATION

Public concerns about the risk from food hazards have increased in recent years, influenced by a number of well publicised food scares such as the mad cow disease (bovine spongiform encephalitis, BSE) or Salmonella in eggs, and dioxin and bird flu in chicken (Miles and Frewer, 2001). Similarly, people have become suspicious about the impact of new biotechnologies, such as genetically modification of organisms, perceived by many as an alteration of natural world order (Marris and Wynne, 1997; Frewer, 1999). A second relevant trend is the growing contentious character of risk assessment and risk management. Contrasting views, controversy and overt conflict have become an usual feature of the interaction among experts and between experts and the public.

This has been partly caused by the different perspective from which experts and laypeople form their judgements (Wynne, 1995). Experts' assessment is based on the probability of occurrence and the outcome of an event (Slovic, 1987 and 2000), whilst public risk perceptions are rather shaped by factors such as the severity of the outcome, the awareness about the hazard, the involuntary nature of risk and the size of exposed population (Sparks and Shepherd, 1994; Fife-Show and Rowe, 1996; Marris *et al.*, 1997; Grobe *et al.*, 1999). In order to bring experts and laypeople into alignment and resolve the conflicts, huge efforts have been devoted to develop efficient risk communication strategies. However, there is little evidence of their success in reducing the gap between experts' technical assessment and public perceptions of risks (Nature, 1999). Conversely, political activism to reduce risk and the role of mass media in distributing risk information have led to further distrust in risk managers (Slovic, 1993).

One of the main causes of this communication failure can be attributed to the lack of trust (Wynne, 1980; Slovic, 1993; Fischhoff, 1995; Fischhoff and Downs, 1997). Trust in risk information sources and risk managers is indispensable for a satisfactory risk communication process. One of the main question addressed by the risk communication literature is why some sources of information are trusted and others are not.

Both psychological and social phenomena have been recognised to be at the core of trust. Social psychology stresses the importance of source and food hazard characteristics as determinants of the trustworthiness of risk information sources (Frewer *et al.*, 1996). On the one hand, competence of the source, fiduciary responsibility and sharing of public values are among the potential reasons for trust while absence of accountability and expertise do not seem to be influential; (Douglas and Wildavski, 1982; Johnson, 1999; Kee and Knox, 1970). On the other hand, distrust seems to be related to perception of deliberate information biases and past history of releasing erroneous information (Frewer *et al.*, 1996).

However, factors other than source credibility affect consumers' attitude and trust in released information. Initial beliefs (priors) strongly influence the persuasive effects of source credibility (Sternthal *et al.*, 1978; Frewer *et al.*, 1998). Complex interactions of source credibility, hazard type and persuasiveness in determining trust in food risk information have been reported as well (Frewer *et al.*, 1997).

Trust is likely to depend not only on structural factors but also on dispositional factors such as personality, social, demographic and cultural characteristics (Johnson, 1999). While extensive research has been carried out on how socio-demographic attributes influence risk perceptions and priorities for risk reduction for several hazards (Frewer, 1999; Grobe *et al.*, 1999; Kraus and Slovic, 1988; Langford *et al.*, 1999), less effort has been devoted to study consumer segmentation with respect to factors affecting trust in different information sources and distinct food hazards.

The sociological perspective stresses how group characteristics, ideology and organisational rules that influence lifestyles and values are relevant to risk perception and trust in food risk communication and management (Krimsky, 1992). According to this approach risk is a social construct. Different cultures select different risks (Douglas and Wildavski, 1982) because the associated practices of risk avoidance provide group stability and reinforce its identity. In this context, trustful relationship may be hampered by difference in the beliefs system of different social group (Wynne, 1992). In addition food has a symbolic value of identification and this role needs to be taken into account when dealing with food risk issues (Fonte, 2000). Conversely, few studies have been conducted so far on the economic impacts of widespread diffusion of distrust among food consumers. The scanty research on this topic focuses mainly on consumer learning processes in face of recurrent food scares (Böcker and Hanf, 2000).

A further perspective on trust is brought about by behavioural economics that – using tools developed by computational economists – has investigated the properties of aggregate models of consumer behaviour (artificial adaptive systems) which deal with information processing, learning, and socially evolving preferences (Arthur, 1991; Aversi *et al.*, 1997). Mental models (or satisfying inferential machines) as well as simpler heuristics, such as the Bayesian one, can be reproduced by algorithms upon which artificial economic agents can be built. This approach was recently used to investigate the social diffusion of trust in financial markets (Orléan, 1998; Tordjman, 1998). No study has been published up-to-date using such an approach to study food consumers' information processing and learning as well as the evolution of their preferences.

Such a complex intertwining of social, economic and psychological aspects make risk communication a sensitive task. Research agenda and findings need to be shared and discussed among stakeholders. There is a large consensus that western societies institutions (political but also scientific) are experiencing a "credibility crisis", which separates them more and more from civil society (Funtowicz and Ravetz, 1992 and 1993; Nature, 1999; Yearley, 2000; Irwin, 2001). It can be argued that, in order to start filling the gap, a revision is necessary of the ways in which risks are assessed and managed. Such revision cannot but include a discourse on "deliberative democracy" (Elster, 1998) for the promotion of a dialogue (and possibly a collaboration) between a number of actors, each with their own stakes, attitudes, beliefs, values, rights, etc. (De Marchi and Ravetz,

2001). All such actors must be heard if one wants to gain an appropriate understanding of the complexity of risk issues, in terms of assessment, perception, regulation, etc. (Levidow and Carr, 1997; De Marchi and Ravetz, 1999; De Marchi, 2001), without leaving aside potential key aspects connected (e.g. cultural significance, ethical beliefs, etc.).

1.3. INNOVATIVE FEATURES AND EXPECTED ACHIEVEMENTS OF THE TRUST PROJECT

The main conclusion that can be drawn from the above assessment of the literature on trust and food risk communication is that a thorough understanding of social diffusion of trust with regards to different information sources requires an in-depth, multidisciplinary research approach, based on comparisons among social groups as well as different types of hazards. Combining psychology, sociology, marketing, consumer science, and economics is therefore a prerequisite for investigating the dynamics of trust building and disruption in information sources and risk management in the food chain. The TRUST project explicitly acknowledges and accepts this claim.

Therefore, the TRUST project involves different expertises. This is mirrored in the composition of the research consortium, where each partner was chosen for its own skills and strengths to contribute to the project and to develop the complementarity it requires (Table 1.1).

Table 1.1. The partners of the TRUST project

Partner	Country	Institution	Expertise
1	I	Dipartimento di Economia Agraria e delle Risorse Territoriali, Università di Firenze	Welfare economics Consumption economics
2	I	Dipartimento di Scienze Cognitive e dell'Educazione, Università di Trento	Experimental psychology
3	NL	Departement Maatschappijwetenschappen, Wageningen Universiteit en Researchcentrum	Rural sociology Consumer sociology
4	UK	Department of Agricultural and Food Economics, The University of Reading	Food marketing Food economics
5	D	Institut für Agrarökonomie, Christian Albrechts University zu Kiel	Computational economics Artificial intelligence
6	I	Istituto di Sociologia Internazionale di Gorizia	Sociology of risk Risk analysis
7	F	Centre de Recherche pour l'étude des conditions de vie – Département Consommation et Marketing, Paris	Consumer science Marketing analysis
8	N	Statents Institutt for Forbruksforskning, Lysaker	Consumer science Food science

The achievements of the TRUST project have been twofold, methodological as well as empirical. From the methodological point of view, the multidisciplinary ap-

proach that brings together a wide range of expertises – psychology, sociology, marketing, consumer science, and economics – is an advance in itself when compared to the traditional sectoral approach adopted by most studies carried out so-far. For instance, the sociological perspective complements the cognitive approach adopted by psychologists and provides new insights in the way trust in food risk information develops.

Another innovative feature of the TRUST project is its contribution to a better understanding of the aggregate outcome of the interaction of complex trust evaluation strategies and political and administrative actions. In doing so the project built an artificial intelligence multi-agent systems that takes into account the trust evaluation strategies adopted by individuals belonging to different groups when facing information about specific food hazards originating from different sources. This system is able to assess the aggregate outcomes compatible with the behavioural assumption derived from psychological, marketing and sociological analyses. It also provides a framework where the market consequences of trust and distrust in food risk information can be assessed leading to costs and benefits evaluations that provide explicit guidance for decision-making criteria by risk managers.

From the empirical point of view the project findings are extremely important in developing new concepts for more effective communication strategies to the consumers and for reinforcing consumer confidence in the safety of the food supply. The understanding and assessment of consumers' trust building and risk perception processes can eventually lead to the creation of more transparent consensus platforms. Moreover, it can also contribute to the development of new predictive models of consumer choice which facilitate innovation of products in the food chain.

1.4. The structure of the TRUST project

The TRUST project is a three-stage research aiming at analysing and assessing trust relationships in the food chain (Figure 1.1). The first stage of the project was devoted to link the economic aspects with those arising from the psychological and sociological literature (work package 1, WP1). Therefore, preliminary laboratory experiments (WP2) and focus groups (WP3, phase I) have been designed to assess the multifaceted nature of trust formation in food market relationships. Source characteristics are believed to be one of the main factors affecting trust in information. However, when information is about risk, the characterisation of risk itself plays an important role. Thus, trust about food related risk is investigated with reference to source types and hazard domains. In order to set up a model of trust diffusion and subsequent changes in consumer behaviour, psychological, sociological, and marketing researches provide information that allow economists to define and estimate operational behavioural models. However, trust depends not only on structural factors but also on dispositional factors, such as personality and attitudes, as well on the socio-cultural environment. Hence the necessity to study this type of determinants.

The second stage of the TRUST project investigated the interplay of social, demographic and economic factors in determining trust in different risk information sources or risk managers. Several methodologies have been used to pursue this objective.
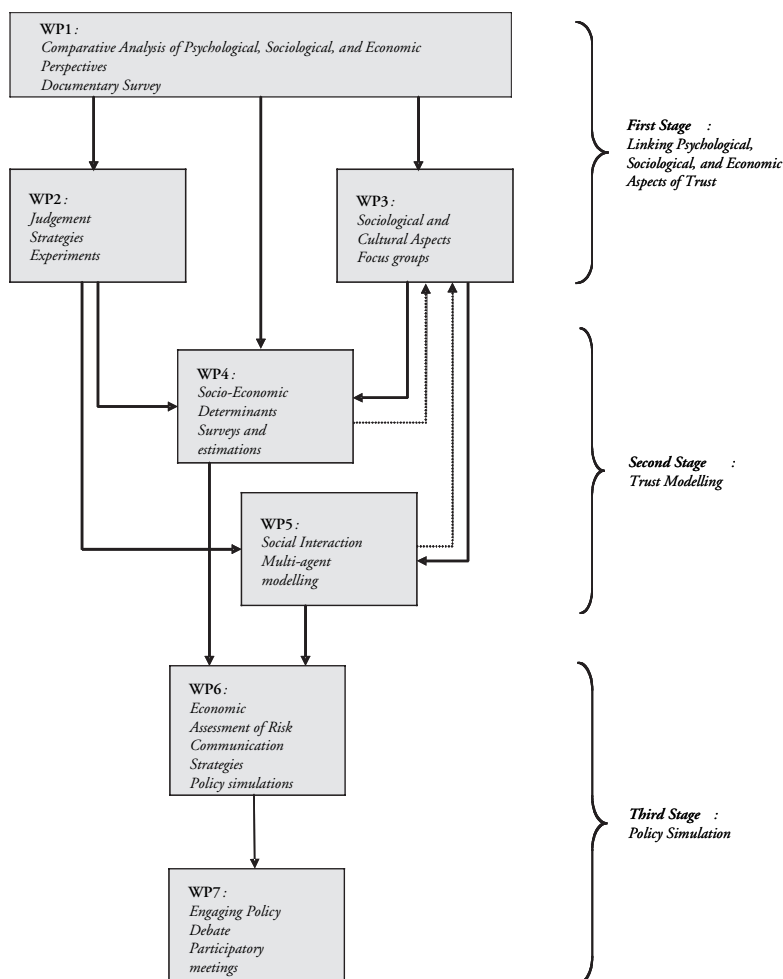
Figure 1.1. The structure of the TRUST project

First, a segmentation analysis (WP4) was performed to try to identify socio-demo-graphic and personality segments that determine differences among consumers' attitudes towards specific food risks and to assess the trust they place upon various information sources. Then, an analysis of the socio-economic determinants of trust in different food markets for different categories of retailers and information sources was carried out through causal model estimation. In particular, a modified model of the so-called "theory of planned behaviour" was estimated to take explicitly into account the role of trust in consumer's buying decisions. Both market segmentation and causal models have been based on a large survey that covered five European countries – UK, France, Germany, the Netherlands, and Italy, which represent a balanced mix of diversities and similarities.

While those research activities focus on interrelated but complementary aspects of investigating the determinants of trust in information sources and food risk managers, another analysis (WP5) modelled the processes that underlie the diffusion of social con-

sensus and trust across society. This was achieved building an artificial intelligence multi-agent system and using it for simulating the social interaction among agents and analysing the aggregate outcomes as a consequence of the adoption of different heuristics or trust evaluation strategies. The objective was the development of a model that reproduces some relevant features of the observable aggregated behaviour in real markets. This required the calibration of model parameters with the observed regularities collected in the previous research activities as well as in a second round of focus groups (WP3, phase II).

The third stage of the TRUST project was devoted to policy simulations and to the dissemination of the project results. Policy analysis exercises (WP6) have been carried out through the simulation of the impacts of different risk information policy options, using the multi-agent model to reproduce the observable aggregated behaviour of real society and market conditions as well as a more traditional tool, that is the assessment of welfare changes due to a variation in the trust level under alternative scenarios. Finally, in this stage the involvement of stakeholders (WP7) through the organisation of policy focused discussion groups and policy briefs ensured a continuous feedback on and the dissemination of research findings.

1.5. The issues addressed by the TRUST project

The general objective of the TRUST project is to contribute to a more in depth understanding of the nature, determinants and processes of social diffusion of trust in food risk information and food risk managers. In pursuing this objective, the TRUST project addressed a number of specific questions (Figure 1.2). The structure of this book is organised around these questions, namely:

WHICH EFFECTS?
Assessing the cost of information biases in a food scare
• How much does it cost a longer than necessary food scare
• In which food scare it pays to intervene and in which it doesn't

WHEN?
Evolution of a food scare
• What happens when the same information is released through different media
• Differences between loose and compact network contexts

The TRUST project
A better understanding of the role of trust and food risk communication during food scares

WHY?
Sociological and psychological determinants
• What happens to people during a food scare
• Why they change their behaviour and attitudes

HOW?
From lack of trust and risk perception to buying behaviour
• How different population segments act
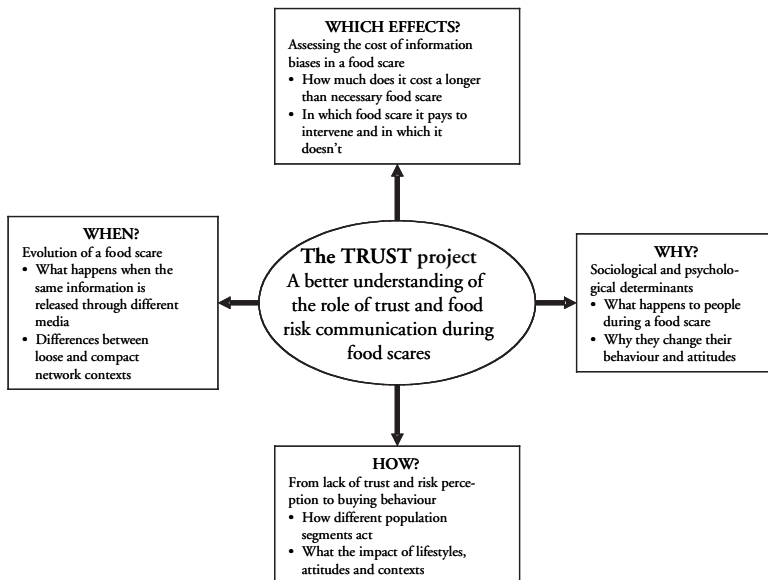• What the impact of lifestyles, attitudes and contexts

Figure 1.2. The issues addressed by the TRUST project

a) Why do food scares determine a change in people's behaviour?
The project has investigated the determinants of trust at the psychological level as well as the evaluation strategies and cognitive models individuals adopt in contexts where they are exposed to food risk information (Chapter 2). Moreover, the role of social interaction and culture has been examined in relation to the process of trust building in food risk management (Chapter 3). Addressing these issues made possible to get some insights on how policy-makers and food agencies should dialogue with people about food safety issues before and during a food scare.

b) How do these changes happen across the population?
The project has investigated how trust in alternative information sources and in risk managers varies across segments of consumers identified by levels of trust, social, demographic, and psychographic characteristics across different EU countries (Chapter 4). The analysis of the relationships between trust, socio-demographic variables and purchasing behaviour has also been carried out (Chapter 5), proposing a new model of consumer purchasing behaviour that explicitly takes into account the influence of trust in standard and food-scare contexts. This part of the TRUST research provides some insights on what policy-makers need to know to understand how a food scare affects consumption behaviour.

c) When do these changes happen?
The project has investigated the evolution of a food scare, by means of a multi-agent simulation model, with emphasis on the social diffusion of trust (Chapter 6). Here, the expected output is twofold: some insights on what are the key elements a policy-maker should monitor to understand the dynamics of information spread and a tool to simulate the evolution of risk perceptions through different networks.

d) What are the effects determined by these changes?
The project has reviewed current public information campaigns across Europe and assessed the economic impacts of alternative risk communication strategies evaluating their costs and benefits (Chapter 7). The comparison of the social costs of a food scare vis-à-vis the cost of an information campaign will help in designing effective food risk communication campaigns, providing also some good practices for information campaigns on food safety issues.

Policy recommendations and the main findings from the TRUST project are summarised in the concluding Chapter (Chapter 8).

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2. Food choice in the context of a food hazard: Insights from psychological experiments

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Abstract

This Chapter describes two studies on consumer decision-making in the context of a food hazard. The first part discusses the role of commitment in inducing consumers to buy a possibly contaminated food product. The second part examines the relative weights of various factors that may affect a consumer's decision to accept a food product in the context of a food hazard. The findings reported show that consumer decision-making is influenced by both emotional aspects and the perception of shared values rather than by socio-economic variables. The consumer's commitment also affects his/her likelihood of accepting a possibly contaminated food product. However, the commitment effect depends on the type of product and on the cultural context.

Keywords: *trust, attitude, commitment, value, decision-making*

2.1. Introduction

The EU has experienced several food crises in recent years, such as the so-called "mad cow disease", the dioxin contamination of chicken and salmon, and more recently the chicken flu. A typical pattern emerges from the analysis of such crises. Public authorities and scientists seek to persuade consumers that the threat is marginal, or that there is no scientific evidence to justify a change in consumer food behaviour. Nevertheless, many consumers change their usual consumption patterns, e.g. not buying possibly contaminated food products.

The change in consumption patterns causes social problems and economic losses. Moreover, distrust is generated by the food crisis. Distrust is a cost not only in economic terms but in social and political ones as well. As suggested by Kramer and Tyler (1996), a failure of public trust may decrease the citizens' willingness to cooperate with institutions.

The analysis of food crises shows, however, that there are marked cultural differences that frame how consumers react to a food threat. For example, the chicken flu crisis affected more severely chicken consumption in Italy than in other European countries (*Corriere della Sera*, 27 October 2005, p.6). Another example is the

"mad cow disease" (bovine spongiform encephalitis, BSE). In Italy and Germany, beef consumption declined by as much as 30% to 50% in 1990 and 1998 (Verbeke and Viaene, 1999). Other studies showed that BSE produced a stronger reaction among German consumers than among American and Dutch ones (self-reported measures in Pennings *et al.*, 2002). Moreover, German consumers reported that they were more risk averse ("For me eating beef is not worth the risk") than their American or Dutch counterparts. While BSE has never been a problem in the USA, which can explain more soft tones among American respondents, Dutch consumers were indeed exposed to it. Nevertheless, significant differences were reported in their reactions to BSE in comparison with German consumers. One explanation for these different reactions may be that American and Dutch consumers trust more the information they receive from their own governments[1].

Although cultural differences play a role in the way consumers react to a food threat, the dissemination of information on the risk of contaminated food is generally associated with a sharp fall in its market demand. This social phenomenon may be affected by many factors, such as the opportunity cost the consumer should incur in changing his/her consumption behaviour or the availability of food substitutes.

This Chapter focuses on consumer decision-making in the context of a food hazard. Specifically, it investigates how psychological variables may affect the decision to buy a possibly contaminated food product. The next Section reports the outcomes of an experiment which assess the role of commitment on consumer's decision making in a risky context. The subsequent section reports the results of statistical analysis of determinants such as commitment, trust, attitude and socio-demographic variables on consumption decision under risk. The final section summarizes the main findings discussing the implications for the design of policies aiming at off-setting the adverse effects of a food crisis.

2.2. HEURISTICS IN CONSUMER DECISION MAKING

The scientific literature on individual decision-making reports that consumers often use heuristics to evaluate economic transactions and to make their choices. A heuristic can be defined as a rule of thumb or a cognitive process which people use to make a choice or a judgment. The main function of heuristics is to simplify decision-making[2]. For example, people may use the price of a product as an indicator to judge the product quality: the higher the price, the better the expected quality. Another example is provided by studies on the subjective value of money, which found that people are strongly affected by nominal prices and by their dif-

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[1] For example, 83% of the US population trust the Food and Drug Administration (Wansink and Kim, 2001).

[2] On the use of heuristics in economic and food decisions see Bazerman (1998), Bonini (2005), Green *et al.* (2003), Rumiati and Bonini (2001), and Russo and Schoemaker (2002).

ferences. The tendency of consumers to rely on displayed prices induces them to underestimate inflation, determining "money illusion" (Shafir *et al.*, 1997)[3].

Consumers use heuristics not only to assess the expected quality of a good or its costliness, but also to decide whether and how to act under risk. Let us turn to social consensus heuristic and to personal commitment, which play an important role in decision-making in the context of a food threat.

2.2.1. The heuristic based on social consensus and the effect of previous commitment

The social consensus heuristic is based on information concerning the behaviour of other people. If a large number of people act in certain way in a given context, this is a good reason for acting likewise. Information about the behaviour of other people also affects how the observer interprets what she/he sees. If many people display similar behaviour in a given circumstance, the observer tends to attribute that behaviour more to the context features than to the individual characteristics of those showing that behaviour (see Cavazza, 1996; Cialdini, 1993).

The use of testimonials is an example of how the social consensus heuristic is exploited. By means of this technique people are persuaded to perform an action by being shown that other people are performing it. The analysis of food or environmental crises shows that stakeholders spontaneously exploit this heuristic. For example, during the chicken flu crisis three ministers of the Italian government had themselves photographed eating chicken offered by an Italian farmer association (*Corriere della Sera*, 23 October 2005, p.19). In France, during the mad cow crisis, President Jacques Chirac agreed to be photographed while eating his favourite dish of calf's head stew. However, the most extreme case of the use of testimonials occurred in California in the 1980s, when the Republican B.T. Collins drank a glass of diluted malathion in public in order to demonstrate that it was innocuous, and that it could be safely used as a spray to counter the "med fly" epidemic then threatening the state's agriculture.

Stakeholders spontaneously use another commitment-based strategy to cope with a food crisis. During the mad cow crisis, for example, several national associations of breeders in Europe organised large-scale street barbecues and offered free steaks to people. This situation is alike to generate the consumer's commitment to an action (e.g. buying beef steaks), as discussed by Cialdini (1993) in his extensive survey of persuasion techniques. Another example of the use of personal commitment is provided by the consumer strike called on 14 September 2005 by the principal Italian consumer associations to protest against inflation. Consumers were invited not to go shopping for the entire day and not to use electricity for only five minutes. This

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[3] Moreover, consumers evaluate a good as more expensive when its price is displayed in a currency with a high (e.g. Italian lira) rather than low (e.g. euro) nominal value. This phenomenon is known as the "euro-illusion' (Burgoyne *et al.*, 1999; Gamble *et al.*, 2002; see also Del Missier *et al.*, 2005 on market price estimate of goods across different currencies and European countries).

was a minor request but it had high symbolic value. Its acceptance would generate commitment in consumers that would induce them to accept similar but more demanding requests in the future.

A distinction should be drawn between the effects of personal commitment and social consensus. In the former case, the consumer freely adopts a behaviour with low cost (both economic and cognitive) and strong symbolic value which will affect his/her similar future decisions. For example, a consumer who agrees to eat a free barbecued steak should be more likely to buy the same food product even in the context of a food hazard. In the latter case, the consumer does not personally perform an action but observes other people as they do so. This observation should make him/her more likely to perform the same action in a similar context.

In social psychology, commitment is described as "a pledging or binding of the individual to behavioural acts" (Kiesler and Sakumura, 1966). For example, a specific behaviour is said to commit to the purchasing of a certain product if it is the execution per se of that specific behaviour that increases the person's likelihood of purchasing the product as opposed to a value-maximising purchasing strategy.

Studies on commitment have focused on the variables by which this effect can be manipulated. In particular, the degree of commitment has been proved (Kiesler and Sakumura, 1966; Joule and Azdia, 2003) to depend on the acts performed by the subject (their number, importance, explicitness and irrevocability), and on other aspects concerning the condition of the subject when performing these acts (as his volition or accountability).

Kiesler and Sakumura (1966) describe commitment as a consequence of a real change in a subject's attitudes. This interpretation derives from Festinger's (1957) "cognitive dissonance" theory. It maintains that when people feel an opposition between cognitions (for example, when they agree to lie without being given sufficient justification for doing so), they are inclined to change their previous belief system in order to resolve the discomfort associated with experiencing an inconsistency with the behavioural acts that they are induced to perform (to continue the previous example, they will convince themselves that the lie they are asked to tell is the truth). In this perspective, the commitment may generate a real change in attitude: if individuals can be made to act in ways that are inconsistent with their attitudes, they will change their attitudes to make them consistent accord with their actions.

Commitment has been studied from another point of view by considering the factors that influence a person's willingness to comply with a request by another person. Freedman and Fraser (1966) apply commitment to a persuasion technique named the foot-in-the-door strategy. First a minor request is made (e.g. displaying a small sign on one's car), knowing that most people will agree to perform a trivial task ("the foot is placed in the door"). Then a larger request, the real goal of the persuasion technique, (e.g. installing a big sign in one's front garden) is made. Those who accepted the first, minor request feel commitment to their previous action and often agree to the larger request as well, and the door opens completely.

The anecdotal evidence on how stakeholders spontaneously react to a food crisis suggests that a consumer's previous commitment may affect his/her decision to buy

a possibly contaminated food product. However, to the best of our knowledge, experimental analysis of the efficacy of commitment in those circumstances has not yet been conducted. This was the aim of the experimental study by Graffeo *et al.* (2005) discussed in the next Section.

2.2.2. The effect of commitment on consumer decision in the context of a food hazard

Graffeo *et al.* (2005) studied the effect of previous commitment on consumer decisions in the context of a food hazard. A total of 211 Italian consumers were interviewed in a shopping centre, and randomly distributed across four conditions[4]. Here we report and discuss the main findings relative to three conditions to which consumers were exposed to specific information on the possible contamination of a food product (chicken and salmon) by dioxin, namely

a) commitment to consume chicken,
b) commitment to consume salmon, and
c) absence of commitment to consume either chicken or salmon.

In the two conditions with the presence of commitment, consumers were asked to imagine that their usual butcher (fishmonger) had offered them a chicken (a salmon fillet) for free in order to celebrate the reopening of the store after refurbishment. They were also asked whether they would have eaten the food product offered. The decision to eat the food product offered can be described as the first step in the foot-in-the-door selling technique. On the commitment hypothesis, consumers previously committed to that action should be more likely to make a more demanding and similar future decision.

To test the commitment hypothesis, all consumers across the three conditions were exposed to specific information on the possible contamination of salmon and chicken by dioxin. To make the social scenario more realistic, the consumers were given an excerpt from an article published on the magazine of a well-known Italian consumer association. After exposure to the food threat information, the consumers were asked whether they would buy chicken (salmon) for an already-planned family dinner.

Below is an excerpt of the *Altroconsumo* article which shows the detailed and specific nature of information provided.

"DIOXIN: A REAL PROBLEM FOR HEALTH. A considerable threat to our health, disappointingly very seldom detected, is the risk posed by the consumption of food contaminated by dioxin. Dioxin is extremely toxic and it is used especially as an additive

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[4] A parallel study was run with British consumers. However, there were two main differences between the two studies: the Italian consumers were interviewed individually, and the sample was double in size.

in oils for motors and condensers. Getting rid of old machinery which has used dioxin is difficult and costly. For this reason, in the absence of effective controls by the authorities, careless people dump dioxin in the environment. Once it has been abandoned, dioxin is deposited in vegetables. These products are then used as fodder for a wide range of breeding animals. The main risk posed by dioxin is its tendency to accumulate in animal fat, so that lower initial concentrations in the fodder increase at every processing phase, and ultimately attain high risk levels in breeding animals. Researchers have demonstrated that dioxin has a large variety of effects on the human body. The organs most at risk are the liver, the reproductive and neurological apparatus, and the immunity system. The EPA (Environment Protection Agency) has classified dioxin as a probable cancerous substance".

(*Altroconsumo*, no. 152, September 2002)

To make the food threat personally relevant, consumers were also falsely informed that "officials in charge of the safety controls had recently discovered some cases of chicken (salmon) infected by dioxin in Triveneto", which was their area of residence (the participants were told that the information provided was false when they were debriefed).

After the consumers had decided whether to buy the chicken (salmon) for their planned family dinner, they were asked to assess the extent to which they trusted each of the main actors in the food chain: producers, suppliers and control authorities. They were also asked to assess their attitude towards the consumption of each of the two food products.

2.2.3. ANOVA analysis

The commitment manipulation proved to be successful, since nearly all the subjects declared that they would eat the salmon (90%) and the chicken (89%) when it was offered for free.

The effect of commitment on the purchase intention

The results show that the percentage of subjects willing to buy the salmon was higher among those with the commitment on the salmon (60%) than among those without such commitment (30%) (Chi-square (1) = 9.41, p < 0.01). However, no significant difference was found between the two conditions with the chicken[5].

The effect of commitment on trust

The participants were asked 15 questions on trust. There were five questions for each actor in the food supply chain and for each food product. The replies were pooled across the "actor" dimension, since a reliability analysis confirmed that they were closely correlated (Cronbach's alphas were = 0.84, = 0.86, = 0.93 for breeders, suppliers, and au-

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[5] Nor was the commitment effect found with the English sample of consumers.

thorities, respectively). A parallel analysis was performed on the participants' judgments of their trust in the actors in the chicken food supply chain. A mean judgment of trust in breeders, suppliers, and authorities was therefore computed on the five items.

Two 2 x 3 ANOVAs with "commitment" as the between factor at two levels (commitment vs. no commitment), and "type of actor" as the within factor at three levels (breeders, suppliers, authorities), were performed on the mean trust judgements for salmon and chicken, respectively. The ANOVA on the judgments on the salmon food supply chain showed a significant effect by the "type of actor", $F(2,208) = 32.90$; $p < 0.001$, and no effect by "commitment" as well as by the interaction between the two factors. The commitment manipulation therefore had no effect on judgments of trust in the actors in the food supply chain as regards salmon. However, trust in the food supply chain actors changed according to the type of actor: authority was the most trusted actor ($M = 2.91$) while suppliers were the least trusted ($M = 2.35$), with breeders lying in between ($M = 2.46$). The ANOVA on trust judgments concerning the chicken food supply chain yielded very similar results: the "type of actor" had a significant effect on trust, $F(2,216) = 44.08$; $p < .001$, but there was no effect by either "commitment" or the interaction between the two factors. As for the salmon food supply chain, the participants in the study placed most trust in authorities ($M = 2.94$), and the least in suppliers ($M = 2.33$) with breeders in between ($M = 2.45$); but these trust judgments were neither increased nor decreased by the commitment manipulation.

The effect of commitment on attitude

The attitude toward salmon and chicken consumption was measured by a set of eighteen bipolar scales. Two factorial analyses were performed on the scales (one for salmon and one for chicken) in order to extrapolate the dimensions of attitude. The extraction algorithm used the principal components method and the matrix was rotated using the Varimax method with Kaiser normalisation. The number of factors to be extracted was not predefined; therefore, the factors extracted were those with an eigenvalue above 1. Rotation converged in five iterations for salmon and in six for chicken.

The attitude scales loaded in three factors for both salmon and chicken. The factors were rather similar in the two analyses, but some scales loaded on different factors. These differences were not levelled prior to computing a mean scale value for each factor because they described our sample's distinctive perception of the factors of each single dimension underlying the attitude towards the two types of food. The three factors were as follows:

a) the "experiential factor" represents the belief that eating salmon (or chicken) is pleasant and good behaviour. This dimension therefore captured the affective component of attitude. This factor is described by scales like "unpleasant-pleasant", "bad-good", and "negative-positive",

b) the "instrumental factor" represents the belief that eating salmon (or chicken) is convenient, advantageous and opportune behaviour, and

c) the "moral factor" which captures the idea that eating salmon (or chicken) is ignoble, wrong and despicable behaviour.

Two 2 x 3 ANOVAs were performed with "commitment" as the between subjects factor at two levels (commitment vs. no commitment) and "attitude" as the within subjects factor at three levels (the three dimensions of attitude) on the attitude judgments, one for salmon and one for chicken.

The 2 x 3 ANOVA on the attitude toward salmon consumption showed no significant effect of "commitment", but a significant "commitment x attitude" interaction, $F_{(2,208)} = 4.47$; $p < 0.02$, and a significant effect of "attitude", $F_{(2,208)} = 50.48$; $p < 0.001$. Tests of within-subjects contrasts showed that all three levels of the factor "attitude" significantly differed for $p < 0.002$. Salmon was judged more positively on the experiential factor and least positively on the instrumental factor, with the moral factor in between. A one-way ANOVA on each of the three levels of the "attitude" factor was run to illustrate the differential impact of "commitment". Analyses showed that "commitment" significantly increased the favourability of attitude in the experiential dimension, $F_{(1,104)} = 5.70$; $p < 0.02$, but not in the moral and instrumental dimensions (Figure 2.1).

The 2 x 3 ANOVA on the attitude towards chicken consumption yielded a significant effect of "attitude", $F_{(2,216)} = 45.01$; $p < 0.001$, but no effect of "commitment" nor of the "commitment x attitude" interaction. Tests of within subjects contrasts showed that only the third level of the factor "attitude" was significantly different (for $p < 0.001$) from the other two levels: chicken consumption was judged more positively on the experiential dimension of attitude than it was on the moral and instrumental dimensions.
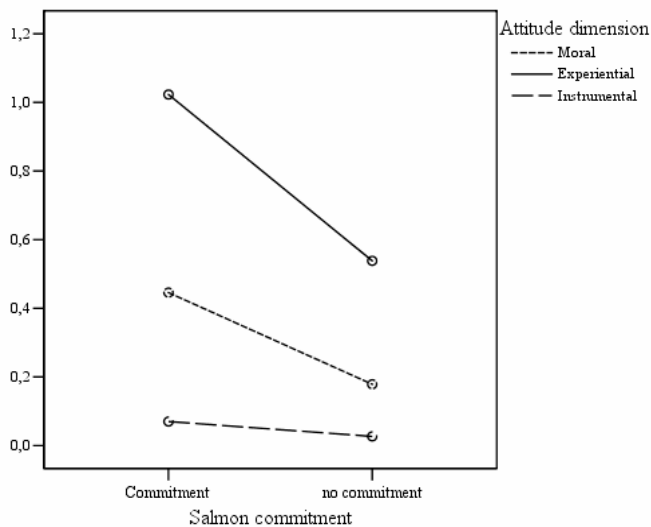

Figure 2.1. Mean attitude on salmon consumption between the two commitment conditions

2.3. The determinants of consumer decisions in the context of a food hazard

We now report a comparative analysis of the roles performed by several variables that may affect consumer decisions in the context of a food hazard. The following variables were studied: previous commitment, trust, attitude, and socio-demographic variables. The relative magnitude of the variables was assessed estimating both a logit regression and a structural equation model.

2.3.1. Logit regression analysis

Graffeo *et al.* (2005) also assessed the effect of previous commitment on the purchase intention in the context of a food hazard, while trust, attitude and socio-demographic variables were simultaneously considered. This analysis showed the impact of previous commitment on the purchase intention relative to the other variables.

Two logit regressions were performed, one on the intention to buy the salmon (Table 2.1) and one on the intention to buy the chicken (Table 2.2). The variables included in the logit regression equation were: status, education, age, gender, trust in the food chain, attitude towards the food product, and previous commitment to the food product[6]. The other variables were the "age" of the respondent, his "trust in the food chain" (retrieved through the TRUST cross-country survey, cf. Chapter 4), and his "attitude towards the food product" (again from the cross-country survey).

The results of the logit regression on the intention to buy the salmon show that "attitude" and "previous commitment" were the only statistically significant predictors. In the case of chicken the only statistically reliable predictors were "attitude" and "trust"[7].

Again, the effect of the previous commitment plays a crucial role only in the decision of buying salmon. More specifically, the odds ratio of buying salmon was three times more favourable in the condition with previous commitment to the same food product than it was without such commitment. Vice versa, the odds ratio of buying the chicken was nearly the same between the two conditions.

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[6] The categorical variables were coded as follows: "status" (single vs. married vs. separated/widowed), "education" (middle school vs. high school vs. university degree), "gender" (male vs. female) and "previous commitment" (without vs. on chicken vs. on salmon).

[7] The important role of "attitude" in predicting the intention to buy a potentially contaminated food product was also confirmed by parallel logit regressions conducted on the English sample of consumers.

Table 2.1. Probability to buy the salmon in the context of food hazard

Variable	B	Sig.	Exp(B)
Status		0.781	
Status (1)	0.479	0.750	10.614
Status (2)	-0.026	0.985	0.974
Education		0.795	
Education (1)	-0.726	0.501	0.484
Education (2)	-0.166	0.769	0.847
Age	-0.043	0.225	0.958
Gender (1)	0.347	0.561	10.415
Trust in salmon food chain	0.062	0.908	10.064
Attitude to salmon	0.723*	0.035	20.061
Commitment		0.184	
Commitment (1)	0.400	0.531	10.492
Commitment (2)	1.220*	0.069	3.389
Constant	0.027	0.991	10.027
Cox and Snell R-squared	0.26		

* Significant at the 0.05 level

Table 2.2. Probability to buy the chicken in the context of food hazard

Variable	B	Sig.	Exp(B)
Status		0.704	
Status (1)	1.229	0.439	3.419
Status (2)	0.713	0.608	2.040
Education		0.806	
Education (1)	-0.615	0.574	0.541
Education (2)	0.061	0.915	1.063
Age	-0.022	0.475	0.979
Gender (1)	-0.079	0.880	0.924
Commitment		0.987	
Commitment (1)	-0.105	0.870	0.900
Commitment (2)	-0.040	0.950	0.961
Trust in chicken food chain	1.278*	0.048	3.590
Attitude to chicken	0.630*	0.054	1.877
Constant	-3.792	0.176	0.023
Cox and Snell R-squared	0.216		

* Significant at the 0.05 level

The attitude variable affected the intention to buy salmon as well as chicken. More specifically, the greater the positive attitude towards the food product, the higher the likelihood that it would be bought.

2.3.2. Structural equation model analysis

Graffeo *et al.* (2004) tested a model of consumer's decision under a food threat based on trust in another person/party and the attitude towards the food product. In this case, socio-demographic variables were not included. Moreover, the factors "trust" and "attitude" were analytically studied by decomposing them into their main components. Finally, a more homogeneous sample of consumers was used, i.e. only participants who were exposed to the food threat and previously committed to the food product were included in the structural equation model. The aim of the study was not only to assess the effect of trust (attitude) as a general variable, but also to assess which antecedents of trust (attitude) affect the intention to buy a food product in the context of a food scare.

The variable "trust" was decomposed into four antecedents, while the variable "attitude" was decomposed into three antecedents. As suggested by Mayer *et al.* (1995), trust in another person or party may be based on (i) competence (ability), (ii) benevolence, and (iii) shared values (integrity). Competence is defined as the perception that the trustee is capable and expert in the specific domain concerned. Benevolence refers to the extent to which a trustee is believed to willing to benefit the principal, aside from any egocentric profit motive. Benevolence suggests that the trustee has some specific link to the principal. Finally, the notion of "shared values" refers to the principal's perception that the trustee adheres to a set of principles that the principal finds acceptable.

The fourth antecedent of trust used in the model was "the perceived truthfulness of information provided by another person or party". This antecedent was introduced because, in the context of a food scare, consumers may be very confident in the competence, benevolence and shared values of the actors, but they may also feel that these actors do not provide them with true information, perhaps for reasons of public order, or for some other purpose.

The variable "attitude" was decomposed into three antecedents: experiential, instrumental and moral. These were the main factors emerging by a factorial analysis on a set of eighteen bipolar semantic differential-type scales used in the cross-country survey (cf. Chapter 4).

The "experiential factor" represents the belief that eating salmon (or chicken) is a pleasant, good and positive behaviour. This antecedent therefore captured the affective component of the attitude. The "instrumental factor" represents the belief that eating salmon (or chicken) is convenient, advantageous and opportune. Finally, the "moral factor" captures the idea that eating salmon (or chicken) is ignoble, wrong and despicable.

The final model resulting from structural equation analysis on salmon[8] is shown in Figure 2.2, where the variables have the following meaning:

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[8] χ^2 (6, N = 103) = 13.14, $p < 0.05$; NNFI = 0.95, RMSEA = 0.11, CFI = 0.99. Standardised regression coefficients in bold are significant at $p < 0.05$. Note that non-significant paths of the base model have been removed. Subscript values in parentheses are standard errors for the regression coefficient.

- COMS: to what extent do you think that Italian salmon fishmongers/breeders/authorities in charge of food safety are competent in their work?;
- BENS: to what extent do you think that Italian salmon fishmongers/breeders/authorities in charge of food safety are concerned about your health?;
- SHAV: to what extent do you think that Italian salmon fishmongers/breeders/authorities in charge of food safety share your values?;
- ATTE: The experiential attitude;
- TRTH: to what extent do you trust Italian salmon fishmongers/breeders/authorities in charge of food safety to tell the truth about salmon meat?;
- TRUS: to what extent do you trust Italian salmon fishmongers/breeders/authorities in charge of food safety;
- INTES: Intention to eat salmon.

The structural equation model analysis for chicken[9] is shown in Figure 2.3, where the variables have the same meaning as before, except for the inclusion of the variable ATTI, which refers to the instrumental attitude.
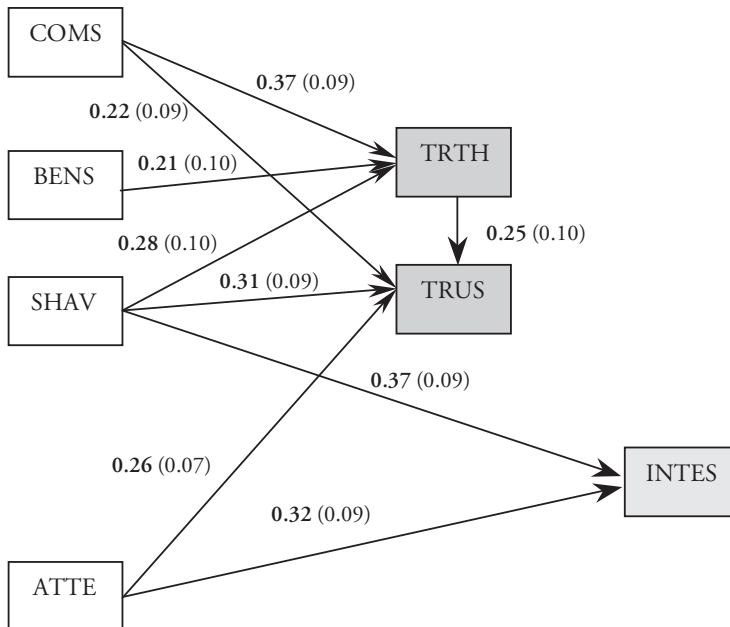

Figure 2.2. Final path model for salmon, with standardised regression weights

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[9] χ^2 (9, N = 103) = 10.81, p = 0.28; NNFI = 0.99, RMSEA = 0.045, CFI = 1.00. Standardised regression coefficients in bold are significant at p < 0.05.
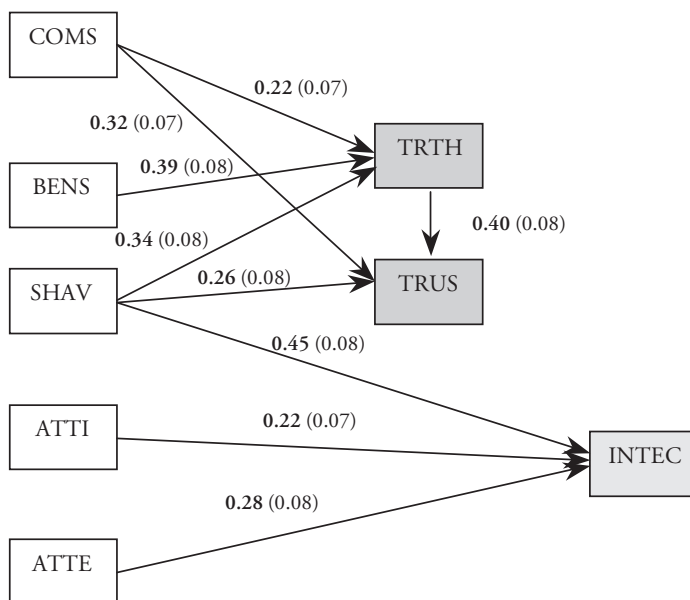
Figure 2.3. Final path model for chicken, with standardised regression weights

The intention to consume salmon in the context of a food scare was affected by the extent to which the consumer believed that the breeder, fishmonger or the authorities shared his/her own values (0.37). It was also affected by the extent to which the consumer liked the consumption of salmon, that is, believed it to be pleasant, good and positive behaviour (0.32). An interesting finding was that trust in the actor was predicted by competence and shared values, as well as by truthfulness of information, but it had apparently no effect in orienting consumer decisions, whereas one of the trust antecedents, i.e. shared values was the best predictor.

A very similar model was plotted for chicken (Figure 2.3). Here, the relationships among the variables were somewhat stronger than those observed for salmon. The intention to consume chicken was significantly affected by the extent to which the consumer believed that the main actors in the food chain shared his/her own values (0.45), and by the extent to which she/he had a positive experiential attitude towards the consumption of chicken (0.28). It was also affected by his/her belief that the consumption of chicken is convenient, advantageous and opportune (0.22). As in the previous model, no significant relationship was found between trust and the intention to consume chicken.

These results confirm the influence of the consumer's attitude on the decision to buy a potentially contaminated food product. Specifically, it shows the importance of the emotional component of the attitude: the greater the consumer's expectation that consumption of the product will be pleasurable, the higher the probability becomes that she/he will buy it.

The findings reported also show that only one antecedent of trust affects the intention of the consumer to buy a possibly contaminated food product. This is the perception of shared values: the greater the perception of shared values with the main actors in the food chain, the more likely purchase of the food product becomes.

2.4. DISCUSSION AND CONCLUSIONS

The results of the analyses summarized in this Chapter suggest that traditional persuasion techniques based on the manipulation of the source/content of the message are not enough to offset the adverse effect of the spread of information on a food threat (Flynn *et al.*, 2001). For example, the message conveyed by public authorities and scientists seeking to convince consumers that the threat is marginal, or that there is no scientific evidence to justify a change in consumer food choices, is not enough to persuade consumers to maintain their consumption patterns. The relative inefficacy of a persuasion technique based on manipulating the content of the message and its source (e.g. by using a testimonial) is consistent with previous results (see, among others, Lewin, 1947)[10].

A model of consumer decision-making in the context of a food threat emerges from the reported analyses. This model is characterised by counter-intuitive features, and it also highlights three psychological factors (attitude, trust and commitment) as being relevant to description and prediction of consumer decisions. Contrary to a naïve model of the decision-maker, our results show that socio-demographic variables are not good predictors of consumer decisions. This conclusion is also supported by the analyses based on the TRUST cross-country survey reported in Chapter 4: consumer decisions seem to be independent of the level of education, gender or social status.

Attitude is the best predictor of the decision to buy a possibly contaminated food product. It affected both the Italian and English consumers in their decisions whether to buy salmon or chicken products[11]. Our studies allow to enucleate which component of attitude performs the main role in mediating risky consumption decisions. The structural equation models show that the emotional component of attitude is the principal determinant of the decision to buy a possibly contaminated food product, while the instrumental and moral components seem to be less relevant.

Again contrary to a naïve model of the decision-maker, a further counter-intuitive finding emerged from the analysis of the trust factor is that the perception of the level of the "competence of the other person" does not affect a risky consumption decision. Hence the perception of the public authority as more or less competent in its

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[10] After the Second World War, the US Administration gave Lewin the task of designing a communication policy that would persuade housewives to use beef offal in their household diets. In his pioneering work, Lewin found that traditional persuasion techniques were outperformed by active discussion groups. He showed the importance of active participation and personal experience in the form of what was later labelled "self-generated persuasion".

[11] The role of attitude is also borne out by the findings of the European survey (see Chapters 4 and 5).

institutional activities appears not to affect the consumer's intention to buy a possibly contaminated food product. The same finding applies to the "perceived truthfulness of information provided by another person or party". However, the perception that the other person "shares your own values" is a strong and consistent predictor of the intention to buy. In general, the greater the perception of shared values with the main actors in the food chain, the more likely the food product purchase.

The consumer's commitment also has a role in mediating a risky consumption decision. In the case of salmon, there is a 30% increase in the intention to buy in the with-commitment conditions vis-à-vis the no-commitment conditions. This is a large percentage difference if one considers, for example, that the steepest decline in UK beef consumption per head during the mad cow crisis was 34% (a comparison of the 1996 vs. 1986 periods of consumption). Moreover, when trust, attitude and socio-demographic variables are assessed simultaneously, commitment is one of the strongest predictors. The odds ratio of buying salmon is twice as much favourable in the with-commitment situation then in the no-commitment condition. However, the effect of commitment is tied to the type of food product and the nationality of consumer.

In sum, consumption experience, commitment, and the perception of shared values are the factors that most strongly affect a consumer's decision to buy a possibly contaminated food product.

The importance of the emotional dimension of the consumption experience suggests that a policy aiming at strengthening the consumer's emotional attitude towards the food product is likely to be a good "antidot" against food crises. This could be achieved, for example, designing a policy that increases positive food tasting experiences, or to enhance the emotional context in which such tasting experiences takes place. This is exactly what the so-called "sensory marketing" aims at[12].

The perception of shared values is also a factor that strongly affects the decision to buy a possibly contaminated food product. Although we do not know which shared values are the most important (this was not the purpose of the reported studies), this finding per se suggests another line of attack to prevent or offset a drop in the demand for a food product under threat. The intervention policy should strengthen public communication or personal experiences by consumers which show that the main actors in the food chain and consumers share common values. At a purely speculative level, one may argue that shared values relate to a set of ethical rules. Values such as honesty and environment and animal welfare protection are general moral principles, and they certainly count for a great deal. However, relevant questions that should be addressed in designing such a policy are: when do consumers perform their evaluation of similarity between their values and those of a supplier? What else do they consider? What type of message is able to convey these values?

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[12] For example, the British shirt retailers Thomas Pink use the sense of smell as a marketing tool. They have installed sensors in some of their stores that emit the evocative smell of freshly laundered cotton (air-dried linen) when customers pass by. Floorgraphics Inc. are designing in-store supermarket adverts that feature smell, sound, and vision (Ellison and White, 2000).

Some insights can be drawn form the study on the effectiveness of different strategies of meat labelling since the BSE crisis carried out by Roosen *et al.* (2003). The BSE crisis caused a dramatic fall in EU beef demand, and in order to counteract this fall, beef producers and retailers attempted to signal the quality of their products. Origin labels were rated by consumers as the most important among the solutions proposed, even if differences among countries were significant. Origin labels presumably convey a message relative to geographic origin, physical production environment, but most of all to traditions of agricultural practices and food processing. It is likely that these traditions involve principles or values similar to those embraced by consumers.

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3. Trust from hope to action

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Abstract

The Chapter begins with a brief discussion of the main socio-cultural perspectives on food consumption, risk, trust and policy legitimacy. Subsequently it describes the design of the sociological research and its main findings. Two rounds of focus groups were carried out in five countries (France, Germany, Italy, the Netherlands, and the UK) in order to investigate the social and cultural dimensions of trust in relation to food issues, focusing particularly on safety and communication. The participants' views of food safety and the related trust investments turn out to be remarkably multi-faceted in all countries. The meaning of safety encompasses much more than the mere absence of risk, and is embedded in a broader notion of quality. Safety considerations thus influence consumption choices indirectly, rather than in a straightforward manner, through concerns for quality, defined by several criteria and pursued by a number of buying strategies. Opinions on the different actors involved in the food chain, including regulatory and control agencies, are diverse, complex, and sometimes contradictory. Trust in the different actors of the food chain is largely absent, whereas a need for it is largely shared. In the impossibility of grounding trust on solid foundations, some participants develop attitudes of resignation, hope, a kind of "solipsistic self-reliance" or total distrust. Food scares do not seem to be the main or only source of anxiety and distrust, being perceived as the tip of an iceberg, suggesting structural problems in the food market. These are often judged as inevitable and partially unmanageable, being entrenched in the overall functioning of society. Consumption habits tend to change temporarily, rather than permanently, as a consequence of food scares, with some notable exceptions, depending partly on personal sense of agency. Negative judgments prevail as to the handling of information during and after food crises. From the participants' comments, a number of indications are drawn for more effective risk communication and policy.

Keywords: *focus group, food consumption, food crises, food safety, agency, legitimacy, policy, responsibility, risk, risk communication, interpersonal trust, systems trust, uncertainty.*

3.1. Risk, trust and legitimacy

The understanding of the concept of risk differs widely across disciplines and among scholars. Among sociologists, a widely accepted definition of risk is that given by Luhmann (1991), who maintains that we can talk of a risk only when the occurrence of an event (positively or negatively evaluated) is linked to a decision. On the contrary, when the occurrence of a (negatively evaluated) event is independent from

any decision, he argues that we should talk of danger. While any and every culture and human community have developed the concept of danger, that of risk gains relevance only in connection with the modern mechanistic and manipulative (or instrumental) view of the relationship between humans and nature, as well as between humans themselves. The individual is seen as a free and rational subject and on that ground domination over nature is established and praised.

As humans increasingly attempt to control nature (and society), dangers are transformed into risks, and society becomes, in Ulrich Beck's words, a "risk society" (1986). In many respects we (in the Western world at least) live a less dangerous life than – say – a century ago, but at the same time we live a riskier life. When applied to food, this change means that, thanks to scientific-technical advancements, food production and consumption satisfy more and more human needs and desires. However, this does not imply that producing and eating food is less risky than before. On the contrary, such activities are riskier for the very reason that they entail more and more decisions. This perspective helps us understand why risks grow in connection with technological innovation. Innovation introduces new sources of risk because it opens up new spaces for decision. Before the era of gene manipulation, genes could be a source of danger, but not risk.

Another key point to take into account is the particular significance assumed by uncertainty. While uncertainty is by definition an existential condition of human life and a basic component of scientific research, the rise of uncertainty as a social and political issue is fairly new and depends on several factors. The first element to be considered is that the type of uncertainty embedded into many environmental and technological issues is not the same as the one typically faced by the rational decision maker. Rational choice theory usually deals with finding the most suitable means to achieve a given goal. An emergent feature of many environmental and technological issues can indeed be called "radical" or "epistemological" uncertainty (see Funtowicz and Ravetz, 1993; Pellizzoni, 2003). This term refers to situations where not only the means, but also the goals and structure of a problem are ill-defined. Cases in point are issues (and sometimes crises) such as climate change, BSE, the use of GMOs in agriculture, and electromagnetic fields. In all such cases, uncertainty derives from complexity, indeterminacy (too many variables to take into account, open-ended causal chains, etc.) or actual ignorance (we don't know) (Wynne, 1992; Stirling, 1999).

Though the outlined approaches to risk and uncertainty may look quite sophisticated, an appreciation of the implications of human attempts to control nature and society is by no means out of reach of "ordinary" people, as testified by various studies. These reflect the public's growing scepticism towards science and its distrust of scientific and political institutions (see Irwin, 1995; Pellizzoni and De Marchi, 2002; Eurobarometer, 2001). Moreover, socio-cultural perspectives throw light on very important processes related to risk as a social phenomenon. For example, the "cultural theory" of risk, developed by the anthropologist Mary Douglas and her followers (Douglas and Wildavski, 1982; Schwarz and Thompson, 1990) argues that there is a close connection between social structure and culture, and that the different risk constructions of social communities or groupings derive from different cultural per-

spectives. In other words, within society there are different basic orientations towards risk, which are deeply rooted in individuals and groups and cannot easily be overcome simply by means of communication and persuasion strategies.

Moreover, there are important processes of "social amplification of risk". The idea behind this concept is that "events pertaining to hazards interact with psychological, social, institutional and cultural processes in ways that can heighten or attenuate perceptions of risk and shape risk behaviour" (Kasperson, 1992). In other words, social organisation can play a significant role in heightening or lowering public attention to specific risks. Two elements deserve particular attention here. On one side, there are institutional constraints. The structure or the very existence of an institution can modify the social prominence of an issue. For example, the creation of the EFSA and its organisational characteristics does not simply respond to pressing policy problems, but is deemed also to contribute actively to shaping them. Another important aspect of the social dimension of risk is that people, groups and organisations actively compete to impose their own perspective on a certain risk issue as the dominant one in the public sphere, in order to "control" its insertion in the policy agenda and the solutions envisaged (Hajer, 1997).

To sum up, from a sociological perspective risks may be interpreted as "social problems" (Griswold, 1994), that is as public issues which emerge neither simply by virtue of their own nature, nor solely because of the clash of the different world views co-existing within complex societies. Rather they emerge as a consequence of a number of institutional constraints and of the deliberate and non-deliberate (or occasional) actions of a plurality of social actors.

The concept of trust is closely connected with those of risk and uncertainty. The relationship between risk and trust is evident in most current definitions of trust. According to the prevailing accounts, trust consists of expectations which have a positive influence on the social actor and are formulated under conditions of uncertainty (see Mutti, 1994 for an overview). In other words, we can talk of trust in a situation where an actor is not sure of what another will do, but has good reasons to be confident that the latter will conform to his own expectations. Similarly, according to Mayer *et al.* (1995), trust is one subject's readiness to be vulnerable to the actions of another subject, based on the expectation that the other will behave in a way that is important to him or her, irrespective of his or her ability to monitor or control such behaviour. Trusting means taking risks, even if usually we don't think explicitly in those terms (Lagerspetz, 1998).

Mayer *et al.* (1995) identify three major antecedents of trust: perceived ability (expertise, experience, training and education, success, etc.), benevolence (altruism, loyalty, sincerity, empathy, etc.) and integrity (adherence to principles, consistency of past behaviour, congruence between words and actions, etc.). A decline in trust would thus mean that the way risk issues are handled has brought into question the ability, benevolence and integrity of regulators, controllers, expert bodies and business actors. Such a conclusion actually finds wide empirical support (see Eurobarometer, 1998 and 2001; Grove-White *et al.*, 1997; Irwin *et al.*, 1999; Pellizzoni and De Marchi, 2002).

Fiduciary expectations replace uncertainty with some degree of certainty and reassurance. They are never entirely based on hope or emotion: they also have a cognitive content, although the balance between cognitive and non-cognitive motivations is highly variable. Correspondingly, trust cannot be entirely described in cognitive terms, otherwise we would fall back to the familiar ideal type of the rational decision maker. Trust entails a commitment to something, rather than just a cognitive understanding (Giddens, 1990).

Trust is a foundation of society because it reduces the range of conceivable alternatives of action due to the contingency of social relations (I don't know what your intentions are, you don't know mine, and I know that you don't know them, etc.). Fiduciary expectations are largely based on norms and shared values. This means that the uncertainty inherent in trust is connected to the normative frame of the situation. The normative dimension of trust takes the form of expectations linked to individual or organisational roles. In this sense, Sztompka (1999) talks of "anticipatory trust". Moreover, normative expectations (i.e. expectations based on value commitments) may affect both cognitive beliefs and emotional orientations. For example, if I trust a fireman's ability to extinguish a fire it is not because I have previously seen him at work. Rather I believe in his professional expertise, and I do so not because I have actually checked the quality of the firemen training courses, but because I have a normative belief, a commitment to such an organisation and I believe in the firemen's competence and goodwill (i.e. his own commitment) as a matter of principle. Of course, the lack of any normative frame represents an almost impossible case. Therefore, "the degree of coherence and completeness, of ambiguity and manipulability of normative systems becomes crucial in the explanation of generative processes of social expectancies and of uncertainty reduction" (Mutti, 1994, p.82).

Normative beliefs represent an important element of what Giddens (1990) calls "systems trust", i.e. trust in expert systems (e.g. airplane transport) and symbolic tokens (e.g. money). Such beliefs are accompanied by a factual one, by which we recognise that although we cannot actually assess expert and symbolic systems' reliability, we cannot but rely on them[1]. To describe this kind of trust, Giddens often uses the term "confidence". The difference between trust and confidence is clarified by Luhmann (1988). According to him, trust exists when we believe we can affect the evolution of a situation; confidence when we maintain that we cannot affect the events, when we feel we are in a strongly compelling situation with little or no chance of getting out. In the first case we consider alternatives, in the second case we do not. This distinction is obviously linked to that between risk and danger. It can also be connected with the different levels of uncertainty characterising the fiduciary relation. The fewer the alternatives, the higher the uncertainty we are bound

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[1] Sperber (1982) has elucidated the difference between a factual and a normative belief. The former indicates a subject's conviction that something is a fact. The latter, which Sperber calls a "representational belief", describes a subject's conscious decision to adhere to a representation, that is to the normative content (moral, political or else) of his or her own belief.

to accept before withdrawing (if possible). Thus an attitude of confidence, rather than trust, implies that a high level of uncertainty is inherent in the situation one is confronted with.

To sum up, all the perspectives on trust outlined above are relevant for the purposes of this study:

- the interpersonal level (e.g. relations between consumer and shopkeeper),
- the systems level (e.g. the consumer's judgement on the reliability of controls in the food chain),
- the cognitive and emotional components, and
- the normative framework (e.g. the credibility and legitimacy of regulatory institutions).

The last point should not be underestimated. The legitimacy crisis of core institutions of present society is a much-debated phenomenon. In the environmental and health fields the deterioration of the relationship between citizens and institutions seems particularly evident, often being described in terms of declining public trust in regulators', scientists' and entrepreneurs' willingness and ability to cope with the challenges posed by the exploitation of natural resources and the increasing pace of techn ological innovation (EC, 2000a and 2000b; Eurobarometer, 1998 and 2001; Pellizzoni and De Marchi, 2002; UK House of Lords, 2000).

Why is the legitimacy crisis so manifest in the environmental and health fields? Various reasons have been advanced (Pellizzoni, 2005). The first is changing relations among the actors. The food sector provides major evidence of that. As Brom (2000, p.128-129) observes, in the emerging global market for food and other agricultural products, the distance between consumer and farm has widened. In Western society, most consumers have no direct contact with the farms where their food is produced. Nearly all food, in the city as well as in villages, is purchased in supermarkets. Food comes from exotic countries and there is little real life experience with modern farming. Moreover, farmers often consider critical questions raised by consumers about agricultural practices as typical "city-issues".

The increasing intricacy of the food chain is a second aspect, particularly stressed by scholars following the "systems of provision" approach (Lockie and Kitto, 2000). They assume that the growing physical and mental distance between the actors affects their relationship, in terms of both power and trust. Relations are further complicated by the recent counter-tendency towards the localisation of production and consumption, that is towards the re-creation or maintenance of short supply chains, where the value of the place of production or the identity of the producer play a major role (Hinrichs, 2000; Marsden *et al.*, 2000).

The third reason is the increasing importance of professional expertise, accompanied by a decline in its ability to deal effectively and efficiently with environmental and technological issues. The proliferation of regulatory policies fosters a tendency to delegate powers to non-elected bodies, for which practical results represent one of the main sources of legitimation (Majone, 1999). Delegation is practised for various rea-

sons, including the ability of these bodies to ensure continuity in the development and implementation of policies thanks to lack of electoral constraints, and the high technical content of policy issues. Since effectiveness is a key criterion for the legitimacy of policy action, a reduction in the former cannot but affect the latter.

The legitimacy of the market economy is also deeply rooted in its promise of effective and efficient resource allocation (Shearer, 2002). If such promise is not fulfilled, as it happens with the over-exploitation of natural resources, legitimacy weakens. The same can be said of science. In their search for effectiveness and efficiency, business and regulators rely heavily on science and technology. However, the growing intertwining of science, politics and business brings into question one fundamental source of the legitimacy of science: disinterestedness. Moreover incidents, crises and long term threats provide evidence of limited control on the social and environmental impacts of scientific advancement and technological innovation. In turn, this trend brings into question another source of the legitimacy of science: the promise of objective and reliable knowledge.

3.2. SOCIOLOGY OF FOOD CONSUMPTION

Food is a very specific consumption good. It is a basic need but also has important social meaning and significance. It is one of the most fundamental expressions of care for others and an important means of establishing and maintaining personal (social) relations. It entails the nurturing and educating of children and is at the same time an expression of love and friendship (Caplan, 1997).

Eating structures our day and the preparation of food takes up a considerable amount of time each day, even nowadays. Moreover what to eat and how to prepare food is a basic element of individual, social, cultural and national identity. But food production and food supply has to do with power and difference in power as well. One example is the dependence of many developing countries on food supplies from the industrial nations, which are also used as a political weapon (den Hartog, 1982). The food industry is an important economic power, employing a lot of people, making a lot of money, having an important political voice but receiving a lot of political/governmental attention and control as well. Food is precious, but dangerous too.

3.2.1. The social meaning of food consumption

Among the sociological approaches to food consumption, the focus on the social meaning of food consumption is most prominent (Gofton, 1986). Changing food consumption patterns are analysed and explained as an element of civilisation. The way food consumption is regulated, prescribing what, how and when to eat for different social groups, underlines its force as a means of social control, regarding broader areas of (proper) behaviour as well:

"Ideas about food, and beliefs about the properties and effects of food, also embody social values, and notions of morality and proper behaviour which reflect the relationships between different age and gender groups, as well as the social classes".

(Gofton, 1986, p.129)

Other peoples' or other nation's eating patterns are often described as uncivilised, primitive and unhealthy or unclean. Every society is worried about the healthiness, safety and "purity" of food but what is considered healthy, clean, safe and "pure" is differently defined. Healthiness and appropriateness of food may even vary within the same society depending (among other things) on age and gender. Bourdieu has applied his theory of habitus to food practices in France and demonstrates the important symbolic and cultural significance of food.

"He suggests that peasants and the industrial working class exhibit 'an ethic of convivial indulgence' and thereby resist 'the new ethic of sobriety for the sake of slimness', which is more recognised at the highest levels of the social hierarchy".

(Bourdieu, quoted in Warde, 1997, p.40)

In former times the situation was quite different, with the rich indulging in conspicuous consumption and waste of food as a demonstration of wealth and luxury, whereas the labouring class had barely enough food for subsistence. But again there was much more differentiation within society also in those times. Elias points out that among religious people, especially in monasteries, self-denial and abstention were preached, restricting the consumption of meat. But the definition of meat as meat differed between the type of animals it was taken from, thus allowing for the consumption of specific meat even as part of a sober and ascetic diet. Some food was even legally reserved for the upper class, and other foods were considered improper and unhealthy for women and children as they might "inflame the passions" (Gofton, 1986, p.140; Caplan, 1997).

3.2.2. Theoretical explanation of modern food consumption

Food consumption has changed a great deal in the course of time. The same is true of food preparation, the cost and availability of food and the ideas about safe and healthy food. Individualisation and informalisation are important trends for food consumption. People now eat more often alone and in different places. When to eat and what to eat is less dependent on the time of the day, the day of the week or the season. Ideas about the necessary qualities of "good" food have also changed, as exemplified by the increase in convenience food but also the increasing demand for "natural" food.

Sociologists have aimed at analysing, characterising and explaining the most important current trends. Following Warde (1997), there are four major trends:

 – a trend towards individual diversity;
 – the development of post-Fordist food;
 – the birth of mass food consumption in a mass society;
 – but also the persistence of food consumption as a means of social differentiation.

As social regulation of food consumption loses influence, what food to eat and not to eat becomes increasingly a matter of individual choice. According to Fischler (quoted in Beardsworth and Keil, 1997) that does not result in more freedom and self-realisation but increases the uncertainty and anxiety of individuals who feel left alone and incapable of making the right decision

The development toward more individualist food consumption patterns may also be interpreted in a positive way, actually as an expression of self-realisation or constitution of new self-chosen groups (or so-called neo-tribes). This differentiation is explained as movement away from uniform consumption patters, as liberalisation from social pressures and as growing cultural pluralism. As a result we see more variety in food consumption and more volatility in consumer preferences. In the future Urry (quoted in Gofton, 1986) expects an increasing use of commodified and pre-prepared food. But at the same time he foresees a growing interest in "natural" food as a reaction to industrial mass food, and a proliferation of consumers' organisation and pressure groups.

What food to eat may be individually chosen but is also an expression of membership in a specific group or socio-political or cultural movement (vegetarianism, organic food, "slow food"). These new groups set up their own rules and regulations regarding food consumption and may even restrict individual freedom, but now this restriction is self-imposed.

Mass consumption may be related to industrialisation and mass production and to what is called the "McDonaldisation of society". Certain foods and brands have become available on a global scale, offering uniform meals all over the world. Uniform food consumption patterns are also related to national contexts. Countries share a culinary tradition and specific ideas about proper meals and proper eating times, which are reflected in national health campaigns. But the same campaigns take the economic interests of the national food industry into account as well. Imports of food are regulated and restricted on the basis of health risks but also as a method of market protection. Moreover, culinary traditions are consciously used to promote countries for tourist purposes.

What is considered as a "proper meal" has only partly to do with what is eaten. It also reflects who is preparing food, where it is eaten and by whom. It entails gendered identities and gender-specific norms. Generally speaking, a "proper meal" is considered to be a home-made meal, cooked by a mother or wife for her loved ones. Offering these proper meals is part of being a good carer, a good mother and wife, and is an important element of (gender-specific) education and socialisation (Charles and Kerr, quoted in Warde, 1997).

Although many scientists have stated that structural characteristics like class, gender, ethnicity, nationality and age have less impact on consumption decisions, there

are also scientists who point to the persistence of social distinctions and class-based differentiation. Bourdieu's theory of taste as cultural capital is still valid today although distinctions may be less pronounced and certain culinary habits more widespread. Warde (1997) remarks that the significance of food as demarcation of classes may differ by country, depending on the significance of food. He refers to the UK, where other things such as education, leisure activities and accent are (or have been) more important communicators of class than food (although food has become more important recently). The same is probably true of the Netherlands and perhaps of northern countries in general. These countries have traditionally given little attention to food and have preached austerity in food consumption (among other things) as part of the Calvinist religion and tradition.

3.3. The study: Aims and method

The foregoing offers a conceptual background for addressing the main results of the sociological study. The purpose of the study was to investigate the social and cultural dimensions of trust in the food field, with specific reference to issues of safety, by means of a series of focus groups (FGs). The choice of the focus group technique precludes the drawing of statistical inferences from the results obtained. However, FGs allow a broad and deep understanding of people's views, opinions, concerns, ways of reasoning and so on (Barbour and Kitzinger, 1999; Krüger, 1994; Morgan, 1997). Thus, great insight can be gained on the framing of the issue by lay people, an insight which can greatly contribute to effective communication and policy. FGs provide the opportunity to elicit dimensions which may not surface in or cannot be appropriately addressed by the survey technique.

Two rounds of four FGs were carried out in each of the five participating countries. The first round took place in late summer 2003 and the second in September 2004.

A protocol for conducting the first round of group discussions was prepared by the Italian team in collaboration with the Dutch one (see Annex 1). The topics included: food choices, consumption habits, consumers' information, trust, responsibility, food safety, causes and effects of food scares, regulations and controls, and the participants' sense of agency.

In the second round of FGs the protocol concentrated mainly on food scares. Participants were invited to report their behaviour in past crises and compare it with "normal" situations. They discussed the relevance of imitative behaviour and evaluated the importance of centralised sources of information (such as public and private institutions and organisations, communicating mainly through the mass media), as opposed to personal networks (such as family, friends, trusted individuals, organisations or experts, available through private relationships). Evaluation of information included its practical usefulness, accessibility, comprehensibility, congruence; the presence of "negative" vs. "positive" information (the former addressing the emergence and development of a food crisis, the latter its conclusion); its reliability and trustworthiness.

As standard practice in the FG technique, the protocols were intended mainly as a guide for the facilitators, with minimal directivity on their part.

The criteria for selecting the participants in the first round of FGs took into account food consumption styles as clues to different underlying beliefs, values and opinions. Four different categories of consumers were singled out.

The first category, labelled "Pleasure", included people for whom food represents an important aspect of their lives; persons who invest time, intellectual energy and money in selecting quality food, driven by criteria of enjoyment and satisfaction (taste, cultural and aesthetic value, social status, etc.). The typical representative of this category is the quality food shop customer, the quality restaurant client, or the "slow food" associate. Participants were recruited using such channels.

The second category, labelled "Concern", included people who consider food also in its social, ethical and environmental implications, including equitable distribution, religious and ethical aspects of consumption, animal welfare, the ecological impact of farming, etc. The typical representative of this category is the fair trade shop customer. Also the organic food shop customer can fit in this category, if moved by the motives listed above.

The third category, labelled "Care" included persons who feel or are responsible for the well-being of people dependent on them (small children, disabled or elderly people, etc.). Their choices are particularly attentive to nutritional, health and safety factors.

The fourth category, labelled "Survival/indifference", included people for whom food is mainly a matter of necessity. Their choices are mainly driven by economic considerations, out of financial constraints, scant attention to nutrition, health and safety, or perhaps conviction that food is basically the same in supermarkets and in organic or "dedicated" food shops. The typical representative of this category is the hard discount customer.

Recruitment of participants in the second round of FGs followed a different set of criteria, based on two sets of hypotheses, namely that:

- consumer behaviour during and after a food scare is significantly connected with the use of information sources, that is to say it is affected by the preferential use of centralised vs. network sources. This preference, in turn, depends on the different "trust investments" of consumers in information sources;
- views of and reactions to food scares may be significantly affected by the consumers' personal experience and memory of past events.

In the light of the first set of hypotheses, participants were assigned to different groups according to their response to a "filtering" question:

"Let us suppose there are rumours that a certain food may be unsafe. Which of the following best describes your behaviour:
A) I inquire about indications provided by the health authorities.
B) I ask for the opinion of persons I trust (e.g. relatives, friends, shopkeepers)".

Age was used as an indicator to differentiate participants in relation to past experience. Half the groups were composed of people from 18 to 30, half of people over 50.

3.4. Main findings

Overall, participants in the FGs discussed food-related issues in a reasoned and articulated way. In other words, their approach proved far from simplistic or purely emotional. On the contrary, it was very reflective and insightful. A common trait of group talks was the propensity to establish connections between specifically food-related issues and other, more general ones referring to the overall functioning of society with its related opportunities and constraints, cultural habits and peculiar modes of thinking.

Here we will offer a synthesis of the most significant findings[2].

3.4.1. Consumers' choice

Consumers' choices depend on a wide range of factors, some specifically related to food (such as the experienced credibility of a brand), others to family composition. Such factors cannot be ranked in any definite order. Moreover, some of them are multifaceted.

One such multifaceted factor is price, regarded as both a constraining element for the consumer and a dominant criterion orienting both sides of the food market – producers/retailers on the one hand, consumers on the other – to the detriment of quality. Food quality is in turn a multifaceted concept, encompassing many different meanings, from taste to naturalness, from nutritional value to ethical acceptability.

Although information is conceived as a major resource, there are concerns about the possibility of adequately assessing its completeness and reliability. This is partly because information is increasingly coming from "distant" sources, ones with which consumers have no direct relationship or long-established acquaintance. Advertising in itself is not the subject of much criticism. However, there is a shared sensation that an "advertising style" is permeating all types of messages from whatever sources, with "partisanship" predominating over neutrality.

There are mixed feelings as regards consumers' agency. Industrialisation of production and intensification of world trade are seen as either enhancing or reducing it. Food agency is connected to both the actual possibility of choice of each consumer and its aggregate effects on the market. Consumers' agency is not perceived as being connected to citizen agency, i.e. the possibility to influence food policies

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[2] A more detailed account is provided by the national and cross-country reports in the working paper series of the Trust project (De Marchi *et al.*, 2003a; Renn *et al.*, 2003; Lobb and Traill, 2003; Couvreur, 2003; De Marchi *et al.*, 2003b). Available online at www.trust.unifi.it.

and regulations.

Opinions on GM food are reasoned and disenchanted. In general it is regarded with some diffidence, but is not stigmatised in principle. It is judged that GMOs can provide some important benefits, improving production and reducing the use of pesticides. In the meantime there is great scepticism about them possibly being (and being presented) as the solution to world hunger. GMOs are also considered as a possible source of long term problems, still insufficiently explored, such as the reduction of biodiversity or delayed negative health effects. Environmental problems (reduction of biodiversity etc.) take on remarkable importance in group discussions. Concerns for information and actual possibility of choice are also expressed. Occasionally, some confusion appears between GM and organic food.

3.4.2. Food safety, trust and responsibility

Food safety is another multifaceted concept not simply equivalent to absence of potential damage. It is connected to quality, including "naturalness" (absence of additives etc.), taste, nutritional value, freshness, hygiene, conservation, geographical origin and preparation.

Awareness is widespread that complete safety is unattainable, that it is impossible to eradicate all types of risks. Many participants stress that one should not become "obsessed" with food safety. Their major concern is for "healthy" styles of consumption. In the meantime sensations of anxiety and uncertainty are widespread. In other words, participants don't think of food safety all day long, nor do they think they should. However, they feel mostly unhappy about how safety issues are addressed by the relevant institutional and economic actors.

As regards the quality of food nowadays, it is judged to have improved considerably with regard to the sanitary aspects of preparation and preservation. However, other important aspects are felt to be neglected, namely those relevant to "traditional", "local", "natural", "nutritionally sound" food. Technological innovation, industrialisation of food production and intensification of world trade have contradictory effects on quality and safety: enhancing some components, while failing to address others.

There are mixed feelings as regards the reality and the adequacy of controls. When mentioned, European regulations are criticised for their excessive formalism and rigidity. Also there is some suspicion that the stakes and constraints of regulatory bureaucracies and the interests of strong lobbies may prevail over safety considerations. European controls are seen as neither particularly efficient nor relevant. In each country national regulations and control procedures are felt to be the most stringent and satisfactory. This view, however, overlaps with a widespread sensation of low protection on the part of authorities.

Information on food safety is drawn from a number of sources and channels: direct (news, ads, labels, newspapers, consumer and supermarket magazines and leaflets, communication exchanges with shopkeepers, relatives and friends, generic

word of mouth) and indirect (price, product and dealer brands). Reliance on personal ability to choose safe and quality food plays also a role. Labels, and particularly expiry dates, are indicated as elements for evaluation, while the role of advertising and the media seems limited to providing very general, basic information (such as on new products). Information on nutritional values and the geographical origin of food is also deemed relevant.

Family habits and consumption styles play a role in driving the participants' consumer behaviour.

All the actors in the food chain are deemed accountable for food safety, including regulators and controllers. Consumers' responsibility for their choices is also stressed to a remarkable extent. Consumer responsibility entails the idea of an "active consumer", who is committed and able to make safe(r) choices and, through such choices, to influence the food market.

Trust is central to the whole food issue, with particular regard to food safety. It is relevant in both its traditional dimensions: interpersonal and systems trust. The former develops in a context of interpersonal relations, for example between consumer and shopkeeper; the latter in a context of activities led by socio-technical organisational structures, such as those responsible for ensuring the quality of food from the sanitary viewpoint. Interpersonal trust is affected by the declining importance of direct, long-established relationships in the assessment of food quality/safety.

There are mixed feelings about the effects of market competition on quality and safety and about the effectiveness of regulatory and control systems. This suggests that the grounds of systems trust are rather unsteady. It also takes an "interpersonal" connotation to the extent that it is affected by a perceived "link" with the addressee of trust, for instance by means of consumer acquaintance with a brand or a firm.

Trust is connected with authority through the attribution of responsibility. To the extent that authoritative subjects are considered responsible for the well-being of those who rely on them, trust investments gain importance. Such considerations involve the economic actors, as implied by the importance ascribed to the credibility of a brand or a firm. Government authorities are mainly considered as untrustworthy, while consumer organisations receive more positive judgements. Opinions are divided as regards experts and research institutions.

Besides interpersonal and systems trust, the dimension of "confidence" is also relevant. It refers to the perceived necessity to rely on actors and procedures, whose "goodwill" and effectiveness cannot be assessed. Confidence emerges when no possibility of "exit" from a situation of dependence on such actors and procedures is felt to exist.

Yet another orientation is a "no trust at all" one, that is to say a "self-reliant" position. This can be analytically distinguished from both trust and confidence. It entails some sense of agency, but that is limited to a practical, experience-based ability to make safe choices.

To sum up, the FGs highlight two contrasting perspectives on the issue of food safety. Most interestingly, the two often coexist. The first one is represented by the idea of an active, responsible consumer. It highlights the benefits of the increasing variety of food and availability of information, as well as the improvement of regula-

tions and controls. The other perspective is that of the sceptical or fatalist consumer. It highlights the overwhelming role of structural constraints, from the predominance of corporate interests to the imposition of "unhealthy" lifestyles, inattentive to the value of food. The intricacies and "unknowns" of food production and trade imply a growing difficulty in assessing the safety of food, on the part of consumers as well as institutional and business actors. This perspective finds expression in a deep sense of "loneliness", of "being held hostage", of "groping in the dark". Trusting is thus something of a necessity, a constraint, an obligation, rather than a well-grounded option.

3.4.3. Food scares: Issue framing and effects on consumers' behaviour

The issue of food scares does not seem to play a crucial role in shaping overall perspectives on food safety and consumers' present behaviour. Although the issue is a focus of research, usually it does not emerge until the facilitator raises it. The BSE crisis is most frequently mentioned, but quite a few others are recalled, such a animal epidemics (influenza, salmonella etc.), hormones, foot and mouth disease, plastic packages, GMOs, dioxin and other chemicals discovered in animals, vegetables or products like wine, water and oil.

Memory of crises is often vague and imprecise (period, origin, nature of problem, etc.) and differences exist among groups and countries. For example, the Chernobyl issue is recalled in Italy, Germany and France, while the implications of SARS for Chinese food are mentioned only by younger Italian participants.

On one side they are regarded as the tip of an iceberg, at the same time signalling and hiding broader and complex problems of safety and quality. In other words, they are understood as occasional events, but events which are not independent from the broader context of food production, sale and consumption.

People become quite reflective when discussing food scares and their arguments can be grouped under the following headings:

a) framing, that is to say the connection between food scares and the operations of the food sector: desire for rapid profit, lack of adequate controls, corruption, etc.;
b) information, that is the role of the media in raising public attention to food scares; features – mostly negative – of media communication and their consequences for consumer response;
c) features, that is the territorial scale of scares; involvement of one or more types of food; capability of anticipating problems; options for treatment of negative health effects; chance for consumers of adopting protective actions, etc.;
d) ethics, that is the connection between food scares and unnatural practices, disregard for animal welfare, and so on.

The effects of food scares on the participants' behaviour can be summarised as follows:

a) temporary change of behaviour. This is the prevailing and most immediate reaction. It ranges from temporary interruption to reduction of consumption of "hazardous" foods and entails shift to different types of food, brands, etc.;

b) durable change of behaviour. This is a fairly frequent response. It may be the consolidation of an already present consumption orientation (such as a low use of meat) or a change in shopping preferences (such as turning from super-markets to small shops). Sometimes changes in the family composition, such as the birth of a child, play a role in fostering behavioural change, beyond food scares. Once taken up, new habits often come to be considered healthier than the previous ones, beyond the specific protective function they had been originally adopted for;

c) no change of behaviour. This reaction characterises a minority of participants, who judge their consumption habits sufficiently self-protective or resolve that it is pointless to change them. They maintain that when a warning is issued, it is already too late to adopt effective "preventive" measures.

The reasons provided by participants for resuming original behaviours are basically the following:

a) tedium with the issue, feeling that "enough is enough". This is usually connected with an overload of information from unremitting and pervasive media coverage;

b) forgetfulness, gradual "fading away" of personal concern. This is usually parallel to a decline in media coverage;

c) practicality, that is to say difficulties in persisting with restrictions in diet;

d) reassurance from the media, friends, shopkeepers. Few participants mention this motive and they generally judge it as the least important.

It is worth noticing that explanations in terms of imitative behaviour are given little credit by virtually all participants. However it is not easy, either for the consumers themselves or the researchers, to distinguish actual imitation from influence by significant others[3] (relatives, friends, trusted dealers, etc.). Also, some participants may be reticent to admit their imitative behaviour publicly even when they are aware of it.

3.4.4. Food scares: Effects of media communication and lessons learned

Feelings are mixed as regards the role of the media. They are considered to play a crucial role. The media – particularly the TV, but also the radio, newspapers and

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[3] Significant others usually means the people who play a particular role in providing the actor with cognitive, normative and affective behavioural models. See Mead (1934).

magazines – set the agenda, providing some initial and baseline information on food scares. Subsequently personal styles of information seeking, active to varying degrees, are enacted. Access to the Internet for finding further information and different sources is frequently mentioned, in particular by younger participants who are familiar with the use of the computer in their professional or leisure activities.

Overall media coverage of food crises is judged negatively: uninformative, sensationalist, inconsistent, and possibly driven by vested interests. However, the media are also praised for their capacity to alert public attention and broadcast warnings. A positive consequence of highly publicised food crises is the introduction of stricter norms and controls.

A closer look at the criteria according to which information is evaluated provides the following results:

a) approach to communication. This includes complaints about sensationalism (though possibly justified in the initial phase of a crisis), untimeliness, and inconsistency. The main consequences are public boredom, annoyance, anxiety and diffidence;

b) characteristics of the media. This includes considerations of the trustworthiness (independence, reliability, accuracy, competence) of different media, broadcasters and sources, as well as particular programmes and communicators. There are complaints about the limited space for "independent" scientific advice;

c) information content. This includes considerations about the predominance of "negative" content (information on food crises and their "bad" effects) over "positive" content (advice on appropriate behaviour). Complaints also regard deficiencies in clarity, completeness, precision, consistency, practical usefulness and reasoned arguments. A few participants judge that the withdrawal of some information may be justified by concerns about spreading panic.

It is maintained that bad news gets more attention than good news. Not only is "negative" information more widely and repeatedly disseminated, it is also more frequently believed (and therefore effective) than "positive" information, which is often regarded with scepticism. Many participants complain that only negative events are reported by the media, and there is no clear indication about the end of a crisis.

It is worth noticing that the distinction between "source", "channel" and "broadcaster" seems to some extent blurred in the group discussions[4]. In other words, when talking of centralised sources of information, participants refer on the one side to particular newspapers, TV channels and programmes, to the professional communicators who prepare and present information, or broadcasters for one particular channel (such as radio vs. TV). On the other side, they refer to those who talk through these channels or whose claims and opinions are reported. Sometimes they refer to both of them at the same time.

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[4] On the difference between source, channel and broadcaster see the classic studies by Klapper (1960) and Hovland *et al.* (1953).

Declarations of interest in more information and facilitated access to different sources contrast with the scant efforts made to this end. Motivations refer to the deficiencies of the information system and their negative psychological effects.

Interpersonal communication (with relatives, friends, shopkeepers etc.) is very important in either providing additional information or mediating the processing of that derived from the mass media. This appears as a confirmation of the classical "two-step flow hypothesis" of mass communication, suggesting that interpersonal communication plays a remarkable role in filtering and interpreting information from centralised sources, thus orienting behavioural decisions (Katz and Lazarsfeld, 1959). Evaluation of information from interpersonal sources is based on trust investments, where "affective" elements coexist with attributions of specific competence and insight in a certain issue.

There are mixed feelings about official communications. Overall, acquaintance with designated authorities is limited. Official statements are often regarded as unsatisfactory, untimely and reticent, although hardly groundless or misleading. Trust investments appeal to the authorities' competence and responsibility. Mistrust derives from suspicion of vested interests or a lack of honesty. Official information remains a baseline which sets the agenda for media communication as well as personal reflections and responses to food scares. Consumer associations, when mentioned, are mostly regarded as potentially reliable sources of information. Occasionally possible vested interests are mentioned. Technical competence is considered crucial but worryingly missing in politicians, who are the actual decision makers. There are contradictory feelings about safety enforcement. On the one hand it is judged that, as a result of food scares, experts now have a greater influence on setting up regulations and control procedures. On the other, controls are seen as inadequate or ineffective as events remain unpredictable, partly because of deficient, inconclusive or reticent evaluation on the part of the experts.

The lessons learned from past food crises largely coincide with the "durable effects" already mentioned above. They can be ascribed to two main categories:

a) behaviour: increased attention to safety issues in food choices; shift to healthier consumption styles; upgrading of controls;
b) issue framing: crises are seen as a manifestation of the "way things go". Other crises are expected in the future, resulting from a combination of unbecoming conduct and some unpredictable factors connected with technological innovation and social change. Crises are again going to trigger different and even contradictory individual responses, including bafflement, mistrust and disenchantment as well as enduring trust, confidence and self-reliance.

3.5. COMPARATIVE REMARKS

We regard as a major finding of this study the fact that the results outlined above have been obtained with a high degree of consistency across the various groups in each country. In other words, similarities largely prevail over differences. Most

noticeable is the usually similar articulation of arguments in both rounds of discussions, though their focus was not identical. Sometimes consistency goes down to specific details (such as the reference to "humans playing God" with reference to GMOs, typical of the French groups). Also clearly manifest is the same articulation of the dimensions of trust (interpersonal and systems trust, confidence, self-reliance). Overall there are no significant differences between participants' opinions and feelings according to gender. Only in the second round of FGs did British female participants seem more concerned than males about food safety and more inclined to imitative behaviour.

Though they provide no indications of any clear trend, it may be worth pointing out some minor differences that emerge between groups and between countries. Let us consider first cross-national differences. As said, knowledge of the control systems is generally low, at both national and European level. However, in the Netherlands and the UK awareness of who is in charge of national food safety is higher while national standards and controls are generally regarded as more reliable than "foreign" ones. In some countries considerations are more critical than elsewhere. In France some are worried about the weakness of sanitary controls, due to financial and personnel limitations. In the British FGs only, the BSE crisis is often described as a prominent cause of the decline of trust in the government. And while BSE is mentioned everywhere, other scares are cited only in some countries (Chernobyl in Italy, Germany and France and the implications of SARS for food consumption only in Italy).

The importance of ethical and environmental information is emphasised mainly in the Netherlands and UK, while the ethical implications of food scares are discussed in Germany, France and the Netherlands, focusing mainly on "unnatural practices" and disregard for animal welfare. These types of considerations are practically absent in Italy.

Some sources of information are more valued in some countries (such as the Internet in UK), while distrust in the independence and reliability of information is stronger in France, Italy and the UK. In France, however, there is more evidence of trust investments in "centralised" vs. "network" information sources. Moreover, trust in official communication on food scares is greater here than elsewhere. In the Netherlands interpersonal communication is less important than elsewhere while there is a recognition of the role of "positive" information (official information concerning the end of a food crisis) in restoring importance attributed to original consumption styles.

In France and Germany consumer organisations are more consistently indicated as trustworthy. Scientist and experts are generally appreciated. In the Netherlands there is a mainly positive evaluation of them, while in France and the UK the decline of trust also involves those working in universities and research institutions, who are believed to be influenced by private fund providers.

Finally, the "active consumer" argument is endorsed more prominently in the Netherlands, whereas confusion, scepticism, diffidence and fatalism find stronger expression in France and Italy. The UK and Germany offer a somehow contradictory picture, with differences between the first and second round of FGs.

Let us now consider between-group differences in more detail. As regards the first round of FGs, "Care" and "Concern" group members are to some extent more interested in collecting and assessing information. Particularly in Italy and the Netherlands, the "active consumer" argument is endorsed to a lesser extent in some groups ("Care" and "Indifference" in Italy; "Indifference" and "Concern" in the Netherlands). Some predictable discrepancies characterise the "meaning" of food and the ranking of the criteria of choice. Participants in the "Pleasure" groups tend to downplay the function of food and to highlight its cultural value and its taste, which also has nutritional health connotations (what is good to eat is also healthy because produced in the right way, using quality components). They also consider food as an indicator of "class". The appreciation of "naturalness" and nutritional aspects are stressed more by participants in the "Concern" and "Care" groups[5], while attention to price is more marked in the "Indifference" group. However, similarities are also largely predominant in this case. It is striking, for example, that members of the "Indifference" group are quite close to the others in attributing importance to taste, freshness, quality and safety. Sometimes they seem even more concerned than many participants in the other groups.

In sum, in each country inter-group discrepancies do not override intra-group ones. This finding partially contradicts those studies which stress the relevance of institutional and cultural differences on fiduciary relations in the food sector (Sassatelli and Scott, 2001; Berg *et al.*, 2005).

In all countries FG participants describe food-related issues in similar terms. There are differences in how such terms are combined and how the argumentation is developed. However, no national trend is detectable.

Even from the second round of FGs, no outstanding differences emerge on any of the topics addressed in the discussions, according to the "trust investment" (priority assigned to centralised or network information sources) or "age" variables, which were the two criteria considered in the composition of the FGs. As regards the former, differences are minor and erratic. There is some evidence that age makes a difference. For example, "antagonistic" behaviour in response to a food scare (going on with or enhancing the "risky" consumption style) seems mostly typical of young (male) participants. At the same time, being a teenager when a scare occurred, particularly BSE, seems to have produced particularly strong effects on food consumption styles (such as becoming a vegetarian).

In general younger participants show a higher level of interest and appreciation for reasoned arguments and comprehensive explanations. They take a more disenchanted stance towards authorities, experts, business and the media, being more aware of their specific agendas. Moreover, they are not easily captured by the rhetoric of "what ought to be" and seem more concentrated on "what is likely to be". Overall they are fairly confident in their own ability to filter, select and process information, using a number of resources and strategies.

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[5] In the second round of FGs, particularly in France, participant*s* with children tended to show more concern for food safety and information.

3.6. CONCLUDING REMARKS

Several indications can be drawn from the above. The overall picture of the connections between trust, food safety, risk information and consumption is somewhat blurred. There are many different and at times contradictory opinions about the roles of individual consumers, public authorities and the different actors in the food chain, as well as about the positive and negative aspects of the regulatory and control systems and of the market as a regulatory mechanism. Attributions of responsibility are very difficult to establish, due to the intricacy of the food chain and the weaknesses of the regulatory and control systems. Recent major food scares are not indicated as the main causes of general mistrust and social pessimism. This situation clearly has many causes, although BSE, dioxin-chicken and the like did nothing to improve it. Food scares, moreover, seem not to have significantly modified consumers' behaviour, which is seen as primarily dependent on the "structural" factors shaping the food sector.

A shared opinion (or rather feeling) is that no subject or institutional setting really addresses the preoccupations and concerns of the citizens, in a context characterised by high levels of uncertainty. As a consequence, individuals seem to "wander" in search of someone or something to trust, being ultimately driven by their own idiosyncrasies. This is confirmed by the apparent lack of any consistent trend based on national belonging or other discriminating criteria, such as those adopted in the composition of the groups. As already mentioned, the FG technique does not allow for generalisation of findings, yet the latter do allow the formulation of some sound hypotheses in the light of the discussions among participants.

The lack of ultimate discriminating power in the variables considered in the design of the study may be interpreted in three different ways. The first is that this is the actual situation. Contradictions are found precisely because people are confused. The second is that (contrary to the hypotheses which drove FG formation) participants' views are linked neither to food consumption styles nor to trust investments in information sources.

The third interpretation is that there is a linkage between trust and the variables considered, but it is an indirect one, with other factors acting as intervening variables (Pellizzoni, 2005). Group discussions provide some support to this interpretation. For example, we are aware that the filtering question for the second round of FGs was apt to grasp only a very basic or generic trust orientation, while the participants' positions are actually much more nuanced, as group discussions showed. In each country, and to some extent across Europe, all participants share a largely common ground as to exposure to and possible selection of information sources. Also the lines of argumentation are likely to be fostered, to some extent, by the very opportunity of reflection offered by the FGs, an opportunity which clearly was not there when the filtering question was asked. However, it is unlikely that such "reflective" attitudes were built from scratch in the group discussion setting. It is more likely that the latter provided the participants with the opportunity to "crystallise" and verbalise some underlying orientations hitherto "unattended". Group discussions show that "reflective" responses to food safety issues predominate, with "reactive" ones mostly concentrated in the initial phases of a crisis.

As already pointed out, even participants in the "Indifference" groups choose hard discounts not because they are not concerned about food quality and safety, but because their assessment of the issue drives them to particular conclusions. This is conveyed by statements about the unjustified cost or doubtful quality of organic food, or the debatable relevance of labels and brands in terms of safety.

What types of intervening variables one should look at? The relevance of socio-demographic ones (age, gender, income, etc.) can better be explored by other research techniques, such as the survey (see Chapter 4). Possibly, orientations on food safety, trust and responsibility are part of a *Weltanschauung*, a worldview which assembles attitudes, values, opinions and normative and factual beliefs on different but somehow related matters such as the pros and cons of science and technology, the reliability of public authorities, the role of the EU, the reliability of one's own network of relations.

If the preceding considerations grasp something real, as FG discussion suggest – that is if consumers' orientations on issues of food safety are highly reflective and connected with a broad set of value commitments and factual considerations about one's own situation and the context in which one's choice has to be made – then the conclusion is that any policy approach aimed at restoring people's trust in food safety and in the credibility and reliability of the various actors present in the food chain should not dismiss this complex scenery. No ready-made information strategy is likely to succeed. Credibility and trust – including consumers' trust in their own ability to choose safely and responsibly – are unlikely to be obtained without a sustained effort to behave consistently and reliably on the part of the political, economic and scientific parties in the food sector. Overall, group discussions showed that individual responses to food scares are likely to depend on several factors, namely: personal consumer experiences and already existing consumption habits; sense of agency; information from the mass media, with particular reference to source and content of communication; information from interpersonal relations, with reference to existing networks and the related trust investments (attributions of goodwill, technical competence, factual knowledge); personal situation; socio-demographic characteristics (age, gender, household composition, income, etc.); basic value-orientations towards political, economic, scientific and cultural institutions. These factors should be taken into account in the design and implementation of food safety policies and more specifically of communication strategies.

A possible outline of the latter, as it may be drawn from group discussion on information needs, includes the following five partially overlapping phases.

First phase: basic information and warnings. In the initial phase communication should provide the public with basic information, warnings and advice on the problem in question. Some sensationalism may be tolerated, as it arouses public attention. Journalists, political actors and health authorities should have the floor.

Second phase: emergency actions. There should be more detailed accounts of what is being done (at regulatory, control and market levels) to deal with the crisis as well as advice to consumers on how to protect themselves and contribute to damage control.

Third phase: analysis. This is the time for more detailed accounts of the causes and dynamics of the crisis, including different possible interpretations and management strategies. A major role should be taken by scientists, experts, independent research bodies and scientific journalists. Dedicated programmes should be broadcast by radio and TV, special articles should be published in newspapers and magazines; informative leaflets should be widely disseminated to targeted audiences and so forth. The communicative approach should pursue pragmatic outcomes while increasing space for reflection in connection with in-depth consideration of possible multiple causes of a crises and related possible strategies for its governance.

Fourth phase: re-solution. The media should report on the implementation of the devised management strategies, providing accounts of their achievements, failures, difficulties, costs, benefits and drawbacks. There should be reasoned forecasts about the expected end of the crisis and competent advice on resuming consumption of the "incriminated" food product. Information should catch public attention by combining "quick news" with more "reasoned" accounts of what is going on.

Fifth phase: end of crisis. In this phase there should be clear, unambiguous accounts of how, or to what extent, the problem has been "solved" and the crisis is exhausted. A combination of "quick news" and more detailed explanations is again advisable. The floor should be taken mainly by official health authorities and the government. Information should include devised changes in food production and consumption which are likely to be durable and positive for health, safety and quality. There should be accounts of the inputs provided to the food market to enable it to reorganise accordingly.

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4. Trust across Europe: Results from a cross-country survey

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Abstract

The paper presents the survey instruments developed in order to collect data on attitudes toward chicken consumption, food risk perception and trust in the food chain actors at a the European level. Consumers segments in five European countries are illustrated with respect to the trust they place upon various information sources through a cluster analysis. The final results evidence the presence of three kinds of consumers characterised by different level of trust in food chain actors and in information sources. Thus influence consumption choices indirectly, rather than in a straightforward manner, through concerns for quality, defined by several criteria and pursued by a number of buying strategies. Opinions on the different actors involved in the food chain, including regulatory and control agencies, are diverse, complex, and sometimes contradictory.

Keywords: *food consumption, food crises, food safety, consumer segmentation, food attitudes.*

4.1. Introduction

In recent years the agricultural and food sectors have experienced repeated food crises and the level of trust in food safety information has become increasingly topical in both the public arena, and from a research perspective. Consequently consumers and policy makers have begun to focus their attention on risk communication. Many interesting differences between European consumers and foreign consumers have emerged (USDA, 2004). Food scares in the USA are generally more isolated and have small impacts on consumers' demand. The main reasons for such differences are related to the high degree of confidence in American regulation of the food supply chain (Buzby and Ready, 1996) vs. the mixed confidence in European governments' public controls.

The research problem addressed in the TRUST project is the understanding of the nature, determinants and process of social diffusion of trust in food risk information. Three key components of the above research problem can be recognised: (1) to identify socio-demographic and personality consumer segments differing in their attitudes towards specific food risks, with respect to the trust they place upon various information sources; (2) to test the causal relationship hypothesised between socio-demographic factors and trust

and between attitudes towards food risk and trust (see Chapter 5); and (3) to compare the determinants of trust across EU countries. In order to answer to the above objectives, primary data needed to be collected within the TRUST survey, explicitly taking into account the inputs from psychological experiments and focus groups (see Chapters 2 and 3) and providing the necessary information for the subsequent research phase.

This Chapter has two fundamental objectives: firstly we introduce the main methodological aspects related to the survey conducted in Spring 2004 in five European countries (Italy, UK, France, Germany and The Netherlands) in order to analyse socio-demographics determinants of trust in food chain actors; secondly, we present the fundamental characteristics of European consumers in terms of consumption habits, food quality and safety perception and trust in food information sources, in descriptive statistical terms, as well as through the use of segmentation analysis to identify consumers who may have a greater propensity to behave in a certain way, thus allowing policy makers to direct a message at that group.

The Chapter is structured as follows: Section 2 briefly summarises literature on different definition of trust. Then, in Section 3, the survey design is outlined following options and discussions from TRUST's partners during the first phase of the project. Section 4 underlines the final choice of surveying method, along with some descriptive results. A segmentation analysis is conducted with results reported in Section 5. Finally, some conclusions are drawn.

4.2. Survey design and reference population

In order to collect consumer data developing a cross-country analysis, as in our case, a survey was planned, as shown in Table 4.1.

Table 4.1. Steps to be followed in developing a survey

a) Identification of the reference population
b) Definition of the research questions
c) Choice of sampling criteria
d) Definition of the estimation methodology for making inference on the surveyed parameters
e) Choice of sample size
f) Choice of the data-collection method (method of administration)
g) Questionnaire design
h) Costs evaluation

Source: authors' elaboration from Malhotra (1999)

Thus, a first issue is the choice of the sampling unit, which is closely related to the definition of the reference population. The information required as it emerges from the research questions is strictly related to decision-making and action and would be strongly biased if the respondent were not involved into making food purchasing

choices, being in this context, the economically relevant person. The sample is also expected to be probabilistic and nationally representative in order to minimise differences between those living in different countries/cultures.

However, having a sampling frame for food shoppers which is also significant at the national level is virtually impossible. Hence, it is convenient to maintain the household as the sampling unit and ensure that the respondent is a representative individual for the whole household. The reference population comprised all households in the UK, the Netherlands, Germany, France and Italy. The sampling method must ensure a representative sample for each country, which means five separate surveys with identical characteristics. The sampling unit is the household, and the person in charge of food shopping is expected to be the respondent. Table 4.2 reports the number of households in each of the above countries.

Table 4.2. Reference population

Country		Great Britain	Italy	France	Germany	The Netherlands
Year		2002	2001	1999	2002	2002
One person	%	29	24	31	37	34
Two people	%	35	26	31	34	33
Three people	%	16	23	16	14	13
Four people	%	14	20	14	11	14
Five or more people	%	7	8	8	4	7
All households (=100%)	millions	24	22	24	39	7
Average household size	People	2.4	2.6	2.4	2.1	2.3

4.3. The choice of the TRUST survey method

The next step requires the choice of the survey method and sample size, taking into account the trade-off between costs and sampling error, given a limited budget. For a detailed methodological note on sample size determination see Appendix 4.1.

In determining the survey method, it is worth noting that the difference between mail, face-to-face and non computer-assisted telephone interviews is marginal in terms of precision, both for sample mean estimates and percentage values. This, despite the fact that for the given budget, mail surveys and telephone interviews allow for a sample size which is almost double that of face-to-face interview. There are two explanations for such a result. The first is related to the fact that the number of respondents for the face-to-face interviews is large enough to guarantee an acceptable level of precision, with confidence interval for the population estimates within a maximum range of ± 7.3% for the mean estimate and ± 9.8% for the percentage estimate. The second

explanation depends on the way the variables are measured. Despite being regarded as a quantitative variables, Likert-type measures, show by definition, a limited range, hence a relatively small sample size is sufficient to obtain good estimates.

Some further considerations about the precision level are necessary. The precision levels reported in Table 4.3 are computed assuming the maximum possible dispersion in the population, so that we can reasonably expect that the actual error will be lower. These must be taken as an upper band for the sampling error. Furthermore, the gain in precision from a stratified or post-stratified sample can not be computed as the information about variability within the strata is lacking, but even a simple stratification – as a subdivision into two strata, with or without children, will most likely lead to a significant improvement in terms of sampling variance and relative error.

Table 4.3. Sample size, sampling variance and maximum sampling error of estimate in the TRUST survey for different survey methods

	Sampling size(a)		Mean(b)		Proportion	
	Questionnaires	Estimated Respondents	Sampling Variance	Relative error (%)	Sampling Variance	Relative error(c) (%)
Survey method Mail Survey	3,875	775	0.0116	± 5.3	0.00032	± 7.0
Face-to-face	446	402	0.0224	± 7.3	0.00062	± 9.8
Telephone (no CATI)	1,160	870	0.0103	± 5.0	0.00029	± 6.6
Telephone (CATI)	167	125	0.0720	± 13.1	0.00200	± 17.5

Note:
(a) Assuming a 7-point Likert scale variable, with a mean value of 4 and a variance of 9
(b) Assuming a percentage value of 50%, i.e. the point of maximum variability (25%)

It is generally accepted that face-to-face interviews provide higher quality response with respect to their mail and telephone counterparts. This is due to personal contact with the interviewer and the respondent, even if there are other issues to be carefully considered (interviewer bias, wariness of respondents, social desirability of answers). Another advantage is that the face-to-face approach should allow a higher sampling control, especially in cases where the market research company arranges the interviews in an appropriate way (i.e. agreeing the best time for the interview, providing an accurate explanation of the research purpose, etc.). This reduces significantly the non-response ratio, which could be an extremely relevant problem for mail and telephone interviews. Apart from the CATI telephone interview, whose high fixed costs seem to prevent us from producing a competitive sample, there is no real sampling difference across the remaining method. Thus, it is worth considering other aspects of the different survey methods. Tables 4.4 and 4.5 estimates the sample error, costs for different sampling sizes as well as the budgetary conditions necessary to minimise the level of sampling error.

Table 4.4. Relative sampling error levels and costs for different sampling sizes

Sample size	100	150	200	250	300	500	1000	10000
	Efficiency							
Mean – sampling variance	0.090	0.060	0.045	0.036	0.030	0.018	0.009	0.001
Mean – relative error (%)	± 14.7	± 12.0	± 10.4	± 9.3	± 8.5	± 6.6	± 4.6	± 1.5
Proportion – sampling variance	0.0025	0.0017	0.0012	0.0010	0.0008	0.0005	0.0002	0.0000
Proportion – relative error (%)	± 19.6	± 16.0	± 13.9	± 12.4	± 11.3	± 8.8	± 6.2	± 2.0
	Costs(a)							
Mail Survey	8,000	10,000	12,000	14,000	16,000	24,000	44,000	404,000
Face-to-face	13,200	16,800	20,400	24,000	27,600	42,000	78,000	726,000
Telephone (no CATI)	9,300	10,950	12,600	14,250	15,900	22,500	39,000	336,000
Telephone (CATI)	31,000	39,000	47,000	55,000	63,000	95,000	175,000	1,615,000

Note: (a) Based on cost quotes and response ratios as reported in Table 4.3

Table 4.5. Sample size and costs for different levels of the relative sampling error

Relative sampling error	± 1%	± 2%	± 5%	± 10%
	Mean			
Sample size required	21,609	5,402	864	216
Mail Survey	868,360	220,090	38,574	12,644
Face-to-face	1,561,848	394,962	68,234	21,558
Telephone (no CATI)	719,097	184,274	34,524	13,131
Telephone (CATI)	3,472,440	879,360	153,298	49,574
	Proportion			
Sample size required	38,416	9,604	1,537	384
Mail Survey	1,540,640	388,160	65,466	19,366
Face-to-face	2,771,952	697,488	116,638	33,660
Telephone (no CATI)	1,273,728	322,932	56,709	18,677
Telephone (CATI)	6,161,560	1,551,640	260,862	76,466

Note: Based on cost quotes and response ratios as reported in Table 4.3

Hence, when deciding among different survey type, it is very important to consider quality issues together with the sampling size. If we accept that a minimum level for the relative sampling error (i.e. a confidence interval) within ±10% range, a sample size of about 400 would guarantee such results for proportion estimates (and the mean error. would be ±7.3%). This would lead to a cost of about € 34,800 for a face-to-face survey, the preferable option for this survey.

The adopted sampling method was Random Location Sampling, which provides a country-representative subdivision into locations; the locations were selected randomly across potential locations and accounted for a national representative sample (e.g. probability of extraction proportional to population). The sampling unit was the household and the respondent the person responsible for the actual purchase of food.

Preliminary research helped to devise an appropriate modelling framework for the questionnaire, to investigate the survey design and sampling issues, leading to the development of the survey protocol, and providing an example questionnaire. Following the Theory of Planned Behaviour (TPB) framework a questionnaire was developed in order to analyse EU consumers' behaviour in relation to purchasing chicken. The questionnaire was designed and translated in the various languages using the back-translation method to ensure invariance of meaning of questions across countries. A pilot study using two products, chicken and eggs, was undertaken across all participating countries in April 2004 with a minimum of 10 participants in each country. The pilot study was particularly useful in assisting with devising the final questionnaire and ensuring that cross country issues and translation problems could be kept to a minimum.

The questionnaire was revised following the pilot study to focus solely on chicken and a nationally representative survey of 500 to 600 consumers (depending on country size) was conducted in five countries (UK, Italy, Germany, the Netherlands and France) in May 2004 on 2,725 respondents as face-to-face, in-home interviews (Figure 4.1). The questionnaire took approximately 30 minutes to complete with "prompts" on certain questions from the interviewer when required by the respondent. Data was subject to a 10% validation. Following the survey a segmentation analysis (Section 6) and a causal model analysis (see Chapter 5) were conducted.
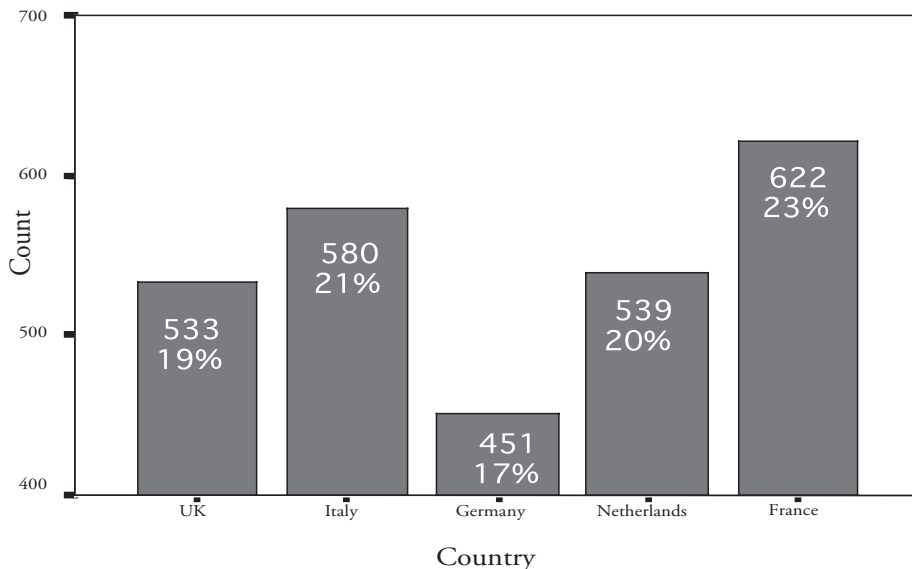

Figure 4.1. Sample size by EU country participants

4.4. Descriptive analysis and results

This Section examines the data from the survey in descriptive terms and presents an overall picture of the sample of each individual country and across the five European countries.

4.4.1. Demographics

As the respondent was the person responsible for the purchase of food, the greater proportion were female (69.1%), however this varied between the five countries (Table 4.6).

Table 4.6. Country analysis by gender

		Country					Total
		UK	Italy	Germany	Netherlands	France	
Gender	Female	87.6	51.0	70.0	70.8	68.0	69.1
	Male	12.4	49.0	30.0	29.2	32.0	30.9
Total		100.0	100.0	100.0	100.0	100.0	100.0

Within our sample group there was an overall dominance of married respondents (60%), which was highest in the Netherlands (68%) and lowest in the UK (51.6%). The mean age was 45 years old, with a minimum of 18 and a maximum of 94 years.

Across our EU sample most people (72.3%) had completed a Higher Secondary School education. The Netherlands had the highest proportion of people with a University Degree or above (15%) and the French respondents had the highest proportion of people with no formal education (11.2%). 41.4% of all respondents were employed full time and 19.2% were retired. Of the specific categories of employment, the French had the highest proportion of full time employees (55%), followed by the British (29%). The Germans had the highest proportion of unemployed (5.4%), the French the highest proportion of retired workers (27.6%), the Dutch the highest proportion of part time employees (37%), and the Italians the highest proportion of students (7.7%). The majority of respondents were employed, working in non-manual jobs (33%) with only 1% of the overall sample employed in farming or agriculture. The Germans had the largest proportion of people employed in non-manual occupations (50%), the French the highest proportion of manual employees (17.2%), the highest proportion of executives (19.6%) and the highest proportion of farmers/agricultural workers (2.1%). The Italians were more likely to be self-employed (14%) and the most likely to be employers (3.2%).

Across our EU sample 18.9% of people live on their own. 32.6% live with one other person and 39.5% of people live in households with 3 or 4 people (19.7% and 19.8% respectively). Across individual countries the French are the most likely to live

alone (26.8%), and the UK and Italy are the most likely to have 3 or 4 people per household (45% and 47.4% respectively). The largest households (5 or more people) are in the Netherlands (12.6%) or the UK (11.6%).

On average, 43% of our EU respondents have children with the Italians the least likely to have children (33%) and the British the most likely (57.4%). Of our EU respondents who have children, 64% of the children are under the age of 16.

Across our EU sample 25% of respondents live in towns with less than 10,000 people, 45% live in towns between 10,000 and 100,000 people and 30% live in towns larger than 100,000 people.

4.4.2. Purchasing habits

Food shopping for households' home consumption takes place on average (54%) between once and twice every week. 60.8% of people across the EU sample spend between 45 and 119 Euros (Pounds in the UK) each week on food for the household's home consumption. On average this suggests that, since the respondent buys food for the consumption of 2.69 people per week, somewhere between 17 and 28 Euros (Pounds in the UK) are spent on food for home consumption per person. Interestingly, over 50% of the Dutch spend more than 120 € each week on food for their household's home consumption, although they generally have larger households. 15.4% of the French spend less than 45 € per week on food, although the French have the smallest households. Less than 6% of the EU sample has vegetarians in their households. The Netherlands has more vegetarians than the other European countries. With regards to chicken, our product of choice for the survey (see Section 4 for justification) less than 10% of EU respondents never buy chicken. The British are most likely to buy chicken at some stage (95%) and the Italians are least likely to buy chicken (14.6% never buy chicken).

Fresh and frozen chicken are the most commonly purchased chicken products. The Germans and French are far more interested in purchasing "fresh" chicken than those from other countries. Over 70% of the Dutch, French and Italians never purchase frozen chicken and over 60% of the same groups never purchase chicken as part of a prepared meal.

The type of chicken purchased was difficult to measure (Figure 4.2). A scale, including an "I don't know" option, from "value" chicken, "standard" chicken, "organic" chicken to "luxury" chicken was developed. Interviews were prompted to explain that the interpretation was provided as follows (this is typical for the British consumer): "Value" chicken is the cheapest variety of chicken you can purchase at a supermarket often sold in bulk; "Standard" chicken is the typical chicken you find on the shelf of a typical supermarket. "Luxury" chicken is equivalent of corn fed or free range chicken or even Tesco Finest Chicken, or perhaps chicken from a higher class store e.g. Marks and Spencer or Selfridges Food Hall. 50% of the EU sample purchases what they believe to be "standard" chicken. The French, and to a lesser extent the Germans, are far more concerned with purchasing "luxury" or "organic"

chicken. The Dutch appear to be more price conscious purchasing a high proportion of "value" chicken even though they spend more money on food for household home consumption than any other country.
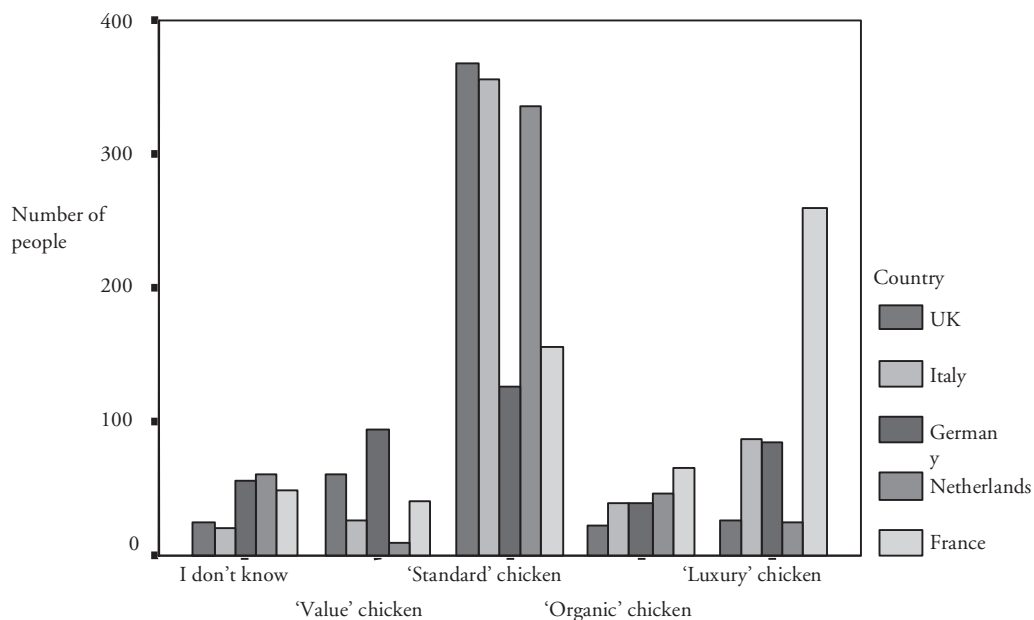

Figure 4.2. Type of chicken purchased by country

An average of 1 kg of chicken is purchased for a household in a typical week with a minimum of none and a maximum of 25 kg per week. The UK shows the highest level of consumption in terms of quantity on average. On average 6 € is spent in a typical week on chicken, with a minimum of zero and a maximum of 82 €. This translates to, on average, a price of 6 € per kg of fresh or frozen chicken. On average, the Italians spend the most on their chicken per week, even though they are the least likely to purchase chicken.

Overall, 75% of people purchase their chicken at the supermarket, with the British being the most likely to purchase at the supermarket (85%), the Germans are the least likely to purchase from the supermarket (44%). The Germans are the most likely to purchase at a discount store (32%) or a local shop (16%), whilst the British are the least likely to purchase from a discount store (95%) and the French the least likely to purchase from a local store (97%). The Italians are most likely to purchase their chicken from a butcher (57%), the Germans are least likely to purchase from the butcher (87%). The French are most likely to purchase from a farmer (27%) or a market (32%), the British are the least likely to purchase from these sources (99% and 97% respectively).

4.4.3. Quality, safety and risk perception

Food safety is generally considered to be "extremely important" (52.5%) with 93.7% of people ranking food safety above a 5 on a 7 point scale from "extremely unimportant" (1) to "extremely important" (7). The French are the most ambivalent towards food safety: 11.9% reported a 4 or less on the 7 point scale. The Italians appear to be the most concerned about food safety: 97% concluded that food safety should be awarded a score greater than 5.

When looking at general issues other than food safety and how important they are to consumers, on a country by country level, we see some interesting results. Fat and cholesterol content is considered to be more important (>5 on the 1-7 scale) in Italy (86.1% and 85.6% respectively) than the other countries, and less important in France (64.5% and 57.9% respectively), suggesting the Italians are the most health conscious group in our sample with the French being the least concerned with such issues. Most products are perceived to be reasonably safe, apart from GM foods and prepared meals. The Italians and the French are most concerned about GM foods; the Dutch are the least concerned about GM foods.

The Dutch appear to be the most adventurous when trying different foods and restaurants, the Italians are, by far, the least likely to like food from other countries. The French and the Italians appear to be the most quality conscious and are always willing to pay a little more for quality. The British although appearing quality conscious are not prepared to pay the extra money required to purchase higher quality food. The Germans appear to be the least quality conscious. Over 50% of Italians try not to purchase products with pesticide or antibiotic residues, although they are not quite as keen as the French to pay for the privilege.

Moving to focus on chicken specific issues, on average, across all countries, people perceive chicken to taste good (the highest score for the attribute which most influences one's decision to buy chicken), be low in fat and be a food which is liked by many and works well with a lot of other ingredients. Chicken is also generally perceived as low in cholesterol, even though there is no recognised link between chicken and cholesterol levels. When examining salience issues it is interesting to report that the three most important reasons for buying chicken across the EU (ranked first) were: "chicken tastes good", "chicken is good value for money" and "all the family likes chicken". Within individual countries these three attributes remain the most important (ranked first) with the exception of the Dutch. The only attributes ranked at some point in the three most important attributes (which coincide with the three highest scores for the attribute which influences one's decision to purchase chicken mentioned at the start of this paragraph) were: "chicken works well with lots of other ingredients" and "chicken is low in fat". The taste of chicken truly is the most important attribute that people consider when considering whether or not to buy chicken next week.

Safety, not recognised as a deciding factor when purchasing chicken regardless of its importance on a general level, is relevant to the investigation. 25.8% of the EU sample believes chicken is neither a safe nor an unsafe food, when responding to the statement "chicken is a safe food", with the majority of the respondents

(56.6%) seeing it as more safe (> 5 on a 1 to 7 scale from "completely disagree" (1) to "completely agree" (7)) than unsafe (17.6%) (<3 on the scale). The Dutch are the least likely to view chicken as a safe food with 32% disagreeing (< 3 on the 1 to 7 scale). The Italians are the most likely to view chicken as a safe food (67.4%) (>5 on the 1 to 7 scale).

The EU sample view themselves as having low or negligible knowledge of health risks related to chicken. French and Italian respondents feel they are more knowledgeable of health problems resulting from antibiotics, pesticides and growth hormones. The Dutch and Germans (and to a lesser extent the British) feel they are more knowledgeable about salmonella. Most of respondents claim to recognise "safe" chicken as (1) "fresh"; (2) being clearly labelled; (3) being organic, free-range or corn-fed. The majority of respondents (79.8%) feel that they can minimise their food safety risks by taking appropriate action (for >5 on a 1 to 7 scale, from "to a minimal extent" (1) to "to a large extent" (7)). Interestingly, the Dutch (91%) and the British (89%) feel they have more self-control over food safety risks than those in the other European countries. The Italians are the most sceptical, as only 70% rated a score of 5 or greater.

Interestingly swimming is perceived to be the least risky activity (only 10% of respondents perceived a risk greater than 5 on a 7 point scale where 7 is the risk is "extremely high"). The most risky activity according to the EU sample is taking illegal drugs (93%), closely followed by smoking cigarettes (92%). On average, Italians appear to be the most risk adverse, while Germans are more inclined towards taking risks.

4.4. FOOD SAFETY INFORMATION, SOURCES AND TRUST

Television advertising is the least trusted source of information across all countries on average, followed by political groups, processors, government and magazines (Table 4.7). The most trusted information sources across all countries are, on average, doctors and other health authorities, national food safety authorities, university scientists and consumer organisations. The EFSA is not as trusted as the national authorities. The British appear to be on average the most trusting group with no rankings below the mid-point 4 of "neither trust nor distrust". However the British are also less trusting of their National Food Safety authority than those in other countries. The French appear to be on average the least trusting group with television adverts and political groups rating 2.9 out of 7. The French also trust speciality stores and farmer/breeders above the average. The Italians are also on average more distrusting of political groups. Differences across countries emerge when trying to quantify the level of trust towards specific actors on average. The French are the most trusting of organic farmers, farmers in general and to a lesser extent brand producers. The Italians are the least trusting of farmers. The Dutch are the least trusting of industrial poultry breeders. On a general trust level, on average, the Dutch appear to be the most trusting.

Table 4.7. Trust in information

Source	Country					
	UK	Italy	Germany	Nether-lands	France	Total
Shopkeepers	4.64	4.72	4.48	4.54	**5.01**	4.69
Supermarkets	**4.99**	4.73	4.54	4.49	4.48	4.64
Organic shop	5.27	5.08	5.27	5.14	**5.30**	5.21
Specialty store	5.12	4.05	4.91	5.28	**5.70**	5.01
Farmers / breeders	5.07	4.67	4.90	4.56	**5.56**	4.97
Processors	3.95	**4.01**	3.90	3.97	3.00	3.74
Doctors / health authority	**6.24**	5.91	5.98	6.08	5.78	5.99
University scientists	5.53	5.92	5.77	**6.04**	5.58	5.77
National authority in charge of food safety	5.80	5.60	5.98	**6.01**	5.62	5.79
Government	4.39	4.29	4.67	**5.36**	3.90	4.50
Political groups	3.55	3.33	**4.04**	3.98	2.89	3.52
Environmental organisations	4.86	4.78	**5.41**	4.51	4.84	4.86
Animal welfare organisations	4.50	4.69	**5.34**	4.40	4.67	4.70
Consumer organisations	5.22	5.58	**6.02**	5.72	5.91	5.69
EU authority in charge of food safety	4.62	5.52	**5.54**	5.41	4.97	5.21
Television documentary	4.96	4.84	**5.26**	5.05	4.87	4.98
Television news / current affairs	5.17	5.15	**5.55**	5.39	4.79	5.19
Television adverts	**4.18**	3.56	3.25	3.04	2.95	3.38
Newspapers	4.53	4.87	5.33	4.97	**5.01**	4.94
Internet	4.54	4.34	4.77	**4.82**	4.25	4.54
Radio	4.86	4.56	**5.35**	5.00	5.13	4.97
Magazines	4.55	4.28	**4.81**	4.39	4.48	4.49
Product label	4.81	5.19	4.48	5.01	**5.50**	5.03
Average	*4.89*	*4.78*	***5.03***	*4.93*	*4.80*	*4.88*

Note: average scores to Question 43: "Suppose that each of the following has provided information about potential risks associated with salmonella in food. Please indicate to what extent you would trust that information" (on a 1 to 7 point Likert scale from 1='completely distrust" to 7='completely trust') for each European country. The more trusted sources/actors on average and the most trusting country (on average) for each source/actor are in bold.

From this, it can be surmised that the Germans are generally more trusting in food safety information from a variety of sources/actors, on average, than those from the other European countries.

4.5. Segmentation analysis

The aim of this Section is to attempt to classify consumers from the five European countries using a segmentation analysis with respect to the degree of trust they place on various information sources about food safety information. Both factor and cluster analyses were used to perform the segmentation analysis. Consumers can be segmented in several ways, by lifestyles, demographic characteristics, and in this case by their trust in sources of information. All three analyses were conducted, but the most significant segmentation result is based on trust variables. In fact, taking into account only demographic or lifestyle variables does not provide a very informative classification and the interaction between these variables is limited; alternatively, looking at the lifestyle characteristics we can observe, more or less, conservative or adventurous consumers but their demographic characteristics are not enlightening. Instead, by looking at the level of trust people have in food safety information from different sources it is possible to obtain three distinct groups: "Non-trusters", especially in independent sources; "Mixed trust" characterised by distrust in food chain actors and trust in independent sources; and "Trusters", especially in food chain actors and less in media.

4.5.1. Methodology

Segmentation of the statistical units according to a pre-determined set of variables is achieved through principal components analysis (PCA) and cluster analysis (CA), where the former technique allows a reduction of the data matrix into a reduced set of unrelated components and the latter produces the actual classification on the basis of the principal components score.

The advantages of performing PCA prior to clustering rather than applying CA to the original data set are to reduce the biases implied by the subjective researcher's initial choice of the variables, as the inclusion of highly correlated variables might lead to an excessive weight on their common factor. The extracted principal components can be interpreted as underlying latent factors. For a more formalised description of the PCA see Krzanowski (1988) or Duntemann (1989). Through principal components analysis the initial set of p indicators observed on n statistical units can be transformed into a reduced set of k principal components which are able to explain a significant proportion of the original variability. In the case study described hereafter, the method of Guttman-Kaiser was adopted to choose the number of principal components to be considered. The method advises to retain the components whose eigenvalue is equal or larger than 1. Generally this criterion led to the selection of a number of components explaining between 65% and 70% of the original data variance. The variables obtained through PCA are a linear combination of the original indicators and are uncorrelated between variables.

In order to eliminate the effects of different measurement units, it is useful to apply the PCA to the correlation matrix. Working on the correlation matrix means in practice standardising the original data matrix and avoiding that the indicators with larger variability exercise a distorting influence on the principal components extrac-

tion. Operating on the correlation matrix leads to the following formulation of the principal components scores that can be computed for each statistical unit.

4.5.2. Cluster analysis

Once the principal components have been extracted, one can proceed to the actual aggregation of the statistical units through cluster analysis. The aim of this method is the classification of a set of data often classifying people, in a purely empirical way, into a set of "mutually, exclusive, exhaustive, groups such that individuals within a group are similar to one another while individuals in different groups are dissimilar" (Chatfield and Collins, 2000, p.212). The final set of groups is called partition.

For this analysis, the number of clusters was determined by comparing the results of three different clustering approaches:

   a) the Ward hierarchical approach;
   b) a repeated application of the non-hierarchical k-means method for different cluster numbers;
   c) once the numbers of clusters were decided, the actual segmentation was based on the k-means method.

4.5.3. Segmentation analysis

From the design of the questionnaire the consumer could be potentially segmented in three different ways: lifestyles, demographics or variables explaining their level of trust in sources of information (see Chapter 5 for more details). All three types of segmentation analysis were performed however the most significant segmentation was by trust levels. The two segmentations using demographic or lifestyle variables do not return a very informative classification and the interaction between these variables is rather limited. We obtained four demographic groups but differences in trust towards food safety information across the clusters, albeit statistically relevant, are very marginal and it is not possible to differentiate distrusters from trusters. Similarly, if the multivariate analysis is applied to lifestyles characteristics, we obtain a meaningful classification suggesting conservative or adventurous consumers, but again there is no real connection between lifestyles and trust levels. Therefore the results of a segmentation based on trust characteristics are reported.

The most significant segmentation was based on trust variables, using the information from question 43[1]. The original aim of this question was the understanding of consumers' trust in different food chain actors (shopkeepers, supermarkets, organic shop, specialty store, farmers and processors), scientists (doctors, health authority and

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[1] Question 43: "Suppose that each of the following has provided information about potential risks associated with salmonella in food. Please indicate to what extent you would trust that information".

university scientists), public sources of information (government, political groups, national and European authority in charge of food safety), independent sources (environmental, animal welfare and consumer organisation) and media.

Performing a factor analysis through a quantitative PCA (principal component analysis) we obtain five components. Selection of the principal components is based on the "method of eigenvalues", which requires retention of principal components associated with an eigenvalue larger than 1. This leads to five principal components (see Chapter 5).

Hence, trust in food safety information is aggregated through principal component analysis to account for correlations across sources perceived as similar and provides estimates (principal component scores) for the latent trust constructs.

Table 4.8 reports the latent trust dimensions and the relative component loadings after Varimax rotation. As shown in Table 4.8, the latent constructs emerge as strongly characterised, with the first component emphasising trust in mass media, the second, trust in food chain actors, the third one trust in sources likely to be perceived as independent (and interestingly including consumer organisations), the fourth was labelled as "alternative sources" as it includes specialty and organic stores as well as non-profit organisations and the fifth was termed "vested interest" as it includes sources including food processors, political groups and television adverts.

Table 4.8. Principal components loadings for trust in food safety information

Information source	T1	T2	T3	T4	T5
Shopkeepers	0.12	**0.81**	0.11	-0.05	0.15
Supermarkets	0.17	**0.74**	0.17	-0.06	0.31
Organic shop	0.11	**0.68**	0.10	**0.40**	-0.05
Specialty store	0.20	**0.74**	0.08	0.25	0.03
Farmers / breeders	0.10	**0.73**	0.11	0.11	0.07
Processors	0.11	**0.47**	0.18	-0.04	**0.59**
Doctors / health authority	0.18	0.23	**0.76**	-0.01	0.04
University scientists	0.18	0.13	**0.72**	0.10	0.07
National Food Authority	0.14	0.16	**0.79**	0.12	0.21
Government	0.21	0.06	**0.50**	0.10	**0.64**
Political groups	0.28	0.09	0.19	0.28	**0.74**
Environmental organisations	0.21	0.13	0.18	**0.83**	0.15
Animal welfare organisations	0.18	0.12	0.10	**0.84**	0.16
Consumer organisations	0.30	0.11	**0.52**	**0.51**	-0.09
EFSA	0.26	0.05	**0.62**	0.23	0.24
Television documentary	**0.67**	0.12	0.22	0.13	0.10
Television news / current affairs	**0.73**	0.15	0.30	0.03	0.10
Television adverts	**0.40**	0.23	-0.02	0.06	**0.60**
Newspapers	**0.75**	0.15	0.16	0.13	0.13

Table 4.8. (contd.) Principal components loadings for trust in food safety information

Internet	**0.63**	0.04	0.13	0.17	0.25
Radio	**0.79**	0.16	0.18	0.15	0.07
Magazines	**0.71**	0.23	0.05	0.15	0.25
Product label	0.35	**0.43**	0.18	-0.03	0.12
Component label	*Media*	*Food chain*	*Independent*	*Alternative*	*Vested interest*

Note: Varimax rotation. Values equal or greater than 0.40 in bold.

However, Table 4.8 results are non-univocal. For $k = 22$, where k is the number of nearest neighbours employed by the algorithm (using the rule $k=2 \log N$, being N the number of observations), the identified number of clusters is 3. However, for in the neighbourhood of $k = 22$, 2 and 4 clusters are also detected. The Ward algorithm suggests 5 clusters. The K-means cluster analysis is carried out for analyses from 2 to 6 clusters; the CCC and pseudo-F statistics suggest respectively 3 and 4 clusters.

Thus, two criteria out of four suggest using 3 clusters. The following step is to perform a cluster analysis with K-means method. This particular tool is recommended when there is an *a priori* hypothesis about the correct number of clusters. Specifying initial cluster centres the relative algorithm can handle a large numbers of cases. The results of the convergence after 25 iterations are reported in Table 4.9.

Table 4.9. Segmentation on trust variables: number of clusters

K	20	21	22	23	24	25	Ward
No. of clusters (density method)	4	4	3	2	2	2	5
CCC	-80		-65	-48			-38
Pseudo-F	7.9		8.2	9.2			205
Pseudo-t2	5.2		7.4	7.1			138
k*	21.87033						
K-means			(two-steps)				
	2	3	4	5	6		
CCC	-6.68	-9.17	-11.84	-17.65	-21.65		
Pseudo-F	296.86	301.95	307.79	301.43	308.23		

In order to complete our analysis it is now interesting to explore the main characteristics of each of these groups. This analysis is mainly performed by looking at the average values for the most significant variables in our questionnaire. Looking at the overall results

it is possible to underline many common patterns among the three segments: for instance, the food consumption style is not dissimilar (i.e. at the question "in my household we like chicken" all "slightly agree" and the values are 5.53 for the first, 5.53 for the second and 5.94 for the third group: thus we can observe a difference of 0.5 on a seven point Likert scale); also the questions concerning the "food neophobia" and the purchasing of product of quality reveal a fairly similar perception between the segments. It should be noted that these three clusters have very similar demographic profiles, which suggest little connection between the level of trust in food safety information and socio-demographic variables.

Examining Table 4.10 it is possible to give a name to these groups: the first seems to be composed of people who distrust all the sources (all negative signs) and especially the independent ones: university scientists, national and European food authority, governments and doctors. Thus we can qualify this segment as "Non-trusters". This cluster is composed of 507 respondents (25.9% of the valid cases). 28.6% of this group consist of people from Italy. The second segment, "Mixed trust", is characterised by the distrust in food chain actors and trust both in independent sources and (even if only slightly) in the media. This group is mainly characterised by the presence of people from Germany and Netherlands (27.2% and 26%) this group includes 29.5% of the sample. Finally the last segment seems to be characterised by a general trust in all food sources of information and especially in food chain actors: people belonging to this segment can be qualified as "Trusters". The group of "Trusters" is well balanced across all five countries and overall it is considered the most numerous segment (873 cases, 44.6% of the valid cases).

Table 4.10. Segmentation on trust variables: factor loadings

	Cluster		
	1	2	3
Trust in media	-0.38536	0.23765	0.06646
Trust in food chain actors	-0.08513	-0.94193	0.67307
Trust in independent	-10.24728	0.55694	0.35563
Trust in alternative sources	-0.16913	-0.17910	0.21680
Trust in vested interest	-0.10538	-0.32443	0.27600

These groups are clearly shown in Figure 4.3 while the distribution of the identified segments within the countries is reported in Table 4.11.

The analysis shows a significant segmentation based on trust towards food safety information. It attempts to measure the trust people have in food safety information from different sources; it is possible to obtain three different groups of consumers:

a) "Non-trusters", especially wary towards independent sources,
b) "Mixed trusters", characterised by distrust in food chain actors and trust in independent sources, and
c) "Trusters", which especially rely in information provided by food chain actors and less in media.

Figure 4.3. Graphical representation of three consumer segments showing trust variable in each country

Table 4.11. Segment composition by country

			Cluster (Trust variables EU)			Total
			1	2	3	
Country	**UK**	Count	111	66	168	345
		% within Country	32.2%	19.1%	48.7%	100.0%
		% within Cluster (Trust variables EU)	21.9%	11.4%	19.2%	17.6%
		% of Total	5.7%	3.4%	8.6%	17.6%
	Italy	Count	145	132	191	468
		% within Country	31.0%	28.2%	40.8%	100.0%
		% within Cluster (Trust variables EU)	28.6%	22.8%	21.9%	23.9%
		% of Total	7.4%	6.7%	9.8%	23.9%
	Germany	Count	94	157	180	431
		% within Country	21.8%	36.4%	41.8%	100.0%
		% within Cluster (Trust variables EU)	18.5%	27.2%	20.6%	22.0%
		% of Total	4.8%	8.0%	9.2%	22.0%
	Netherlands	Count	59	150	163	372
		% within Country	15.9%	40.3%	43.8%	100.0%
		% within Cluster (Trust variables EU)	11.6%	26.0%	18.7%	19.0%
		% of Total	3.0%	7.7%	8.3%	19.0%

Table 4.11. (contd.) Segment composition by country

France	Count	98	73	171	342
	% within Country	28.7%	21.3%	50.0%	100.0%
	% within Cluster (Trust variables EU)	19.3%	12.6%	19.6%	17.5%
	% of Total	5.0%	3.7%	8.7%	17.5%
Total	Count	507	578	873	1958
	% within Country	25.9%	29.5%	44.6%	100.0%
	% within Cluster (Trust variables EU)	100.0%	100.0%	100.0%	100.0%
	% of Total	25.9%	29.5%	44.6%	100.0%

The results of this study confirm the mixed degrees of confidence that European consumers have in their country's information providers' ability to deal with food safety crises. There are, however, some key differences between the five countries that could be considered to be of policy relevance: the French and the Italians are generally "Non-trusters" with Italy having the smallest proportion of "Trusters"; the UK has the largest number of both "Trusters" and "Non-trusters" and the lowest of "Mixed trusters"; Germany and the Netherlands have high proportions of "Mixed trusters". However, it is important to note the limitations of this cluster analysis as it does not give an in depth understanding of demographic characteristics difference across trust-based segments, whose values are generally close to the average values of the sample. This suggests that there is need for further research in this area.

4.6. Conclusions

A sampling theory framework for assessing the different options available for the TRUST survey has been provided in this Chapter. Some assumptions about the costs of different survey types and the question type allowed to quantify the expected (minimum) levels of precision (sampling error) for different sample sizes and vice versa the sample size (and budget) required for attaining different levels of precision. The results show the trade-off between the sampling error and costs and the marginal gain in increasing sample size is quickly decreasing. We also argue that once an acceptable sampling error is guaranteed for the sample size, it is preferable to allocate extra budget to the survey quality improvement rather than allowing for larger samples. In this respect, face-to-face interviews were considered the more appropriate methods given the objectives of the TRUST research. Although, limitations always arise and in future more attention should be devoted to issues such as the interviewer bias and the risk of socially desirable, or acceptable, responses.

A sample size of between 250 and 400 units per country provided acceptable levels of relative sampling error for the TRUST survey given the budget constraints. On the basis of the above consideration, the adopted sampling method was Random Location Sampling, which provides a country-representative subdivision into locations; the locations were selected randomly across potential locations and accounted for a nationally representative sample (e.g. probability of extraction proportional to population). The sampling unit was the household and the respondent the person responsible for the actual purchase of food.

The descriptive statistics mainly suggest that television advertising is the least trusted source of information across all countries, on average. This lack of trust in information providers is followed by political groups, processors, government and magazines. Trust in information from food chain actors loses relevance, but remains an important reassuring factor. Information provided by public authorities has a differentiated impact, depending upon the country. The most trusted information sources across all countries are on average doctors and other health authorities, National Food Safety authorities, university scientists and consumer organisations. The EFSA is not as trusted as the national authorities. However, the effect of trust in authorities and independent sources of information can be reversed through higher education levels.

The results of the segmentation analysis suggest that it is possible to obtain three different groups of consumers who have different degrees of trust in food safety information from different sources:

a) "Non-trusters", especially wary towards independent sources,
b) "Mixed trusters", characterised by distrust in food chain actors and trust in independent sources, and
c) "Trusters", which especially rely in information provided by food chain actors and less in media.

This confirms the mixed degrees of European consumer confidence in their country's information providers' ability to deal with food safety crises and further suggests that communication strategies should be country-specific and take into account the cultural differences rather than socio-economic and demographic characteristics of the households.

The causal model estimation and results reported in Chapter 5 support the general findings presented in this Chapter and make further policy relevant recommendations.

Appendix 4.1.
A methodological note on sample size determination

A list of all the households residing in each of the five countries would be necessary in order to have a pure random sampling technique. However, as discussed below, practical and economic reasons usually lead to the formulation of stratified and/or

multi-stage sampling techniques, as this allows to increase the precision of the estimates with respect to simple random sampling, being sample size the same.

A desirable sampling frame should ensure a perfect correspondence with the population of interest. Hence, administrative sources (e.g. registry offices) would be preferable, even if there is no guarantee that the lists are updated and complete. An easy alternative is the telephone book, which involves several risk of inconsistency with the chosen population.

A key issue in the TRUST survey planning is to gather detailed information about the population list, so that a proper sampling can be arranged. Provided that an appropriate sampling frame is available, a sampling technique is selected with the following objectives:

a) to obtain a representative sample
b) to obtain an acceptable precision given the budget constraint.

Two alternative sampling designs are discussed in this Chapter, in order to provide the basis for discussion and selection of the most suitable sampling method for the TRUST project: (a) simple random sampling; (b) stratified sampling.

Sample size varies according to the desired level of the sampling error, the population size, and the variability of the target variable(s) in the population. However, a major constraint is usually given by the available budget and the trade-off between additional precision and marginal costs should be explicitly taken into account.

The classic solution to this problem in sampling theory (Cochran, 1977) consists in defining a cost function and a variance function.

The cost function for the TRUST survey is defined as follows:

$$C = c_0 + c_1 n \tag{1}$$

where c_0 are the fixed cost, c_1 the variable costs (per interview) and n is the sample size to be estimated.

The variance function is specific to the chosen sampling method and expresses the variability of the sample estimates as a function of the sample size, the population size and the variability of the target variable in the population.

Some further simplifying assumptions are needed before to proceed to the sample size computation.

Despite having a wide range of variables to be measured in order to answer to the research questions, most of the questions will be asked on a 7- items Likert scale. This means that we can safely assume that the maximum standard deviation for the population mean value is 3 (this is the value corresponding to the maximum dispersion). Instead, if we take into account the maximum standard deviation for a proportion, this can be fixed at 0.25.

Simple random sampling
The basic choice involves simple random sampling on the population list. For a given sample size $n_0 = (C-c_0)/c_1$ simply computed from (1) as the maximum size achievable for a given budget C, the variance of the sample estimate of the population mean is given by the following equation:

$$Var(\bar{x}) = \sigma_{\bar{x}}^2 = \left\{ 1 - \frac{n_0}{N} \right\} \frac{S_x^2}{n_0} \tag{2}$$

where $S_x^2 = \dfrac{\sum\limits_{i-1}^{N}(x_i - \bar{x})^2}{N-1}$ is the population variance of variable X.

This can be converted into a relative precision measure by assuming a normal distribution for the mean estimate:

$$\Pr\left\{ \left| \frac{(\bar{x} - \bar{X})}{\bar{X}} \right| \geq r \right\} = \alpha \tag{3}$$

where r is the level of relative sampling error, $\bar{X}$ is the population mean and α is the level of confidence. From (3) it follows that r can be computed as (Cochran, 1977):

$$r = \pm \frac{t_{\alpha/2} S_x}{\sqrt{n}\, X} \sqrt{1 - \frac{n}{N}} \tag{4}$$

where $t_\alpha/2$ is the critical value from the student-t distribution.
Likewise, one may compute the sample size (hence the cost) for a given sampling error level through (Cicchitelli *et al.*, 1992):

$$n_0 = \left(\frac{V_0}{N^2 S^2} + \frac{1}{N} \right)^{-1} \tag{5}$$

where V_0 is the desired variance for the sample mean estimate. An approximation in terms of relative error is given by (Cochran, 1977):

$$n_0 = \left(\frac{t_{\alpha/2} S_x}{r X} \right)^2 \tag{6}$$

For the cases when a proportion is concerned, equations (4) and (6) become respectively (7) and (8):

$$r = \pm t_{\alpha/2} \sqrt{ \frac{1-p}{p \cdot n_0} \left(1 - \frac{n}{N} \right) } \tag{7}$$

$$n_0 = \frac{t_{\alpha/2}^2 (1 - p)}{r^2 p} \qquad (8)$$

where p is the (estimated) population probability, or – in our case – the probability corresponding to the maximum population variability (i.e. p=0.5).

Stratified sampling

The stratified random sampling involves the stratification of the population into H strata, where N_h is the size of stratum h in the population and n_h is the sample size in a stratum, with h =1,…,H. Here we assume proportional stratified sampling ($n_h/n = N_h/N$).

Assuming that both the cost per unit c_i and the population variance are the same across the strata, the variance and the relative sampling error for a given overall sample size are identical to the case of simple random sampling. The same holds true for the estimation of a proportion.

However, as sample means and proportions will probably differ if the stratification variable is related to the target variable and stratification is reasonably expected to lead to smaller variance, it can be shown that stratification improves the precision of estimates (Barnett, 1974). If knowledge on variability within different population strata is available (e.g. after a pilot study), then the allocation of the overall sample size across strata can be computed through Neyman allocation (Cochran, 1977).

If the required sample size is computed conditional to a desired level of relative error r, an approximate measure of the sample size for large population is given by:

$$n = \frac{S_{\bar{x}}^2 t_{\alpha/2}^2 N}{r^2 N + S_{\bar{x}}^2 t_{\alpha/2}^2} \qquad (9)$$

where (9) is also valid for proportions, provided that the variance $S_{\bar{x}}^2$ is substituted with $p(1\text{-}p)$.

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5. Role of trust and risk in consumer food choice: The SPARTA model

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Abstract

This paper explores the role of trust in food safety information in determining consumer choice in relation to socio-demographic effects and other determinants. We propose a modelling framework which extends the Theory of Planned Behaviour to account for risk perception and trust and allows for country-specific effects. The model is tested on the impact of salmonella information on chicken consumption choices across five European countries, France, Germany, Italy, Netherlands and the UK, based on a nationally representative survey for a total of 2,725 face-to-face interviews. Results show that no relationship emerges between socio-demographics variables and the trust placed by consumer in food safety information, although country differences are relevant. The findings also suggest that the policy priority should be on building and maintaining trust in food and health authorities, and research institutions.

Keywords: *food consumption, food attitudes, theory of planned behaviour, ordered probit.*

5.1. Introduction

There is considerable empirical evidence that different consumers respond to food risk communication in different ways. This implies that policymakers and food firms cannot rely on a single strategy for informing the public of an emerging food risk. Furthermore, the impact of food safety information varies significantly according to the sources who provide it.

The multiple food scares that have hit the European markets in the last decade led to the creation of the EFSA, with the responsibility of setting up a rapid alert system and managing communication in event of a food crisis. A growing body of research investigating the factors that determine consumer response has been developed to provide some scientific basis to the EFSA tasks. However, the issues surrounding information processing and the subsequent food choice in a situation of increased risk perception – hence increased levels of involvement, are too varied to be applied at EU level.

While no univocal evidence is available for determining the role of socio-demographic characteristics in processing food safety information and reacting to

reactionary news, European-wide scares such as the 1996 BSE scare have clearly shown that the country effect is important. According to Faostat data[1], 1997 beef consumption levels in the UK are now only 1.7% lower than in 1995, while in Italy per capita consumption fell by 3.9% and in Germany by 7.4%, regardless of the fact that cases of BSE in Italian and German cows were absolutely negligible as compared to the UK. Again, there is no unique explanation for these cross-country differences. Media communications were different in each country, for example while in most European countries the focus was on the animal disease, the German media put more emphasis on the potential links between BSE and the related human variant, Creutzfeld-Jakob Disease. Secondly, social networks and the preferred sources of information are diverse across EU countries. A third relevant factor which is likely to differ across countries is the level of trust that citizens have in institutions, the media, scientific bodies and other potential sources of food safety information.

The aim of this paper is to explore the complex interactions between all of the above factors, with a cross-cultural EU case study on the impact of salmonella information on chicken consumption choices in five European countries, France, Germany, Italy, Netherlands and the UK, based on a nationally representative survey for a total of 2,725 face-to-face interviews.

5.2. Framing the factors behind consumer response: The SPARTA approach

The strategy behind the model introduced in this paper is framed within the Theory of Planned Behaviour (TPB) (Ajzen, 1985 and 1991), which has proved to be a successful analysis tool for a range of behaviours, often associated with risky or health-related actions such as smoking, risky driving, physical activities and exercise, or contraception (see Conner *et al.*, 2003 for an extensive list of applications). The TPB framework has also been widely applied to food choices e.g. Cook *et al.* (2002) investigate consumer attitudes to GM foods, while Dennison and Shepherd (1995) explore adolescent food choice. In another study which looks closely at the impact of information on consumer choice, McEachern and Schröder (2004) investigate the effects of value-based meat labelling on purchasing intentions. The implications of applying the TPB model to different countries are discussed in Kalafatis *et al.* (1999), who analyse the intentions of purchasing environmentally friendly products in the UK and Greece and find that their determinants have a different weight in the two countries.

The TPB framework, devised from the Theory of Reasoned Action (TRA), (Ajzen and Fishbein, 1980), defines human action as a combination of three dimensions, behavioural beliefs, normative beliefs, and control beliefs. Behavioural

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[1] Cf. http://www.fao.org.

beliefs (i.e. beliefs about the outcome of the action), produce either a positive or a negative attitude towards behaviour; normative beliefs refer to subjective norms or perceived social forces; and control beliefs lead to perceived behavioural control. All these produce intentions to behave (Ajzen, 2002), a pre-determinant of behaviour.

Attitudes to behaviour are noted as being principally different from the broader concept of attitude towards an object. For example, one may like chicken (an attitude to chicken), yet choose not to purchase chicken because of a specific dietary requirement. Subjective norm is a concept based on how one "should" act in response to the views or thoughts of others. Subjective norm influences may include friends, family members, colleagues, doctors, religious organisations, etc. Perceived behavioural control can be described as "the measure of confidence that one can act" (East, 1997), for example one may not be able to purchase chicken if it is not available.

Integrating risk perception and trust into the TPB framework and considering the influence of different individual (or household) characteristics leads to the development of the SPARTA approach. The acronym SPARTA comes from the initials of the global variables used to explain behavioural intentions:

- subjective norm (S),
- perceived behavioural control (P),
- attitudes (A),
- risk perception (R),
- trust (T),
- alia, other variables, e.g. socio-demographics, psychological and cultural (country-specific) characteristics, which may lead to shifts in the weight of the above global variables (AL).

The interaction between these components can be expressed pictorially in Figure 5.1, noting that the relationships hypothesised in this model between risk perception and trust can be tested statistically within the SPARTA framework. Three modelling levels are identified: (1) global variables (S, P, A, R, T) relate to their specific determinants (beliefs, risk factors and trusted sources); (2) the level of interaction between the global variables is quantified; and (3) intention to purchase (ITP) relates to the global variables obtained. The influence of different consumer characteristics (AL) is investigated by allowing the relationships estimated in level (2) and (3) to vary as a function using them as shifters of the behavioural parameters estimated in level (2), as discussed more in detail in the methodology Section.

Chicken was chosen as the product to be investigated in the survey as it is a widely consumed food across Europe and it is not usually associated with high risks despite being potentially subject to a number of hazards. A further reason is that chicken consumption is not as sensitive to food safety concerns as beef following the BSE crisis, hence it is expected to be more representative of standard food safety issues and consumption behaviour.
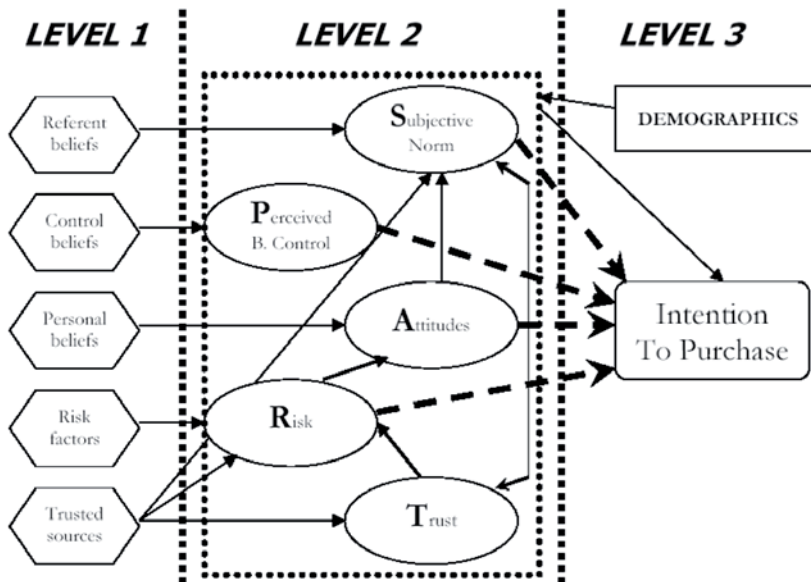
Figure 5.1. The SPARTA modelling approach

5.3. Methodology

A nationally representative survey based on probabilistic area sampling was conducted in five countries (UK, Italy, Germany, the Netherlands and France) in May 2004 on 2,725 respondents as face-to-face, in-home interviews. The sampling unit was the household and the respondent the person responsible for the actual purchase of food. The questionnaire took approximately 30 minutes to complete with "prompts" on certain questions from the interviewer when required by the respondent. Data were subject to a 10% validation. The questionnaire was based on the SPARTA model specification. The questions were built following the TACT (target, action, context, time) guidelines discussed in Ajzen (2002).

The behaviour of interest is purchasing fresh or frozen chicken in the week following the interview. Since the survey does not allow a check on actual behaviour, the intention to do so was measured on a 7-point Likert scale, from extremely unlikely (1) to extremely likely (7). Global variables such as attitudes, subjective norm and perceived behavioural control were elicited (a) directly through a seven-point Likert Scale and anchored with a corresponding statement and, (b) indirectly through a set of specific questions to identify their sub-determinants (following previous research, e.g. East, 1997; Cook *et al.*, 2002). Each respondent was also asked to identify up to three specific chicken attributes considered to be most relevant when deciding whether to purchase chicken. This allows us to take into account the issue of saliency, as it is recognised that in normal circumstances consumers take into account only a small number of product characteristics in choosing food products (East, 1997). Questions

measuring perceived risk were adaptations of previously used questions (e.g. Slovic, 1992), again posed as 7-point Likert scales. The trust questions were measured as 7-point Likert scales based on a set of food safety information sources in relation to the risks of salmonella in food. A second behavioural intention was included in the questionnaire to check for the impact of a food scare. The respondents were asked to state their purchasing intentions (again on a 7-point Likert scale) assuming that they had just discovered, by reading an article in the newspaper, that high rates of salmonella in chicken had been found in their area, leading to the hospitalisation of several people.

Applied studies based on the TPB have used a variety of methods for estimating the relationship between behavioural intention and its determinants. Most articles (e.g. Conner *et al.*, 2003; Kalafatis *et al.*, 1999) rely on structural equation modelling, rather than multiple linear regression (Povey *et al.*, 2000; Shaw and Shiu, 2002; Tonglet, 2001) or tobit regression (Lynne *et al.*, 1995) when the data are censored. Cook *et al.* (2002) base their estimate of a TPB model on an ordered discrete choice model. The ordered probit model is used for estimating the third level of the SPARTA model, i.e. relating purchasing intentions to the global determinants. Given that we measure behavioural intentions with a 7-point Likert scale, standard multiple regression is not applicable. As the dependent variable is discrete, nominal, ordered and non-continuous, the ordered probit model is appropriate (Liao, 1994). This model belongs to the class of discrete choice probability models widely used in the analysis of attitudes, behaviours and choices and the likelihood of their occurrence. The ordered probit model is estimated by the BFGS (Broyden-Fletcher-Goldfarb-Shannon) maximum likelihood algorithm in the LimDep package. Two main outputs can be produced: estimates of the coefficient for the ordered probit equation, i.e. the relative weight of each intention determinant, and a table of marginal effects. The latter measures the change in probability for a given value of the dependent variable induced by a unit change in one of the determinants. The marginal effects tables are not shown in this paper, but are available on request from the authors.

Two other statistical methods are employed within the overall SPARTA modelling strategy: simultaneous equations modelling and principal components analysis. A simultaneous equations model is employed in the second level of the analysis, since endogeneity (feedbacks) among the dependent variables is recognised. A consistent and asymptotically efficient estimator for the coefficients in this model are provided by three-stage least squares (3SLS). The model satisfies the order and rank conditions that ensure proper identification. Principal components analysis (see e.g. Duntemann, 1989) is needed for obtaining the latent trust determinants as discussed in Chapter 4.

5.4. Results

Trust

The level of confidence in the information provided by different sources was measured by the following question: "Suppose that each of the following has provided information about potential risks associated with salmonella in food. Please indicate to what extent you would trust that information" and the answer was measured on a

7-point Likert scale from "completely distrust" to "completely trust", where 4 is the neutrality point and explicit non-responses were allowed. Table 5.1 reports the means of the trust measures by country.

The level of trust in information is generally high, above the neutrality threshold for all but a few sources, namely information provided by processors (especially in France), television adverts (less in Italy and the UK) and political groups (especially in France, less in UK and the Netherlands). On average, doctors and health authorities are the most trusted source of information (5.99), although Germans and French show the highest degree of confidence in consumer organisations.

Table 5.1. Trust in food safety information

Source	Country					
	UK	Italy	Germany	Netherlands	France	Total
Shopkeepers	4.64	4.72	4.48	4.54	5.01	4.69
Supermarkets	4.99	4.73	4.54	4.49	4.48	4.64
Organic shop	5.27	5.08	5.27	5.14	5.30	5.21
Specialty store	5.12	4.05	4.91	5.28	5.70	5.01
Farmers / breeders	5.07	4.67	4.90	4.56	5.56	4.97
Processors	3.95	4.01	3.90	3.97	3.00	3.74
Doctors / health authority	6.24	5.91	5.98	6.08	5.78	5.99
University scientists	5.53	5.92	5.77	6.04	5.58	5.77
National authority in charge of food safety	5.80	5.60	5.98	6.01	5.62	5.79
Government	4.39	4.29	4.67	5.36	3.90	4.50
Political groups	3.55	3.33	4.04	3.98	2.89	3.52
Environmental organisations	4.86	4.78	5.41	4.51	4.84	4.86
Animal welfare organisations	4.50	4.69	5.34	4.40	4.67	4.70
Consumer organisations	5.22	5.58	6.02	5.72	5.91	5.69
EU authority in charge of food safety	4.62	5.52	5.54	5.41	4.97	5.21
Television documentary	4.96	4.84	5.26	5.05	4.87	4.98
Television news / current affairs	5.17	5.15	5.55	5.39	4.79	5.19
Television adverts	4.18	3.56	3.25	3.04	2.95	3.38
Newspapers	4.53	4.87	5.33	4.97	5.01	4.94
Internet	4.54	4.34	4.77	4.82	4.25	4.54
Radio	4.86	4.56	5.35	5.00	5.13	4.97
Magazines	4.55	4.28	4.81	4.39	4.48	4.49
Product label	4.81	5.19	4.48	5.01	5.50	5.03
Average	*4.89*	*4.78*	*5.03*	*4.93*	*4.80*	*4.88*

While it should be noted that there is a very high degree of consistency across items (which leads to an overall Cronbach-Alpha of 0.92), Principal components analysis is

a helpful tool to identify the latent trust components, i.e. the groups of sources which tend to attract a similar level of trust (or distrust). Five components with eigenvalues larger than 1 were extracted as it was discussed in Chapter 4. The PCA results identify five groups of sources that are the targets of consumer trust or distrust. A cluster analysis is then applied to the component scores to identify homogeneous groups of consumers with respect to the level of trust in these sources. The three identified clusters are: truster, mixed truster and non truster and their profiles are described in Chapter 4.

One result is particularly striking: the three clusters are practically identical in terms of demographic characteristics. In other words, no links emerge between the level of trust in food safety information and socio-demographic variables. Instead, some difference emerges when looking at the cluster distribution across the five countries. The UK has the highest percentage of trusters and distruster and the lowest of mixed trusters. The distrusters group is also relevant in Italy and France, and Italy has also the lowest portion of trusters. Germany and the Netherlands have high percentages of mixed trusters.

Level 1: The SPARTA determinants

The last step consists in obtaining the statistical estimates for the SPARTA model described in Figure 5.1. The average values for the model variables are shown in Table 5.2. These variables were built by aggregating the questionnaire items in step 1 according to the expectancy-value formulation by Fishbein and Ajzen (1976).

Table 5.2. Average values of variables in the SPARTA model

Country	UK	Italy	Germany	Netherlands	France	*All sample*
Behavioural determinants						
Subj. Norm	3.85	3.66	3.54	2.62	3.01	*3.33*
PBC	4.08	3.51	3.69	4.41	3.22	*3.76*
Attitude	6.14	6.06	5.60	5.82	6.00	*5.94*
Risk perception	1.88	2.62	3.48	2.77	2.36	*2.60*
Average trust	4.89	4.78	5.03	4.93	4.80	*4.88*
Trust in information provided by different sources						
Mass-media	-0.11	-0.17	0.23	0.02	0.04	*0.00*
Food chain	0.19	-0.08	-0.19	-0.18	0.35	*0.00*
Experts	-0.22	0.04	0.03	0.26	-0.17	*0.00*
Organisations	-0.15	-0.16	0.37	-0.23	0.14	*0.00*
Vested interest	0.21	0.12	0.03	0.17	-0.60	*0.00*
Behavioural intentions						
Standard purchase intention	5.57	5.00	4.85	4.94	4.49	*4.97*
P.I. after salmonella scare	3.41	2.53	2.88	2.87	2.80	*2.89*
% change (average)	-22.52	-40.89	-30.48	-11.69	-5.53	*-21.58*

It is worth noting the characteristics of the overall sample and some country specificities. The TPB determinants and the purchasing intentions are measured on a 1-7 scale, 4 being the neutrality point. This means that on average, the average respondents has a high likelihood of purchasing chicken in the week following the interview (especially in the UK, less in France) and that the attitude towards buying chicken is very positive (with the highest value again in the UK). The subjective norm (i.e. the referent beliefs) have a marginal impact and are close to neutrality, although in the Netherlands and in France it would seem that the average referent belief has a slightly negative influence towards purchasing chicken. Perceived control on behaviour is also neutral on average, while risk perception is low and average trust in food safety information is above the neutrality threshold. Trust in information is measured through standardised principal components scores, so positive value indicate trust above the sample average. This means that average trust in mass media is higher in Germany and lower in Italy, while food chain actors are especially trusted in France and the UK. The same countries have less trust than others in experts' opinions on food safety (this includes governments). Consumer, animal welfare and environmental organisations are especially trusted in Germany and France, less in other countries, while France has a much lower confidence in information provided by those with a potential vested interest, i.e. processors and adverts, political parties, etc. Finally, it is interesting to notice that the wider impact of a (potential) salmonella scare is measured in Italy (where intentions to purchase fall by 41%) and Germany (-30%). This result is consistent with the reaction to beef purchases in these countries after the BSE news, as compared to the rest of Europe, and, at least in the case of Italy, it is consistent with the sharp drop in consumption triggered by the avian flu epidemic.

Level 2: Interaction among determinants and demographics

The second step consisted of estimating a simultaneous equations system for evaluating the strength and direction of the relationships between the global variables, i.e. attitudes, subjective norm, perceived behavioural control, risk perception and trust. The number of endogenous relationships was determined in order to ensure proper identification and the overall R-square for the overall model varied between 0.15 and 0.21. Table 5.3 shows the results for the aggregated sample and at a country level.

The results reported in Table 5.3 highlight some relevant relationships and some differences across countries.

The subjective norm, i.e. the relevance of referent beliefs, is positively influenced by trust in food safety information from all sources. This means that those who have a higher degree of confidence in information provided by external sources, also rely on their referent beliefs more than others. No clear demographic influences emerge. This is consistent across countries. As shown by the estimated intercepts, attitudes towards buying chicken are very high in all countries. These attitudes are negatively related to risk perception, as expected, but the influence of risk perception is weaker in UK and Italy. The presence of children in the household increases attitudes on average (especially in France), while larger town sizes are associated with lower attitudes. The most interesting equation is probably the one relating risk perception to trust in food safety information. On average, there is a negative association between risk perception and trust in information provided by the food

Table 5.3. Interaction among global variables

	All sample	UK	Italy	Germany	Netherlands	France
R-square	0.15	0.16	0.18	0.20	0.17	0.21
Subjective norm						
Intercept	0.67 *	2.03 *	-0.66	1.75 ***	0.52	3.47 ***
Attitudes	0.41 ***	0.25	0.62 ***	0.24 ***	0.36 ***	-0.15
Trust in media information	0.29 ***	0.28 ***	0.25 ***	0.51 ***	0.35 ***	0.22 ***
Trust in food chain information	0.15 ***	0.25 ***		0.40 ***	0.18 **	0.20 ***
Trust in expert information	0.11 ***			0.17 *	0.19 **	0.26 ***
Trust in alternative information	0.27 ***	0.49 ***		0.38 ***	0.22 ***	0.21 ***
Trust in "vested interest" information	0.36 ***	0.30 ***	0.55 ***	0.34 ***	0.34 ***	0.25 ***
Age	0.11 ***	0.17 *			0.12	
Education						0.14 ***
Kids					-0.26 *	
Income		0.06	-0.13 *	0.15 **		
Town	0.10 *		0.55 ***			
Attitudes						
Intercept	6.48 ***	6.35 ***	6.77 ***	6.22 ***	6.75 ***	6.48 ***
Risk perception	-0.21 ***	-0.06	-0.07 *	-0.24 ***	-0.23 ***	-0.18 ***
Age		0.14 **				
Education		-0.09 *				
Kids	0.16 ***					0.24 **
Income		0.07 *		0.10 **	-0.06	
Town	-0.09 **	-0.13 *	-0.37 ***		-0.18 *	-0.21 ***
Risk perception						
Intercept	3.02 ***	1.72 ***	2.57 ***	3.44 ***	3.74 ***	2.51 ***
Trust in media information		0.22 ***	-0.22 ***			
Trust in food chain information	-0.29 ***		-0.25 ***		-0.15	-0.33 ***
Trust in expert information	-0.10 **	-0.13	-0.23 ***	-0.22 **		
Trust in alternative information	0.16 ***	0.22 ***	-0.40 ***		0.22 **	0.27 ***
Trust in "vested interest" information				-0.23 **		0.12 *
Education	-0.09 ***				-0.20 **	
Kids			0.30			
Income					-0.14 **	
Town	-0.10 *	0.18 *				
Trust						
Intercept	-0.44 ***	-0.54 ***	-0.38 **	-0.42 ***	-0.46 ***	-1.03 ***
Subjective Norm	0.17 ***	0.16 ***	0.11 ***	0.17 ***	0.22 ***	0.37 ***
Age	-0.04 ***	-0.09 ***				
Education			0.10 ***		-0.04	-0.04 *
Kids						
Income				-0.04 **		
Town	-0.06 ***		-0.21 ***			

Note: *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. The following instrument were employed to estimate the system: the direct measures of the global variables, a simple average of the risk factors and the trust components

chain or by expert sources, while trust in information provided by "alternative" sources such as consumer or animal welfare organisations tend to increase risk perception. Risk perception is lower in larger towns and for higher education levels. However, there are relevant country differences. For example, the model, when applied to Italian respondents, shows negative signs for all trust coefficients, which implies that those who trust food safety information in Italy have on average a lower risk perception.

Finally, the overall level of trust in food safety information is related to subjective norm and demographics. Again, a positive link between trust in food safety information and subjective norm is shown. In general trust seems to (marginally) decrease with age and town size, although demographics are hardly relevant in most countries. This confirms the previous finding that trusting food safety information is unrelated to socio-demographic characteristics.

Level 3: Purchasing intentions

Our final step consists of estimating the ordered probit equations relating purchasing intentions to the SPARTA model determinants. The model was estimated separately for the three clusters of respondents allowing for a country-specific intercept. Both behaviours of interests were investigated, the standard likelihood of purchase and the likelihood of purchase conditional on news about a salmonella incident. Results are shown in Table 5.4.

Table 5.4. Determinants of purchasing intentions by trust segment (ordered probit estimates)

	Determinants	Standard situation			Salmonella scare		
		Non-trusters	Mixed trusters	Trusters	Non-trusters	Mixed trusters	Trusters
C	UK	-0.97 ***	-0.39	-0.78 *	-1.08 ***	-0.32	-0.37
	Italy	-1.22 ***	-0.97 **	-1.16 ***	-1.49 ***	-1.03 **	-0.67 *
	Germany	-1.40 ***	-0.86 *	-1.15 ***	-1.16 ***	-0.61	-0.30
	Netherlands	-1.36 ***	-0.71	-0.89 **	-1.20 ***	-0.36	-0.61 *
	France	-1.46 ***	-0.97 **	-1.47 ***	-1.14 ***	-0.85 **	-0.66 *
S	Subjective norm	0.02	0.03	0.02	0.09 ***	-0.01	0.02
P	Perceived behavioural control	0.11 ***	0.07	0.07 *	0.11 ***	-0.02	-0.03
A	Attitude	0.36 ***	0.32 ***	0.40 ***	0.13 ***	0.20 ***	0.20 ***
R	Risk perception	-0.01	0.06	0.00	-0.03	-0.09 **	-0.12 ***
	Chi-square	142.45 ***	45.30 ***	94.71 ***	67.42 ***	54.49 ***	51.39 ***
	Log-lik	-1,721.43	-878.96	-1,202.22	-1,835.71	-870.73	-1,355.25
	Correct pred.	0.32	0.27	0.33	0.43	0.44	0.36
	Correct pred. (three categories)	0.60	0.59	0.72	0.61	0.66	0.62

Note: *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level.

In a standard situation, and holding other determinants constant, the intercepts show that "Non-trusters" are the least likely to buy chicken, whilst "Mixed trusters" (i.e. trusting mass media and experts but less the other sources) are, on average, more likely than "Trusters" to purchase chicken. Attitude is the main determinant for all groups and has a stronger effect on "Trusters". Perceived behavioural control has a lower impact, while subjective norm is not significant in any of the clusters.

More indications can be found by comparing the standard situation models with those assuming a salmonella food scare. If one considers the group of "Non-trusters", while most of the determinants (including intercepts) change only marginally, attitudes lose a major part of their weight, while the subjective norm becomes significant and almost as relevant as attitudes. This could suggest that in the case of a food scare, "Non-trusters", who rely on referent beliefs, are less likely to reduce consumption, emphasising the relevance of social networks, specifically for this group. For "Mixed trusters" and "Trusters", the loss of relevance of attitudes is slightly less prominent, but risk perception has an increased impact. In facts, "Trusters" and "Mixed trusters" are on average less affected by the scare as compared to their non-trusting counterparts, especially if they have positive attitudes. The impact is more relevant for those who declare higher perceived risks even in the standard situation.

The fit of the models is acceptable and becomes relatively good if behaviours are classified into three categories (unlikely to buy, neutral, likely to buy) reaching values between 59% and 72% of correct predictions.

5.5. Discussion and conclusions

The complexity of factors influencing the way a consumer processes food safety information makes it difficult to develop adequate risk communication strategies. This is, however, a priority for current European policy and this paper tries to answer some key questions: (1) Can the consumer be segmented into socio-demographic groups in relation to their trust in food safety information? (2) Are country and cultural differences relevant in the way food safety information is processed? (3) How do risk perception and trust in food safety information influence food choice in relation to other determinants? (4) How does a food scare alter the weight of these determinants? (5) How do information sources differ in terms of how they impact on consumers' risk perception and behaviours? To provide some answers to the above questions, this paper suggests a modelling framework based on an extension of the Theory of Planned Behaviour, the SPARTA model.

The empirical work discussed in this paper, based on a survey of 2,725 face-to-face interviews across five European countries, and on the theoretical framework of the Theory of Planned Behaviour, provides some answers. While the survey and the questionnaire focus on a single product – chicken – in order to guarantee consistency in consumer responses, we expect that the implications of the results can at least be extended to other fresh food products with a low risk perception.

A first major result is that no relationship emerges between socio-demographics variables and the trust placed by a consumer in food safety information. This finding appears to be robust as it manifests from both the segmentation analysis (consumer that differ in terms of sources they trust do not show relevant differences in terms of demographics) and the behavioural modelling (only a few socio-demographic variables are statistically significant and they are not consistent across countries). There are major implications for this outcome, as it would suggest that the impact of food safety information depends on the source and its reliability, rather than the individual characteristics of the consumer processing it.

Risk perception is directly affected by trust in information provided by the food chain, by experts and by alternative sources such as consumer, environmental and animal welfare organisations. In general, information from experts and food chain actors reduces risk perception, while information provided by alternative sources tends to increase it. This however depends on the (positive or negative) content issued by these sources. Hence, a successful risk communication strategy should start from the consideration that people significantly differ in terms of the sources they trust but this is unrelated to characteristics such as age, education, income, etc.

On the other hand, the survey results and the subsequent modelling efforts place emphasise that within Europe there are relevant differences across countries. Germans place more trust in mass media and alternative sources than other countries, while Italians are the least predisposed to trust these same sources. The British trust the EFSA and other scientists to a lesser extent and the French and British place a higher degree of trust in information provided by food chain actors. Furthermore, trust in food safety information does not necessarily influence risk perception in the same direction. In all countries, except Italy, those who trust alternative sources tend to have a higher risk perception. This suggests that risk communication strategies should be country-specific and take into account the cultural differences rather than socio-economic and demographic characteristics of the households. Consequently, while the performance of the SPARTA model is satisfactory when allowing for country-specific effects, the application shows that the effects and interactions of behavioural determinants may vary significantly within the EU.

Results also show that risk perception is unlikely to affect consumer choices when there is no related food scare, although when there is a scare the intention to purchase is affected by differing levels of risk perception. Again, this depends on the trust characteristics of the consumer. Those who have less trust in food safety information, independently by the source, tend to be less sensitive to risk perception and rely more on their social network. Those who are most inclined to trust information from any source are the most sensitive to changing risk perception levels, but those who have a mixed trust attitude also react significantly to changing risk perceptions. These two groups have a relatively high level of trust toward experts in common (i.e. food standard, safety and health authorities, scientists) which gives these sources a key role in communicating risk especially considering that this survey has shown that these sources are the most trusted across all five countries. A key priority should be to build and maintain trust in food and health authorities and research institu-

tions. Furthermore, the communication of risk through these sources should be privileged as they seem to have easier and broader access to a wide range of consumers, independent of their personal characteristics.

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6. A SIMULATION PROGRAM FOR ANALYSING SOCIAL DIFFUSION OF TRUST AFTER A FOOD SAFETY INCIDENT

Volker Saggau, Claus-Hennig Hanf, and Paolo Patelli

ABSTRACT

The Chapter investigates consumer behaviour in risky markets with reference to the case of food scares. Risk perception, trust and the role of the media are investigated by using agent-based modelling. A multi-agent simulation is implemented to analyse the impact of different information strategies released by the media, defined as risk communication strategies. These strategies are evaluated by the recovery of the aggregate trust of an artificial consumer population. Artificial consumer agents follow a Bayes' rule to update the trust in a supplier of the food item under observation by considering food safety information released by the media. The multi-agent simulation is then used to derive implications for risk communication strategies.

Keywords*: food crises, agent-based models, risk communication, information.*

6.1. INTRODUCTION: CONSUMER RESPONSE TO FOOD SCARES
– A MULTI-AGENT SIMULATION

Human beings live in a world of uncertainty, facing various risks every day. In the long run, these risks influence trust. Information can reduce uncertainty and risks, and thus ensure trust. The media pass information to consumers, which face consumption decisions within the food market every day.

This Chapter investigates consumer behaviour within risky markets, especially in the case of a food scare, using a multi-agent simulation.

These risks are manifold, from negligible risks up to perilous individual risks. People participate in various different markets. These markets are also characterised by uncertainties. Incomplete information about quantities, qualities and price developments make future-oriented planning difficult. Competition concerning resources leads to strategic behaviour which is abundant. The resulting dynamics bear risks in the sense of uncertainty for everyone.

Human beings as consumers have to decide about consumption every day. The single is responsible for his single household whereas the parents, mother or father, the one who is doing the every day shopping, is responsible for the children and for the entire household. Children trust their parents that they keep

care of them. Consumers or purchasers have to trust that suppliers and producers are reliable. Hence risk and trust are somehow interconnected and influence each other and both influence the behaviour of the individuals and the consumers (see Chapters 3 and 5).

Information is one important mean to reduce risk and uncertainty. Today there is an immense amount of information present so that each individual can find its own personalised information package – theoretically. In former times information was scarce, now, due to the information overload, it is the consumer's, respectively the listener's attention that is scarce. Thus this effect leads to an increase of uncertainty. Hence the problem is that, on the one hand, too little information cannot decrease uncertainty, on the other hand, too many information leads to an increase of uncertainty.

Uncertainty can also be found in the food market. This kind of risky market is relevant to every individual since food consumption has to be done by everybody. This is a very sensitive area of risky markets. The case of food scares is combined with a high degree of uncertainty of the consumers. This uncertainty is influenced by food safety information released by the media. Germany was for a long time officially declared free of BSE. But in the winter 2000/2001 when the first cases of BSE infected cows was discovered in Germany, the country went into a national BSE-crisis. The market for beef broke down and whole herds of cattle were culled if only one BSE infected cow was discovered. The survival of many farmers was challenged. The politicians in charge made quick and momentous decisions and initiated actions to cope with the crisis at the same time. The media spread increasing numbers of alerting news and they also triggered a discussion regarding the overall safety of food. The uncertainty of the consumers increased and as a reaction to this health risk which was not assessable by them, they changed their buying and consumption behaviour at least in the short-term. The appearance of BSE in Germany was followed by massive economic consequences which were noticeable in the economic markets as well as in politics (Egenolf, 2004).

Consumption decisions of consumers, risky markets and the media as the sources of information are strongly interconnected. They form a complex system. A recent interdisciplinary research approach which is highly engaged in the investigation of complex economic phenomena is called "econophysics". The idea of this research direction is to combine physical research methodologies – especially simulation techniques – with economic and social research fields. Some economic and social phenomena are viewed to have similar characteristics with physical phenomena, which in turn are investigated in the field of complex systems research. Economic research is linked to people and their behaviour in economic decision situations. It is closely related to social sciences where human beings and their relations and networks are in the focus of the investigations of researchers. The network aspect and the collective social behaviour is a domain of social sciences whereas economic research is more engaged in topics like decision finding and making.

In recent time, networks also became of more interest for economic research. This is due to the fact that decision makers faced problems which became more

and more complex – also because of the development of information technology within the last decade. Network effects become increasingly important. One example of econophysics is the application of simulation methods to investigate economic phenomena. The decision makers can be modelled as artificial agents in a network. They are connected to several other agents which more or less influence the decision making process. The agents act at the individual level but they are influenced by reciprocal network relations. The entire system has a non-linear behaviour which seems to be a collective behaviour governed not by one single "market maker" but by the sum of individual actions. If researchers want to investigate the behaviour of such complex systems it is reasonable to choose an agent-based approach. This approach offers the possibility to reproduce and analyse patterns which can be observed in the real world. Agent-based modelling is a technique which was used in physics to investigate the behaviour of multi-particles or to analyse research questions in thermodynamics and which is now adopted by econophysics and social sciences.

The aim of this Chapter is to investigate consumer behaviour in risky markets, especially in the case of food scares. Risk perception, trust and the role of the media are investigated by using agent-based modelling which is illustrated in the next Sections.

6.2. THE THEORETICAL FRAMEWORK OF THE SIMULATION MODEL

The multi-agent simulation software is designed to model the diffusion of food safety information within the artificial consumer population and their impacts on trust and demand after a food safety incidence. Hence, it offers the opportunity to illustrate the variability of trust in the course of time and can provide valuable information about the recovery process of trust and the time that has to elapse before pre-incidence sales are recovered.

As depicted in Figure 6.1, the simulation software comprises three interdependent spheres. These are firstly a set of n individual consumers who more or less frequently decide whether to adopt of not a specific behaviour (to buy or not to buy). These decisions are based on a general decision framework based on the Theory of Planned Behaviour (TPB) by Ajzen (1991) considering the special features of the agent's affiliation to a consumer group, the current state of the agent's information about food safety and risk, and the corresponding trust in food chain actors. Secondly, the n individual consumers are summarised into a demographic network and into social networks in which they exchange information about food safety issues. Finally, a set of m media agents that supplies the consumers' network with either positive or negative information about the food under investigation is introduced. The impact of information on consumers is assumed to depend on their addressees, that is their position within the network, and the media's trustworthiness represented by the specific network weight of the information source (the media agent).
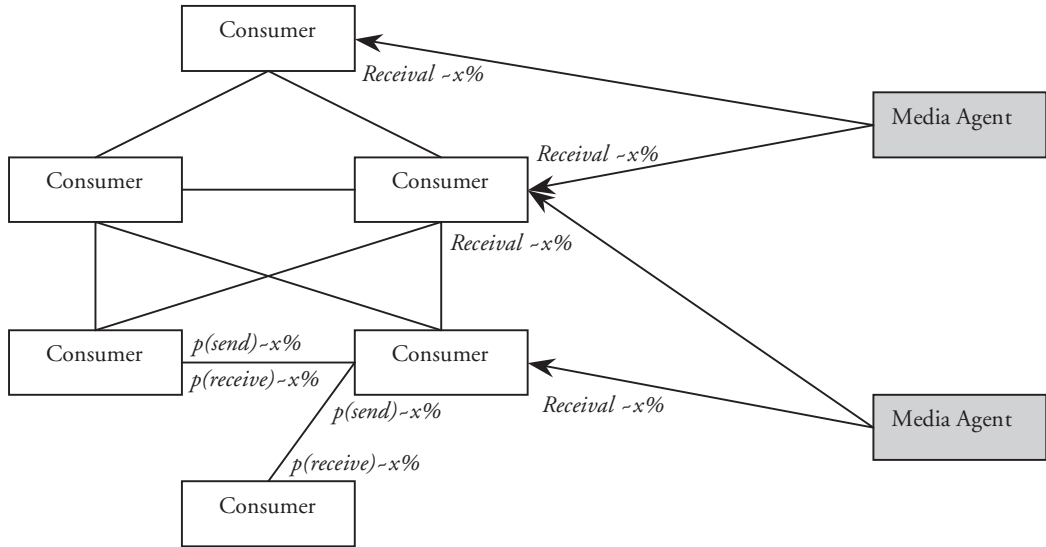
Figure 6.1. The distribution of food safety information within the demographic network and the social networks

Within the network part of the model, it is determined which consumers receive new information about the risk and safety of the investigated food.

The task of consumer agents is to translate this information into trust and ultimately to make a buying decision. Hence, these artificial consumer agents must have been constructed in such a way that they are able to accomplish these tasks. As the transformation process certainly varies from person to person, the artificial consumer agents had to be modelled so that they can correspond in their structural and behavioural characteristics to different consumer segments.

The multi-agent simulation in this case is a computer program. More precisely, it is an object oriented code written in Java where a certain number of repeated interactions between parts of the program generate a complex systems structure.

6.3. Model building

The modelling started with the construction of an economy which consists of an initial population of agents. There are primary agents like consumers and auxiliary agents which often represent different social and environment objects, e.g. media agents.

First the initial state of the economy has to be specified, i.e. the agents will be equipped with their initial attributes. These attributes are type characteristics, internal behavioural norms and internal information about themselves and other agents like the network connections.

The development of the economy unfolds by interaction and updating of internal states of the agents, i.e. updating the trust value for a specific good or supplier. The

simulation model adequately reflects the development of trust or distrust within a population of consumer agents after a food safety incident occurred.

6.3.1. The networks and the information sources

The model consists of several networks which serve as information sources for the agents (Saggau and Patelli, 2004). There are decentralised and centralised networks. Both types of networks serve as information sources for the agents. The decentralised networks are social networks which again are several networks like the demographic network or friend's networks. These networks are endogenous, i.e. the information processing is endogenous whereas the centralised networks are exogenous in the sense of spreading information exogenously via the artificial consumer population. They spread the information from one single information source via the population of agents.

An initial population of consumer agents provides the basis for the simulation. They are connected to the networks. They communicate information about the safety of food and their own trust regarding this food item.

There can be two or three kinds of social networks differentiated. Each network serves as an information source for the agents. The networks are differentiated by unique identifiers so that the information sources are well known to the agents.

In the demographic network each agent of the population finds its place in a family structure. The demographic network consists of three generations: the grandparent generation, the parent generation and the children generation. The agents are consistently assigned to this network, i.e. the family relations are kept, and there are no inconsistent states (see Figure 6.2).

The demographic network can be varied by changing three parameters: the population size, the average number of offspring in the second generation and the average number of offspring in the third generation.
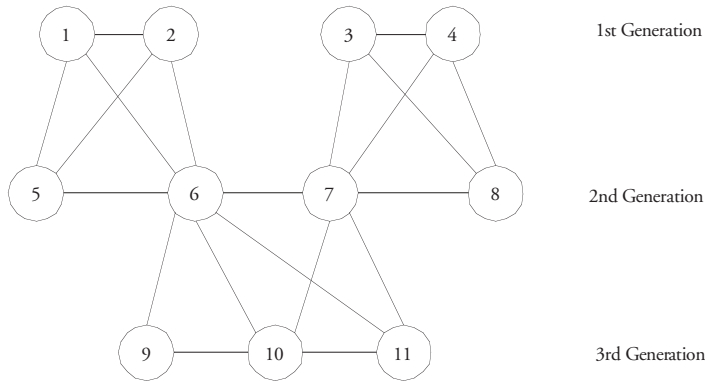
Figure 6.2. Demographic network

The population size determines the size of the adjacency matrix which will be used as the connections matrix. This connections matrix is quadratic and the size corresponds to the number of agents in the population. This matrix will initially be filled with zeros. The zeros change to one when the generations will be set up and only if the connections are determined. During this phase the initial parameters for the agents will be set.

The size of the first generation is given by the population size divided by the product of the average number of the 2nd and 3rd generation. The size of the second generation is the product of the first generation and the average number of children per family in the second generation while the size of the third generation is given by difference.

The "marriage" in the first generation will be done by an algorithm which overwrites the zeros in the connections matrix by a one if two partners are found. In the next step another algorithm generates the offspring of the first generation and connects this second generation with the first generation. The marriage in the second generation is a little bit more complicated the reason being that it has to be excluded that there are no brothers and sisters marrying each other. Finally the grandchildren have to be included into the family structure, i.e. the third generation will be assigned to the second generation.

All these connections will be done in one adjacency matrix by overwriting the zeros with ones. In this way the demographic network will be set up whilst the agents will be initialised and assigned to the network.

Furthermore, each agent can also be part of a friend's network. These are random networks that are not determined like the family network, i.e. each agent randomly receives a variable number of links which connects him to agents that are no family members. The members of these social networks are again the members of the agent population, which already form the family (demographic) network. The connection to other agents can be chosen differently. It's possible to choose between different distributions of the links to the friends.

The uniform distribution for example sets up a connection matrix where the number of connections results from the product of the average connections and the population size. An algorithm then sets up the connections matrix according to the uniform distribution. Figure 6.3 shows a possible structure of this network.
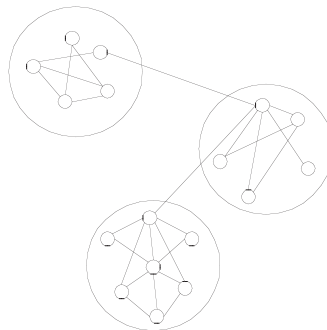

Figure 6.3. Social networks

Agents can be related in groups, that is clusters, where the nodes or agents are interconnected in a bidirectional way. Some agents have links to agents which are outside their own cluster and belong to another cluster. In this way the friend's networks can be created.

Colleague's networks are technically similar, but they have a different weight in the information processing of the single agent, depending on the weight of the network. Both of these networks have a unique identifier so that the agents exactly know where their information comes from. The centralised networks can be shops, media, the government, etc. (see Figure 6.4).
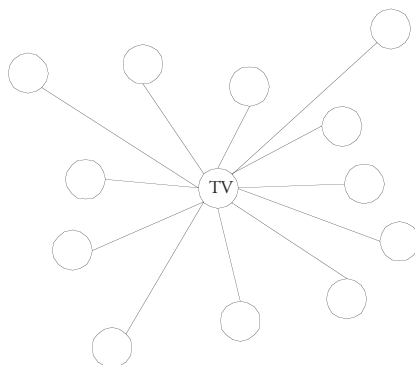
Figure 6.4. Centralised networks

There is a differentiation between global and segment centralised networks. In the global centralised networks each agent receives a message which is released by these information sources. Conversely, the segment centralised networks are just segment specific and segment exclusive. Media agents are newspapers, television, internet and radio. Television and Internet are global centralised networks whereas newspapers and radio can be either global or local or segmented depending on the definition adopted by the user.

Each centralised network also has a unique identifier. The information release distribution is a time related distribution – one iteration is one day.

The user can choose between different media sources. Depending on the media source the data from the survey (mainly weights of information sources for different population segments) will be loaded into the active run of the simulation.

The segment centralised networks refer to specific segments of the population. The data analysis of the TRUST survey (see Chapter 4) identified three segments: "Trusters", "Mixed trusters" and "Non-trusters". For these three segments a cross country comparison was made, i.e. the five EU countries (UK, Italy, Netherlands, France and Germany) have different sizes of the segments.

The population of consumer agents will be assigned to the segments according to the respective percentage distribution.

6.3.2. The agents

The consumer agents are the core elements of the multi-agent simulation. They are responsible through interaction and communication for the results of the simulation runs.

> "An agent is a system that tries to fulfil a set of goals in a complex, dynamic environment. An agent is situated in the environment: it can sense the environment through its sensors and act upon the environment using its actuators".

> (Maes, 1994, p.2)

This statement also comprises, on an abstract level, the consumer agents in this multi-agent simulation which are interconnected in networks of other agents and media agents.

Starting point is an agent who maximises his expected utility. Böcker and Hanf (2000) have investigated consumer response to food scares. They have proposed a model of individual information processing which is based on a two step risk perception process. They capture differences in the reliability between single types of suppliers by subjective failure probabilities. And then trust in an individual supplier J is defined as the subjective probability that he is the reliable one (P_J):

a) probability of supplier J being of Type A who is supposed to be reliable: P_J;
b) probability of supplier J being of Type B who is supposed to be unreliable: $1\text{-}P_J$.

The aim was to analyse the effects of incorporating trust in a consumer's risk perception on food purchase decisions. Böcker and Hanf use a Bayes' rule for this purpose where the Bayesian updating is carried out by revising trust in a supplier of a potentially unsafe food based on new food safety information. It is assumed that consumers apply decision rules which are based on experience as well as on personal and mass media communication (here modelled by the different types of networks in which the consumer agents are situated). These aspects are supported by satisfactory results until the agents receive a signal which is strong enough to make them revise their prior beliefs or established decision rules. Thus the subjective probability of purchasing a hazardous unit of a certain product is given by[1]:

$$P_G = P_J P(G \mid A) + (1 - P_J) P(G \mid B) \qquad\qquad (1)$$

where $P(G|A)$ and $P(G|B)$ are respectively the conditional probability of receiving a hazardous unit given the type of supplier.

It is assumed that the purchase decisions of consumer agents depend on four parameters: the utility from a safe unit of a certain product (U_X^+), the subjective probability to purchase a hazardous unit of that product (P_G), the subjectively presumed disutility from consuming a hazardous unit of that product (U_X^-), and the expected utility from consuming a substitute which is perceived to be safe (U_Y) with ($U_Y < U_X^+$).

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[1] With $P(G|A) < P(G|B)$ and $P(G|A) + P(G|B) < 1$.

The consumer agent only buys and consumes the product if its expected utility is higher than the expected utility of the substitute, under consideration of the possible disutility of a harmed product X:

$$(1 - P_G)U_X^+ + U_X^- P_G > U_Y. \tag{2}$$

Further, the artificial consumer agent responds to information about risk and safety of the product. Positive or negative information regarding food safety changes the subjective probability that the agent relates to purchasing a hazardous unit of this product. For this updating of the prior subjective probability, the Bayesian updating is employed. Böcker and Hanf have implemented a two step risk perception process. The scenario can be described in the following way:

> "One or more units of X sold by J have caused health problems or J has violated health regulation and the consumer K learns about that either through personal experience, personal communication or media reports" (which will actively be done in the multi-agent simulation model). "He now revises his prior belief about the reliability of J according to Bayes' rule to the posterior probability P_{PJ}. This is the conditional probability of the state 'J is of type A' after having observed the event 'X is unsafe'".
>
> (Böcker and Hanf, 2000, p.476)

In this case the Bayes' rule for negative information was implemented. And the second step is that:

> "Now K observes the event 'X is safe' – once again either through personal experience, personal communication or media reports. He revises his confidence in supplier J, with the posterior probability P_{PJ} entering the Bayesian revision process as the new a priori probability. The result is the posterior probability P_{PPJ}, which can also be interpreted as the conditional probability of the state 'J is of type A', after having observed the two consecutive events 'X is unsafe' and 'X is safe'".
>
> (Böcker and Hanf 2000, p.478)

In this case the Bayes' rule for positive information was implemented. The trust updating mechanisms *(revised trust in supplier J)* is thus given by:

a) initial negative information:

$$P_{PJ} = \frac{P_J P(G \mid A)}{P_J P(G \mid A) + (1 - P_J) P(G \mid B)} \tag{3}$$

b) subsequent positive information:

$$P_{PPJ} = \frac{P_{PJ}(1 - P(G \mid A))}{P_{PJ}(1 - P(G \mid A)) + (1 - P_{PJ})(1 - P(G \mid B))} \tag{4}$$

"Confidence is always – at least partially – regained: $P_{ppj} > P_{pj}$ always holds, however, trust is not fully restored".

(Böcker and Hanf, 2000, p. 478)

Differently from the Böcker and Hanf model, this multi-agent simulation uses the Bayes' rule as a reinforcement learning instrument for the agents which is similarly used in artificial neural networks. This updating rule leads the consumer agents to revise their trust based on new information which comes in each iteration of the simulation as an input form the information sources of the agents. The trust P_J will always be assigned the new P_{PJ} value after each revision so that there is no more a two step risk perception process but a permanent updating until the end of the simulation, i.e. each day the trust will be revised according to the news which are around in both network types – the exogenous and the endogenous. Hence if the aggregated information value is positive then the positive updating will be selected which now looks like (5):

$$ P_{PJ} = \frac{P_J\left(1 - P(G \mid A)\right)}{P_J\left(1 - P(G \mid A)\right) + \left(1 - P_J\right)\left(1 - P(G \mid B)\right)} \qquad (5) $$

After each updating P_J will be assigned the value of P_{PJ} so that P_J can enter into the next revision process $P_J \leftarrow P_{PJ}$. This allows for a permanent updating based on daily news releases of media agents. Hence the dynamics of information release distributions or strategies can be investigated based on these mechanisms.

A further extension of the Böcker and Hanf model is the possibility to work with heterogeneous agents in the sense of different risk attitudes and different trust levels. Furthermore, each agent participates in at least one network, the demographic network, but can also belong to other networks. So that, on the one hand, network effects can also be analysed and, on the other hand, the agents act under bounded rationality conditions, since they have different status of information. Each consumer agent is registered in the networks it belongs to. It can go through the networks and ask for information. Additional to the basic model there is the possibility to "see" how other agents behave in risky situations in the sense of registering the changes in the information states of the related agents which serve as the basis for the direction of the trust updating.

6.3.3. Updating algorithms and micro data of the simulation model

The updating of the information value which is the basis for the trust revision is guided by a number of updating algorithms. The updating algorithms allow for the differentiation between different information sources, i.e. the differentiation between the type of the network, the media source (credibility and influence), the intensity and the range of the information release. Information sources in centralised networks like media have far

more influence regarding the aggregate outcomes than a single information source in a single social network but on a micro level the single connections are also relevant.

The micro data of the multi-agent simulation model come from an EU-survey which was accomplished in the TRUST project. The SPARTA model developed in Chapter 5 is derived from the TPB. This model is based on socio-economic differences across the population dependent on classification of trust in information. Chapter 4 describes five information categories based on a principal component analysis which are (1) trust in media information; (2) trust in food chain actors; (3) trust in public authorities; (4) trust in independent organisations and (5) trust in alternative sources. These trust values serve as the weights for the information sources regarding the information weighting. Furthermore they have performed a segmentation analysis based on the TRUST survey data. It categorises consumers into three distinct "trust groups" (1) "Non-trusters"; (2) "Mixed trusters" (those that are neither particularly trustful nor distrustful); and (3) "Trusters". These segments are implemented in the multi-agent simulation and can be addressed by the segment specific information sources. The model offers the possibility to assign different trust values to the three identified consumer segments. Together with the standard deviations of the segmented trust values the system assigns normal distributed trust values around the mean value of the respective segment to each single agent.

6.3.4. Intensity of information releases

The multi-agent simulation works with numerical information values hence the information regarding the safety of food has to be shaped as a numerical value. The reason for this technical issue is that the consumer agent needs to know which updating shall be performed, the negative trust revision or the positive trust revision. This means that the choice about which of the two equations for the Bayesian updating (1 or 2) has to be implemented is based on the updated and aggregated information value.

The range for the information values released by either the centralised media agents (exogenously) or the agents in the networks (endogenously) is between -1 for negative information and 1 for positive information. These are the highest values for both directions. The smaller the values for either directions or say the absolute value, the weaker is the intensity of the information release. Besides the weighting of the information sources this is a second way of weighting the information.

The intensity of the information can be influenced in different ways. If a centralised information source like a local newspaper for example should release information then the intensity of the information is probably less than the intensity of the information release from the television, e.g. for positive information – local newspaper may weight 0.5 and television 0.8. Another example within the same centralised information source can be 0.6 for the news reportage at the prime time and 0.3 for the news reportage in the afternoon for the television information source.

With this variety of information release possibilities and the possibilities for the shaping of different information distribution scenarios, information strategies can be produced and tested with respect to the aggregate outcomes.

6.3.5. Information updating and trust revision

The weight of one network can be interpreted as a proxy for the importance of this information source among the agents. The higher the weight for the information source, the higher is the influence of it with respect to the trust building process of the agent. The empirical data from the TRUST survey regarding trust in different information sources will feed into the multi-agent simulation. They are the weights for the different centralised information sources.

The updating of the information value for each consumer agent follows an algorithm: each agent $i \in \{1, 2, 3, ..., n\}$ collects the information values of its neighbours $C(i)$ in his networks and also the information values of the centralised information sources. Then he computes the mean information value v. This will be done for each network, i.e. asking the family, asking the friends from the social networks and asking the information values from the centralised media agents. Each aggregated information value from each network in which the agent is present will be weighted with its corresponding weight, then the mean of these weighted information values will be assigned to the updated information value of this agent. This will be done for every agent (Figure 6.5).
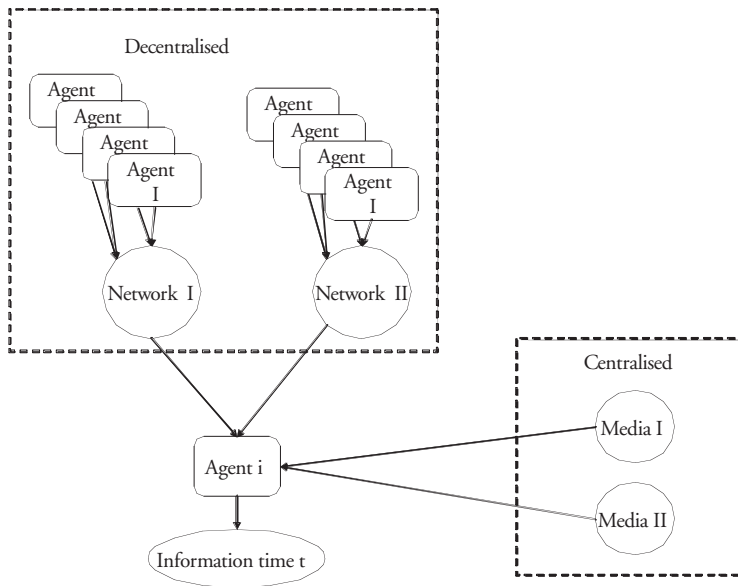
Figure 6.5. Information collection

Thus, each iteration begins with information collection followed by trust updating according to a two step process:

Step 1 – Information collection and processing

In each time step the agents collect information from their neighbours, i.e. from the decentralised information sources and also the agents collect information from the centralised information sources (media, government, etc.).

Step 2 – Bayesian updating

After the information collection the agents update their P_J according to Bayesian updating (see above). The old P_J enters into the equation and revises P_J which is the next P_J value which will enter in the following updating and so on.

The aggregation rule for the information aggregation is closely related to the aggregation of weights of the information sources. Each agent permanently updates his information status in the time horizon of the simulation run. The updating of the information status results in the aggregation of only one information value (*newInfoValue*). This is necessary because this is the decision parameter for the trust revision. Based on this information value, i.e. positive or negative information value, the trust value Pj will be updated according to Bayes' rule – more trust or less trust compared to the previous trust value. For this reason the agent has to aggregate and weight the information values of the information sources, i.e. he forms a new opinion based on the information collection regarding the safety of the food item and the trust in the supplier. Each information source $h \in \{1, 2, ...k\}$ (family, friends, media etc.) has its own information status and a network weight and is registered in the connection list of the respective agent. Both values will be asked by the updating agent. The information values and the network weights will then be multiplied and summarised ($\sum_k (inFoValues_h * weight_h)$). Additionally the network weights will be summarised ($\sum_k (weight_h)$). Finally the new information value of agent i (*newInfoValue$_i$*) will be computed:

$$newInfoValue_i = \frac{\sum_k (inFoValues_h * weight_h)}{\sum_k (weight_h)} \qquad (6)$$

The trust value will then be revised based on *newInfoValue*, i.e. if *newInfoValue* < 0 then the trust value will be decreased and vice versa. Since the agents permanently update the information status and subsequently the trust value there is a slight adaptation of the trust value following the information environment of the single consumer agent. This agent specific information environment results from the endogenous network connections of this agent and also from the news which comes from his connected media agents. Hence the information environment of each agent differs to a certain extend. However the agents are communicating and consequently they converge after a certain time.

6.3.6. Information strategies (information policies)

The impact of different information strategies on the development of the aggregate trust which in turn leads to the aggregate demand changes is the focus of the investigation. The aim is to evaluate different risk communication strategies; this will be done in Chapter 7.

Since we investigate food scares and the corresponding changes in the demand, we focus on information strategies starting with negative information releases, followed by positive information spread by stakeholders using the media.

The distribution of the information releases by centralised media can be chosen by the user of the simulation. Consider the example when centralised media agents spread negative information over the network or the population, i.e. the media reports about a food safety incident. As time goes on and the program iterates the communications steps, the intensity of the information release decreases following an exponential distribution. At a certain point in time – the breakpoint – the information release changes from negative to positive (e.g. it was discovered that the food is now safe). Positive information also follows an exponential distribution, beginning with a high intensity which decreases as time elapses (see Figure 6.6).
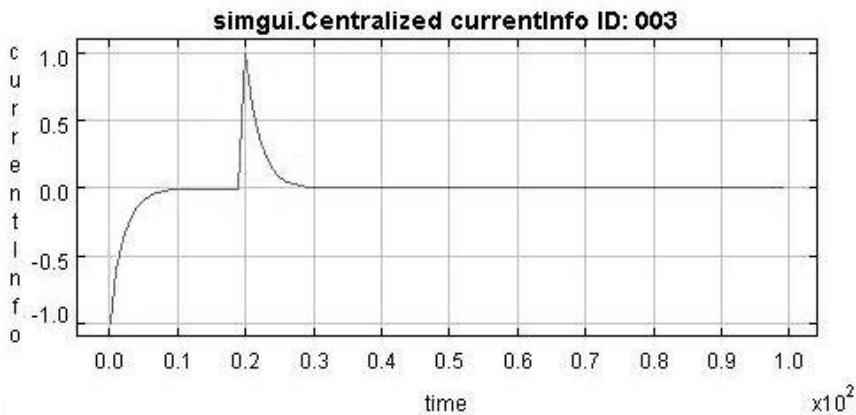
Figure 6.6. Information release strategy by media agent 3

The information release strategy is selected and parameterised by the user and is visualised by the simulation in an output graph. In the case illustrated above the information release distribution starts with an intensity of -1, i.e. a very strong negative news reportage regarding a food scare. In this example at day 10^2 this information source (the centralised media agent) no longer reports about this food safety issue. At day 30 this media agent reports that the food under investigation is safe, i.e. positive information again with strong information intensity (may it be in the television at prime time).

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[2] The time scale is the *x*-value times 102, e.g. 0.1·102=10.

The agents update their own trust value based on the new information from time to time randomly; they are equipped with the starting parameters heterogeneously.

On the aggregated level the development of the average trust value of the population emerge by taking the new information release into account at the micro level and by communicating and updating trust accordingly (see Figure 6.7).
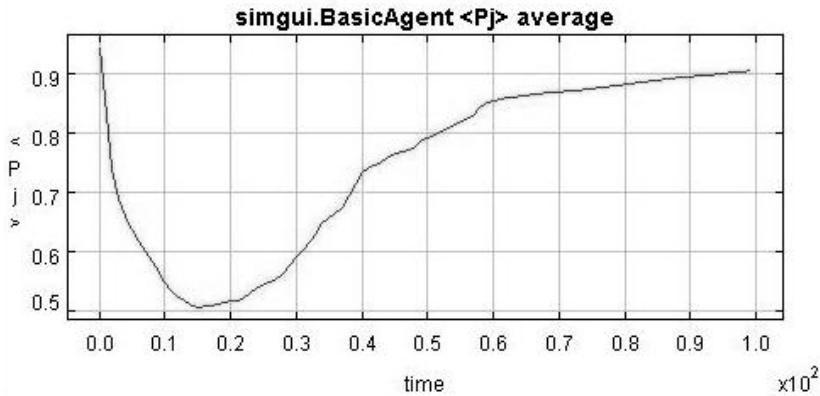

Figure 6.7. Development of the aggregated trust value of the consumer population after 100 days

This double exponential distribution of information releases is just one possibility among many others. The user of the simulation can implement self created information distributions and can also test information strategies by targeting specific consumer segments with information policies.

6.4. Model validation

The validation of a model implies that the behaviour of the model must be conforming to the behaviour of the targeted real feature. If a pattern is observed in reality then the simulation must reproduce this pattern. The model validation of this multi-agent simulation was based on a real world example of a food scare for which some data are available, that is the BSE crisis in Germany.

The BSE crisis was one of the most influencing cases of a food scare which brought about dramatic changes in meat demand. The idea behind the validation of this kind of multi-agent simulation is that there was a food scare, the media reported about this food safety incident (information distributions and diffusions) and demand changed significantly. Hagenhoff (2003) analysed how the impact of the media news reportage concerning BSE in the print media influenced the opinion of the population in Germany. She counted the number of articles regarding BSE for a representative number of German newspapers for the time of 1990 until 2001 (see Figure 6.8). With these data it is possible to display the distribution of articles (information releases) over this period. This distribution

was fed into the model to test how the artificial consumer population reacts in their trust behaviour. In this case trust serves as a proxy for demand.

Number of articles released by a representative number of newspapers (1990-2001)
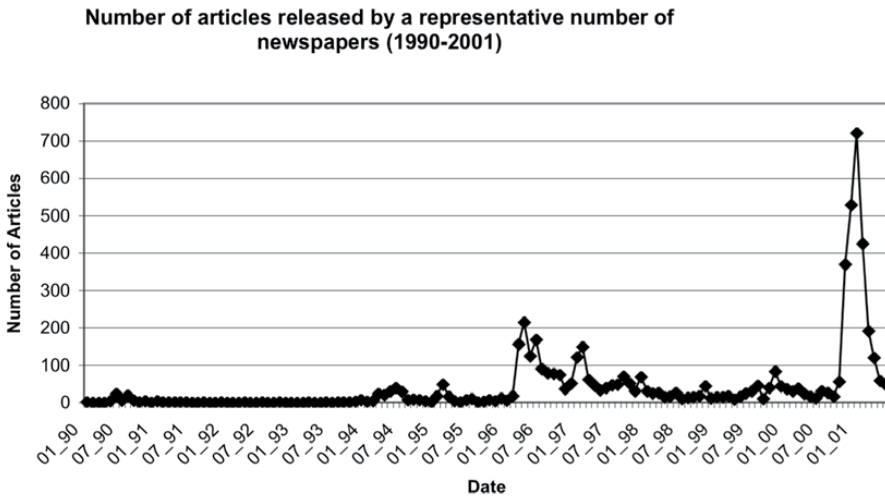
Source : Hagenhoff (2003)

Figure 6.8. Newspaper reportage concerning BSE

The output of the multi-agent simulation must be tested in order to validate the simulation. This means that the simulation model must reproduce the pattern which was observed in reality. The development of demand of beef in Germany for the same period serves as the pattern which should be reproduced by the multi-agent simulation.

In November 2000 the first case of a mad cow disease was discovered in Germany. The media reportage in the print media as well as in all the other media was immense. The shock for the population to face such a disease with its unknown incubation time and the result for the human being was sustainable. The minister of agriculture had to give up his position and also the ministry switched dramatically its focus from agricultural to consumer and food safety issues.

The demand of beef in Germany over the time from 1990 until 2002 was decreasing. The trend to consume less beef can be explained by the demographic change. There is an increasing number of single households who are consuming more convenience food which does not contain beef. But there is one sharp drop in the year 2000 which breaks temporarily the trend recovering back by the end of 2001. Right at that time the first mad cow was discovered in Germany. Based on the information released by the centralised media the demand in beef decreased rapidly after the food scare and recovered more slowly into the direction of the former level when time elapsed. This pattern in the consumption must be reproduced by the simulation given the information release distribution by the print media in Germany. The information release starts with negative information at the time of November 2000. In the following months the information about the mad cow disease increased rapidly until a peak was reached and subsequently decreased again in time.

Since there was no positive information during the first two months after the first discovered BSE case in Germany but only a decline in the number of articles as the crisis went on it is reasonable to choose an exponential distribution with only negative information values decreasing in time (see Figure 6.9).
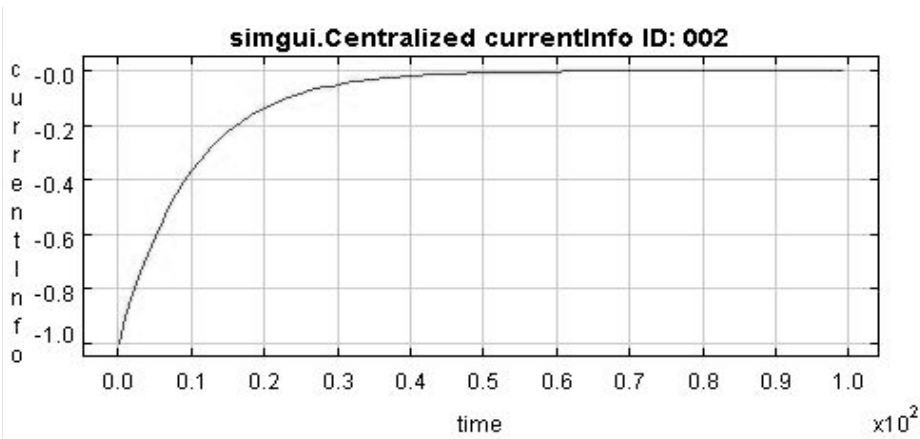

Figure 6.9. Negative news release simulation for BSE reportage (time: 100 days)

Figure 6.9 displays such a news release scenario: there are negative information releases each day. As time elapses the intensity of the information decreases (reasons may be less interest by the public or other more interesting news or information overload by the recipients of the information).
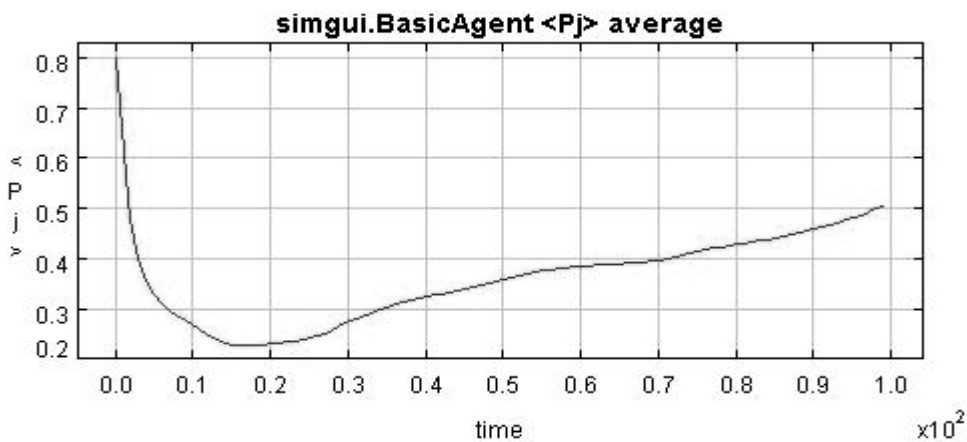
Figure 6.10. Average trust value – rapid decline in trust and slower recovery

The output, i.e. the aggregated P_J trust value, under this information scenario is displayed in Figure 6.10.

In this case trust is assumed as a proxy for the demand thus the pattern looks like the pattern of demand of beef in Germany in that time and under this information environment. The recovery of the trust respectively the demand seems to be consistent with the real data identified by Bruhn (2001) who stated that after seven months the discovery of the first mad cow in Germany the trust was nearly at the level from before this event. Seven months are approximately 210 days – Figure 6.10 shows approximately 50% after 100 days are recovered, if this development will be interpolated then the starting value will nearly be reached after seven months.

The pattern in Figure 6.10 is only one example of one simulation run but the pattern was always reproduced in the sensitivity analysis in a number of simulation runs.

The development of the trust value for each agent depends on the one hand on the updating algorithm (the Bayesian updating), on the other hand on various other factors. The agents are heterogeneous in their parameter equipment and in their network relations. They update randomly and not every day and this is one reason why the development of the individual trust values is different. No agent is fully informed, i.e. each agent is rationally bounded regarding the updating of trust and the decision making. This issue is the interesting point in this methodology of using a multi-agent simulation. Individually the behaviour of the agents is not always conforming but on the aggregate level, i.e. the macro level, the pattern which evolves seems reasonable.

6.5. Conclusions

Information strategies can be formulated as risk communication strategies. Chapter 7 investigates how different information scenarios influence the behaviour of the artificial consumer population. The model provides a tool to economically assess risk communication strategies. Depending on the form of the risk communication strategy, i.e. the duration of strategies, the segments addressed, the selected media, the shape of the information distribution, etc., the recovery of trust and consequently of demand can be a measure of the effectiveness of risk communication strategies.

Several simulation runs under controlled conditions have to be done in order to evaluate the different information strategies. A cost-effectiveness analysis of different risk communication procedures will be done in the next Chapter. A quantitative monetary measure of benefits will be provided by the outcome of the alternative communication strategies using the simulation model.

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7. Trust lost and regained: A welfare analysis of food risk communication strategies

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Abstract

Drawing on previous work on simulating the diffusion of information and consumption changes within an artificial agents society, an assessment of the magnitude of consumers' welfare losses due to needless avoidance behaviour is proposed, with an application to the Italian and UK poultry sectors. A demand shifter is added to simulate a food scare in the poultry industry. Following a one shot outbreak, alternative temporal patterns of consumption are generated in order to mimic the impact of different risk communication strategies (speed of centralised information shocks, type of media employed, intensity of information) on the speed of consumption recovery. Then, a "cost of ignorance" measure of welfare changes due to improved risk communication strategies is estimated taking into account both price and substitution effects that arise in a system of demands.

The main findings can be summarised as follows. As welfare loss arises because of misallocation of consumption and production, the less elastic the supply, the narrower the scope for consumption real-location, and consequently the lower the loss. Moreover, the simulated information campaigns show little differences across media and type of campaign although the pace of information release is important, given the structure of the hypothesised beliefs updating process. The reduction of the needless losses such as the one resulting from the performed simulation wouldn't generate benefits greater than the likely cost of the information campaign. However, it should be borne in mind that all simulations run for this work refer to a 10% drop in consumption at the heat of the scare. More dramatic drop would have cause higher losses and greater scope for welfare gains from risk communication policies.

Keywords: public health, risk communication, welfare analysis.

7.1. Introduction

The way in which consumers evaluate food safety and make food choices can change dramatically in situations of crisis such as those occurring in the case of a food scare (e.g. BSE) or a food poisoning outbreak (e.g. *E. coli*). The release of information about a food crisis is likely to cause a fall in demand for that food. Depending on the way governments and food industries react to the food scare through risk communication and depending on consumer trust in the risk information sources, demand will take a certain amount of time to re-adjust after the downturn following the crisis. As-

suming that objective risk will return to its pre-scare level, the speed of readjustment of demand determines the scale of misallocation of resources and welfare losses for both producers and consumers. In the case of a food scare or poisoning outbreak, both consumer trust in risk information sources and effective communication are likely to play a significant role in bringing back perceived risk to the "normal" level existing before the crisis occurred. Perceived risk, in turn, influences the way in which demand re-adjusts after the drop occurred as a consequence of the crisis.

Drawing on the work on simulating the diffusion of information and consumption changes within an artificial agents society (Chapter 6), this Chapter provides an assessment of the magnitude of consumers' welfare losses due to needless avoidance behaviour by simulating an hypothetical scare within the Italian and British poultry sectors.

The Chapter is organised as follows. The next Section is a brief review of the literature analysing models of risk information processing. Then we will discuss the analytical framework for assessing the welfare impact of changing risk perceptions on demand and the implications of imperfect risk information. In the next Section we provide an example of how welfare losses due to risk misperceptions can be computed from the standard data used to estimate demand curves, using poultry scares in Italy and UK as case studies. This framework is then used to perform a welfare analysis. Finally, some general conclusions on the impact of alternative risk information strategies on consumers' behaviour are drawn in the last Section.

7.2. Food scares, risk perception, and information

One of the main causes of demand shifts due to the occurrence of a food scare is the change in the perception of risk across consumers. Most papers that deal with demand shifts following a food safety crisis analyse risk information processing within a Bayesian learning framework either as a stand alone process or as a consequence of information flows mainly triggered by the media. In Böcker and Hanf's (2000) paper for example, consumers are Bayesian agents that update their prior beliefs about supplier reliability following news of product failure. Liu *et al.* (1998) and Smith and Johnson (1988) rely upon the prospective reference theory firstly proposed by Viscusi (1979) according to which ex post perceived risk is a weighted average of ex ante perceived risk and stated (or sample) risk estimates based on new information. Böcker and Hanf (2000) incorporate consumer trust in suppliers' reliability as a new variable in the Bayesian model describing the temporal updating of risk perceptions and then estimate the impact of risk perception changes on demand.

When information about a food crisis is first released, perceived risk suddenly rises and remains high even after the hazard has been removed or settled. Studies examining the impact of risk information on food purchases show that negative information released by the media has an immediate negative effect on sales, whereas positive media coverage does not seem to have any effect on sales (see, for example, Smith *et al.*,

1988). Liu *et al.* (1998), on the other hand, argue that it is not necessarily true that positive media coverage does not generate any effect on risk perceptions, but rather that the effect of positive information is likely to be delayed over time. Those authors argue that positive and trusted information "can help adjust the subjective risk down to the normal (objective) level". Conversely, distrust slows down the process by which risk perceptions return back to "normal" levels.

The type of information matters as well. Verbeke and Ward (2001) for example find that advertising had only a minor impact on meat demand in Belgium during the BSE scare with respect to negative media coverage. In the same vein, Herrmann and Thompson (2002) report that the negative press coverage on BSE largely offset a generic advertising program on Bavarian beef in Germany. Time can play a further role in the process of moving back to a state of normality, with the impact of information fading as time elapses (Kask and Maani, 1992).

Psychologists have also extensively studied changes in individuals' risk perceptions and the impact of media coverage on the formation of such perceptions. Although, parallelisms exist between models developed by economists and those proposed by other social scientist (see, for example, Liu *et al.*, 1998), this Chapter focuses mainly on economic approaches. For other approaches the interested reader may wish to refer to the extensive literature on social amplification of risk (see, for example, Kasperson *et al.*, 1988; Renn *et al.*, 1992; Burns *et al.*, 1993; Frewer *et al.*, 2002).

7.3. WELFARE MEASURES OF IGNORANCE

Several works have dealt with welfare losses due to incidental outbreak of animal disease (Mangen and Burrell, 2003; Mahul and Gohin, 1999; Herrmann and Thompson, 2002; Caskie *et al.*, 1999) or more generally to food contamination (Foster and Just, 1989; Swartz and Strand, 1981). In a recent survey (Pritchett *et al.*, 2005), the literature on the economic impacts of animal disease has been classified according to the scope of the analysis: producers, allied agribusiness activities, consumer, regional, national and international. Most of the welfare analysis on animal disease at the sector or national level focuses on producer costs or assess economy-wide losses (Mangen and Burrell, 2003).

To some extent the impact on market equilibrium of a food safety outbreak is similar to that of a generic advertisement program as it supposes a structural change in demand albeit of different sign (see, for example, Alston *et al.*, 2000 and the literature there quoted). Indeed, single or multimarket equilibrium displacement models are used in both cases (Piggott, 2003; Hermann *et al.*, 2002).

While the cited literature assesses the welfare losses resulting from deterioration of objective food safety, the focus of this work is on the misallocation of resources induced by biased perceptions about the level of safety (Foster and Just, 1989; Swartz and Strand, 1981). A first classification of welfare losses due to biased perceptions of food safety is provided by Swartz and Strand (1981) who classify losses as "unavoid-

able" and "needless". The former occurs when consumers are perfectly informed and their welfare is reduced by an objective lowering of some food safety index. The latter are due to imperfect information about the actual level of food safety so that resources are misallocated as consumed quantities are higher or lower than they would be if the consumer had perfect information (e.g. consumers avoid consuming food that is safe believing that it is risky). This type of loss deserves particularly attention, especially when risk communication policies need to be developed or assessed.

Swartz and Strand provide a measure of needless losses with reference to a case of seafood contamination in the USA. In the case investigated by the authors, consumers living in an area far away from the place where contamination occurred, incorrectly believe that the safety of seafood is jeopardised and reduce the level of consumption, thus incurring welfare losses. The welfare loss deriving from such erroneous beliefs is given by the difference between the total surplus area (given by the sum of consumer and producer surplus) under perfect information and the total surplus area under imperfect information as is depicted in Figure 7.1, where the higher curve (D^*) refers to the demand of safe food under perfect information, whereas the lower curve (D) refers to the demand in a situation of imperfect information.
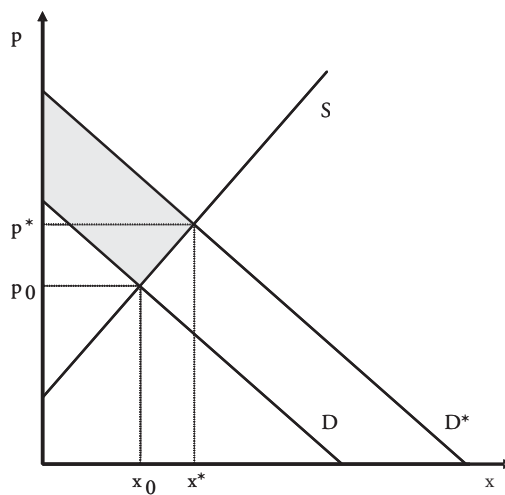

Figure 7.1. Welfare losses associated with demand shifts (according to Swartz and Strand, 1981)

However, the Swartz and Strand's measure seems to be affected by a sort of "bliss ignorance". To illustrate the problem we take into consideration the case in which a reduction in the level of food safety is underestimated by consumers. In this case, the welfare level in condition of ignorance could be higher than the measure obtained in the informed state (thus ignorance is bliss) as the demand curve would shift downwards when correct information were released. Foster and Just (1989) point out that a welfare measurement related to choices made under ignorance should be always referred to a perfect information state. Indeed, as soon as welfare is measured in a condition of perfect information it reveals that choices made under ignorance were

not optimal given the actual state of the world. Thus "ignorance is bliss only if the individual never learns the correct information" (Teisl and Roe, 1988, p.145).

This argument is shown in Figure 7.2 where θ^* represents the objective level of a safety parameter whereas θ is the subjectively perceived level of the same parameter. In the case of an improvement with underestimation of the safety level the observed demand curve D (function of price (p), perceived safety (θ) and income (m)) lies under the curve D^* that would be observed in condition of perfect information. Thus, the correct measure of needless welfare losses due to ignorance is given by the area between the informed demand and supply curve on the right of the (lower) quantity actually exchanged.
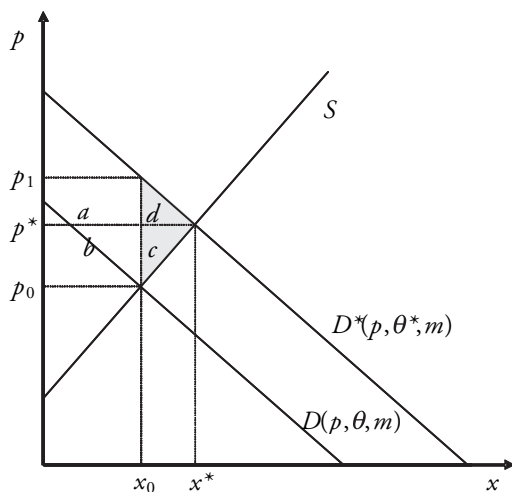
Figure 7.2. Welfare losses associated with demand shifts under full information

What makes the correct measure different from the previous one is that the demand curve under ignorance is no longer considered. The only economic variables that are relevant for the measure are the demand curve under perfect information, the quantity exchanged under ignorance and the corresponding price (x_0 and p_0), the price p_1 at which the quantity x_0 would be demanded under perfect information, and the new equilibrium quantity and price (x^* and p^*).

It is worth noticing that the shaded triangle represent the social losses resulting from the algebraic sum of consumer surplus changes ($+\ b-\ d$) and producer surplus changes ($-\ b+c$). Interestingly, while producers always experiences a real loss because under ignorance a low quantity is demanded, consumers may gain from the ignorance status even if considered under perfect information. Indeed, the lower quantity exchanged under ignorance causes a loss given by the shadowed triangle d but the lower price paid under ignorance (p_0) with respect to the perfect information equilibrium (p^*) gives rise to a gain equal to the rectangular area b. This is a "virtual" gain as it would be perceived only if consumer were fully informed, but

it is consistent with the assumption that all welfare measure should be taken under full information conditions. Apparently, previous works on the cost of choices made under ignorance (Foster and Just, 1984 and 1989; Teisl and Roe, 1998) missed this point because the measure of welfare they used simply considered a horizontal supply curve (see below).

A similar measure can be framed in term of compensating variation (CV) and compensating surplus (CS). Suppose that the objective level of food safety changes following the time pattern of the solid line in Figure 7.3.
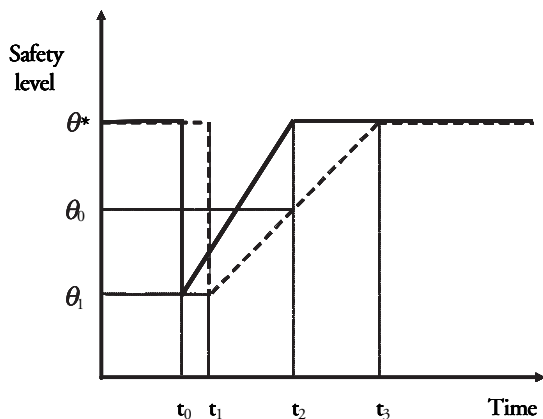
Figure 7.3. Subjective perception and objective level of food safety in a food scare

At time t_1 an outbreak causes a drop in the level of safety from θ^* to θ_1. As the government intervenes to solve the problem, the objective level of safety returns back to normality at time t_2. Now, let the subjectively perceived level of safety be represented by the dotted line in the same figure. As communication about the objective level of risk is not completely trusted, the perceived safety recovers to the initial level more slowly and lags behind the objective level for some time. For example, at time t_2 the perceived safety level is θ_0, still lower than the objective level θ^*.

Taking as reference the utility (U_0) at time t_2 with safety level equal to θ_0, the compensating variation for a change in safety from θ_0 to θ^* is given by:

$$CV = e\left(p,\theta^*,U_0\right) - e\left(p,\theta_0,U_0\right) \qquad (1)$$

where $e(p,\theta,U_0)$ is the minimum expenditure needed to attain utility U_0 at price p and safety level θ. If at safety level θ_0 the optimal consumption of food is x_0, then the compensating surplus for a change from θ_0 to θ^* is:

$$CS = e\left(p,\theta^*,U_0 \big| x = x_0\right) - e\left(p,\theta_0,U_0\right) \qquad (2)$$

where $e\left(p,\theta,U_0\big|x=x_0\right)$ is the constrained expenditure function indicating the minimum expenditure needed to attain utility U_0, given safety level θ, price p and consumption of quantity $x=x_0$. As the value of a constrained minimisation problem is never lower than the value of the unconstrained problem, $e\left(p,\theta,U_0\big|x=x_0\right)$ is greater than or equal to $e(p,\theta,U_0)$ and, consequently $CV \leq CS$, in absolute terms. In-tuitively, the welfare improvement related to a change of safety level from θ_0 to $\theta^* > \theta_0$ is lower whenever consumers are "forced" to consume the same quantity of food they consumed in the lower safety state. Thus they would pay a smaller amount of money to obtain the change with respect to the case when they are free to adapt their con-sumption (that is a smaller negative amount of money needs to be added to income in order to keep utility at the original level). Indeed, an improvement in food safety is likely to increase consumption of the safer food and the impossibility to exploit this opportunity lowers consumers' welfare gain.

The needless welfare loss in the case depicted above can be measured by the "cost of ignorance" (COI), a measure first developed by Foster and Just (1984 and 1989), given by the difference between CS and CV:

$$COI = e\left(p,\theta^*,U_0\big|x=x_0\right) - e\left(p,\theta^*,U_0\right). \qquad (3)$$

COI measures the welfare losses incurred by the consumers since at time t_2 they don't choose the optimal consumption level of food given the objective safety level θ^*. Rather, believing that safety level is θ_0 instead of θ^* they are likely to consume a lower quantity of food (x_0) giving raise to a needless welfare loss. Noticeably, meas-urement of welfare gains and losses takes place in condition of perfect information. That is, consumer welfare is measured under condition of improved information by comparing the consequence of informed actions with those of misinformed ones (i.e. consumption of quantity x_0). As it is difficult to empirically retrieve con-strained cost function, Foster and Just (1989) proposed the following alternative formula for the COI:

$$COI = e(p_1,U_0,\theta^*) - e(p_0,U_0,\theta^*) + (p_0 - p_1)x_0. \qquad (4)$$

Thus the COI measure is given by two components (Figure 7.4). The first is the area below the demand curve under full information condition (θ^*) between the two price lines corresponding to the actual price (p_0) and the price necessary to consume, under full information condition (p_1) the same quantity observable under ignorance (x_0). To calculate the COI the rectangular area given by ($p_0 - p_1$) times x_0 should be subtracted from the first component obtaining the triangular area depicted in Figure 7.4. As both x_0 and x_1 (the quantities consumed under ignorance and full information, respectively) are calculated at the same observed level of price (p_0), an infinite elasticity supply curve is assumed. On the other hand the measure depicted in Figure 7.2, apart from being framed in term of uncompensated demand curves, assumes an upward sloping supply curve.

It is easy to show that the Foster and Just measure is an upper limit of the actual COI when supply is not perfectly elastic. Indeed, in presence of a perfectly inelastic supply curve COI tends to zero as quantity exchanged is supply driven only and no misallocation can take place on the demand side.

Furthermore, the shaded triangle in Figure 7.4 represents the deadweight loss for the whole society rather than for consumers only. In the general case, consumption under ignorance always causes producer losses but may result either in consumer losses or gains depending on the elasticity of the demand curve. Thus misallocation of consumption shows also distributional effects.
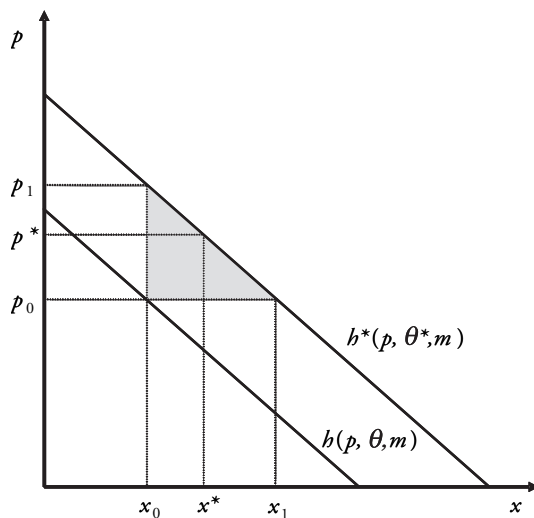
Figure 7.4. Welfare losses associated with demand shifts (according to Foster and Just, 1989)

7.4. METHODS

The modelling framework is made up by two components. The first consist of a multi-agent simulation model (Simtrust) designed to model the diffusion of trust in food safety information across an artificial society. The second is a simple partial equilibrium displacement model that calculates changes in consumer and producer surplus in the poultry sectors in UK and Italy. Only a brief account of the first model is given here (for details, see Chapter 6 and Saggau, 2005) followed by a description of the equilibrium displacement model and a summary of the welfare calculations.

7.4.1. Simtrust

Simtrust is an agent-based model whereby a set of n individuals (that are built as Java objects) update their beliefs about the safety of a food category (or about

the safety of food provided by a retailer or other agent) following a Bayesian like process. Beliefs are stylised as a single parameter (P_j) that represents the agent's subjective probability that a unit of a given food is safe.

Information about the safety of the food spreads across this artificial society in two ways. Firstly, a number of centralised information sources (such as TV news, newspapers, internet) makes public either positive or negative information about that food following a temporal pattern that specifies both timing and intensity of the information release. Each source is characterised by a degree of trustworthiness (at the society level actually a random variable identified by mean and standard deviation) which determines how the source is weighted within the updating process.

Secondly, each agent belongs to two types of network through which the information is spread by a sort of word of mouth process. Within the first kinship network each agent is placed in a family structure consisting of three interlinked generations. The parameters of this network are the means of the Poisson distributions used to sample the offspring in the second and third generation. The other network models the relationships among friends and colleagues. Differently from the previous one, this network is built by randomly assigning to each agent a number of links to other agents that are not members of the same family network. The average number of connections at the society level and its standard deviation are parameters that can be modified by the researcher.

At each simulation step the agents collect information about the safety of the food category from their neighbours (kinship and friends network) and from the centralised information sources. Information coming from other agents is aggregated according to some rule (mean value or max value), while information from centralised source is weighted according to the source trustworthiness. After this stage, the agent's subjective probabilities (P_j) are updated according to the following rule:

$$P_{j,t} = \left(1 - \beta\right)\left[P_{j,t-1} + \gamma\left|I_t\right|\left(\delta - P_{j,t-1}\right)\right] + \beta\left[P_{j,t-1} + \alpha\left(P_j^* - P_{j,t-1}\right)\right] \qquad (5)$$

where, α, β and γ are parameters which can be calibrated on real time series, I is information intensity which is defined on the interval [0,1], δ is 0 when information intensity I is negative, while it is 1 when the information intensity is positive, and P_j^* is the initial level of belief about the safety of the food of the j-th agent.

The first term of the formula aims at modelling the updating process that force the subjective probability about safety towards 1 or towards 0 depending on the intensity and the sign of the information. Conversely, the second term of the formula describes the forgetting process whereby agents tend more or less slowly (depending on α) to recover their initial beliefs. After all agents have updated their P_j a new step begins. The outcome of the model is a matrix of P_j of dimension $n \times t$ where n is the number of agents in the society and t is the number of steps through which the simulation is run.

7.4.2. Equilibrium displacement model

To simulate the impact of supply elasticity on the COI measures the following simple partial equilibrium model has been specified with reference to both Italy and UK:

$$Q_s = BP_w^{\varepsilon} \tag{6}$$

$$Q_d = A(1+\delta)P_r^{\eta} \tag{7}$$

$$P_w = (1-\alpha)P_r \tag{8}$$

where Q_s is the poultry meat supply, Q_d is demand, P_w and P_r are wholesale and retail prices, α is the margin rate, and ε and η are supply and demand elasticities, respectively. The impact of changing food safety perceptions are modelled through an intercept shifter of the demand curve, δ. The model was calibrated employing average figures observed in the first quarter of 2003 (see Table 7.1). Short run supply elasticities were estimated econometrically using monthly data and dynamic specifications in differences to deal whit autocorrelations in residuals. Demand elasticity for Italy were estimated through a dynamic double logarithmic specification in levels employing two stage least squares to account for endogeneity of price (Stefani *et al.*, 2005). All equations being estimated with data for 1997-2003, the impact of the BSE scare was modelled with dummy variables. Conversely, demand elasticity for UK has been retrieved from Lechene (2000) who also used monthly data. The use of short run specifications and monthly data was suggested by the nature of the production process in the poultry sector where food scares usually last few months.

Table 7.1. Italian and UK data

		Italy	UK
Per capita exchanged quantity (Kg)	Q	1.56	0.72
Consumer price	P_r	7.83	1.69
Producer price	P_w	0.75	0.44
Marketing Margin rate	α	0.90	0.74
Elasticity of demand	η	-0.55	-0.52
Elasticity of supply	ε	0.14	0.08

The shifter δ is built from the vector of P_j that results from Simtrust runs, taking the monthly averages and standardising the vector of the means to some predefined value as specified in the following Section.

7.4.3. Welfare change estimation

In the COI framework, consumer and producer surplus are computed under perfect information but are related to the equilibrium displacement caused by resources allocation under ignorance. In the case of underestimation of the safety level of food, choices under ignorance will typically produce a smaller quantity exchanged and a lower price with respect to the equilibrium of the informed market (see Figure 7.2).

Accordingly, producer surplus is computed as the usual wedge between the prices lines above the supply curve. In this simulation all measures are at the retail market level; therefore, producer surplus includes marketing margins. On its turn, consumer surplus is given by the difference between two components: 1) the wedge between the price lines corresponding to p^* and p_1 under the demand curve; 2) the area given by the quantity exchanged under ignorance (x_0) times the differences between the prices p_0 and p_1.

Cost of ignorance is thus given by the algebraic sum of producer and consumer surplus corresponding to the shaded triangle in Figure 7.2. Conversely, the traditional COI measure proposed by Foster and Just (1989), which assumes perfect elasticity on the supply side, allows only consumer surplus with p_0 equal to p^* (see Figure 7.4).

7.4.4. Simulated scenarios

The simulation of risk communication policies was carried out hypothesising that a scare (such as a dioxin contamination) took place on February 2003 in the poultry industry with a widespread negative press coverage. It was supposed that a single event scare took place, that is the actual contamination lasted for just one month, while the countermeasures taken by the food safety authority succeed in recovering the previous level of safety as soon as from the second month of the scare. However, public concerns took longer to slow down and do not mirror the pattern of actual food safety, giving rise to welfare losses due to misallocation of resources (COI). Measures of welfare were estimated over a six month period. Separate simulation were performed for the UK and the Italian case. Two benchmarks and four policy scenarios were set up to illustrate the possible impacts of risk communication policies on social welfare.

Benchmarks
The pattern of recovery of trust depends on the effectiveness of food risk communication policies. In the full information scenarios (Scenario A) it is assumed that consumers perceive exactly the actual level of safety, that is there is no cost of ignorance and consumers recover their initial pre-scare level from the month after the crisis. Hypothesising that contamination in the first month affects 10% of the production, this scenario produces a negative multiplicative shift of the demand intercept that in

the first month equals to -0.10 and subsequently is set to 0. This scenario is used as an upper benchmark against which welfare losses due to ignorance are measured.

Another scenario (Scenario B) can be built up as the "blind" scenario, whereby consumers never recover the pre-crisis level of consumption and stabilise the consumption pattern developed as a consequence of the crisis. Under the assumption that this behaviour results because of permanently incorrect risk perceptions rather than a change in utility functions for chicken consumption, the behaviour hypothesised under scenario B will give rise to the largest welfare losses.

Policy scenarios

Policy scenarios were designed separately for each country (Italy and UK) setting the main parameters of the Simtrust model in order to simulate the initial perception of safety level (P_j), the structure of the family and social networks, the number and type of centralised information sources and the sign, timing, and intensity of information release. A period of 6 months and a population of 500 agents were selected for all simulations.

The average initial P_j and its standard deviation were set in order to reproduce the differences among UK and Italy regarding safety perception of poultry meat. Data were obtained from the cross-country survey (see Chapter 4) carried out within the TRUST project, where respondents had been asked to state their perceived degree of risk of poultry meat using a 7 point scale (from 1 – very risky – to 7 – not risky at all). The average scores were then transformed and standardised to the 0-1 interval. For example, as the sample average in UK is 5.26 and 4.94 in Italy, P_j values were set to 5.26/7 = 0.75 for UK and 4.94/7 = 0.71 for Italy. The same holds for standard deviations.

The average number of children per household (1.71 for the UK and 1.29 for Italy) was retrieved from the total fertility rate statistics of Eurostat, while the average number of friends and colleagues that influence food purchasing decisions (0.64 for the UK and 0.20 for Italy) was estimated from the survey[1].

The media types from whom centralised information spreads were selected among the survey most cited sources where people go for further information when a food crisis occurs. According to the TRUST project survey these were TV news, newspaper and internet for both UK and Italy. The weights of each source were drawn again from the TRUST project survey, that investigated the degree of trust of several information sources on food risk. Mean scores and standard deviations (see Table 7.2) were transformed and standardised to the 0-1 interval.

Having set the main parameters of the artificial society in order to mimic some real features of British and Italian society, four different risk information policy scenarios were implemented: 1) fading away; 2) counterbalancing TV news; 3) counterbalancing newspaper information; 4) budgeted newspaper Ad campaign.

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[1] In fact, the survey questions no. 41 and 42 respectively state "How many friends influence your purchasing decision?" and "How many colleagues influence your purchasing decisions?". An average of the two responses was retained as a parameter for the model.

Table 7.2. Degree of trustworthiness of information sources on food risk in Italy and UK (1 completely distrust – 7 completely trust)

	UK		Italy	
	Mean	Std. Dev.	Mean	Std. Dev.
Television documentary	4.96	1.39	4.84	1.55
Television news / current affairs	5.17	1.30	5.15	1.47
Television adverts	4.18	1.60	3.56	1.71
Newspapers	4.53	1.47	4.87	1.48
Internet	4.54	1.53	4.34	1.84

In the fading away scenario all centralised information sources release negative information starting from the first day of the scare with information intensity set to -1 and declining according to an exponential law. Scenarios 2 and 3 are similar to the previous one but from the thirtieth day of the crisis onward positive information is released from TV and newspapers respectively. Even in this case the intensity of information is initially set to +1 and then it declines exponentially. The last scenario hypothesises the allocation of a fixed budget newspaper advertising. The cost of a typical campaign for these media was estimated drawing on data collected across countries on Ad campaigns costs (Cavicchi, 2005). The amount considered is of the same magnitude as the budget allocated to health information campaigns in Italy and UK by Government Agencies, that is around 5 Mio Euro. The intensity of information for each day of campaign is standardised with respect to the TV Ad (set to 1) accounting for the different number of people reached through this media (see Table 7.3).

Table 7.3. Scenarios' Budget Allocation Simulation

Country	Original Budget	Typology of campaign	Message typology	Frequency	Costs per contact
UK	€ 5 million	Newspaper only campaign with full page ads on 3 nation wide newspapers	Full page	Daily campaign (35,300*3*7)= 741,300 per week	Intensity = 0.35 (1.2 million person reached in one day) 6 weeks and 5 days
Italy	€ 5 million	Newspaper campaign with full page ads on 3 nation wide newspapers	Full page	Daily campaign (67,200*3*7)= 1,411,000 per week	Intensity = 0.32 (700,000 persons reached in one day) 3 weeks and 4 days

7.5. RESULTS

The main results of the policy simulations are presented as follows. First the outcome of the simulation of alternative risk communication policies with the multi-agent network is illustrated. Then the impact on both consumer and producer welfare of the alternative communication strategies is assessed according to the equilibrium displacement model.

7.5.1. The artificial agents network: mean food safety beliefs

Policy simulation within the artificial agents network was carried out according to the settings discussed in the previous Section. Figures reported in Tables 7.4 and 7.5 refer to the mean P_j observed on a monthly basis.

Table 7.4. Results of artificial agents network: absolute Pj values (monthly averages)

Month	Italy				UK			
	Fading	Newsp	Tvnews	Bud_nw	Fading	Newsp	Tvnews	Bud_nw
0	0.71	0.71	0.71	0.71	0.75	0.75	0.75	0.75
1	0.48	0.47	0.47	0.47	0.50	0.50	0.50	0.50
2	0.50	0.58	0.59	0.54	0.53	0.61	0.62	0.57
3	0.54	0.62	0.62	0.62	0.57	0.64	0.65	0.66
4	0.56	0.63	0.63	0.64	0.59	0.66	0.66	0.71
5	0.58	0.63	0.64	0.64	0.61	0.66	0.67	0.73
6	0.59	0.64	0.64	0.65	0.62	0.67	0.68	0.73

Table 7.5. Results of artificial agents network: relative Pj values (monthly averages, pre-scare level = 100.00)

Month	Italy				UK			
	Fading	Newsp	Tvnews	Bud_nw	Fading	Newsp	Tvnews	Bud_nw
0	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1	67.16	66.61	66.61	66.61	66.96	66.96	66.95	66.95
2	70.94	81.97	82.59	76.06	70.81	80.72	82.05	76.05
3	76.19	87.00	87.59	87.87	76.19	85.86	87.12	87.84
4	79.17	88.40	88.89	90.09	79.29	87.50	88.57	94.76
5	81.15	89.42	89.84	90.71	81.35	88.66	89.61	97.36
6	82.60	90.19	90.57	91.28	82.87	89.54	90.40	96.91

According to the fading away scenario, a slow recovery from the negative peak reached in the first month results in the Italian case. Conversely, the release of positive information for one medium leads to a faster pace of recovery, although simulation results don't appear to be so differentiated across media types. Interestingly, the advertisement budget scenario shows a stronger impact from the fourth month onwards. However, it should be noticed that neither the multi-agent simulation model, nor the questionnaire provide a specific weight for newspaper ads so the generic weight for newspapers (that is noticeably higher than the one for TV Ad) has been used.

The same comments could apply to results from the UK simulation exercise. Even in this case the newspaper advertising campaign seems to be more effective. This is likely due to the longer period the campaign can last in UK with the same budget as allocated in Italy.

Table 7.5 shows the relative fall of the mean P_j value with respect to the pre-scare values. The differences that can be observed between the two countries are caused by the different weights on the information sources and on the agents networks. Overall, even through these simple scenarios the complex pattern of interaction between network effects and centralised sources is self-evident.

7.5.2. Welfare estimates

In order to estimate the welfare impact of the changing risk perceptions on poultry meat the original P_j values were scaled down to obtain a -10% shift of the demand curve in the first month of the scare. The A scenario then represents the full information context and subsequently the shift disappears starting from month 2 while all other scenarios produce negative shifts in the subsequent months giving rise to misallocation of resources in the society. Assuming that for small changes in the neighbourhood of the equilibrium point demand and supply function are linear, welfare measures of the cost of ignorance corresponding to the shaded triangle in Figure 7.2 were calculated. Moreover, consumer and producer surpluses (the latter measured at retail prices) were estimated to provide an assessment of the likely distributive impacts. Finally, the traditional COI measure that assumes a completely elastic (horizontal) supply curve was provided as well.

Table 7.6. COI Estimates: Italy equilibrium displacement model (euro per month per capita)

Month	Blind (benchmark)			Fading			Newsp			Tvnews			Bud_nw		
	Cs	Ps	COI	Cs	Ps	COI	Cs	Ps	COI	Cs	Ps	COI	Cs	Ps	COI
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	1.682	-1.706	-0.024	1.500	-1.510	-0.010	0.929	-0.933	-0.004	0.897	-0.901	-0.004	1.224	-1.230	-0.007
3	1.682	-1.706	-0.024	1.237	-1.244	-0.007	0.673	-0.675	-0.002	0.643	-0.645	-0.002	0.629	-0.631	-0.002
4	1.682	-1.706	-0.024	1.087	-1.092	-0.005	0.602	-0.603	-0.002	0.577	-0.578	-0.001	0.515	-0.516	-0.001
5	1.682	-1.706	-0.024	0.986	-0.991	-0.004	0.550	-0.551	-0.001	0.528	-0.529	-0.001	0.483	-0.484	-0.001
6	1.682	-1.706	-0.024	0.912	-0.916	-0.004	0.510	-0.511	-0.001	0.490	-0.491	-0.001	0.454	-0.455	-0.001

COI estimates for Italy are reported in Table 7.6. The values for the fading away scenario are initially close to those of the benchmark B, that is the blind scenario with no recovery of risk perceptions. When negative information fades away following an exponential law its initially strong impact becomes weaker and weaker and eventually is overshot by the forgetting process that drives risk perceptions towards their initial values. Conversely, the release of positive information after the first month seems to halve the losses due to ignorance as early as from the second month of the scare accelerating the recovering process. As stated above, the budgeted newspaper Ad campaign although less effective in the second month of the scare gives slightly lower value of welfare losses from the second month onwards. However, the absolute welfare gain retrievable from counterbalancing information appears to be quite low.

Considering a population of 50 million, an average monthly per capita gain of 0.005 euros, that is of the same magnitude of the difference between losses under the fading away and other "intervention" scenarios, amounts to a monthly countrywide figure of 250,000 Euro only. Such a figure, even if multiplied times the number of months the scare lasts, falls well short of the hypothesised cost of an information campaign. However, even if the loss reduction seems negligible it is worth noticing that, for the partial equilibrium case a global welfare loss is considered. It's easy to see from inspection of Table 7.6 that the deadweight loss results from the combination of a negative producer surplus with a positive consumer surplus. Indeed the outcome of the simulation show that far heavier losses are borne by producers for whom the gains deriving from more favourable pattern of recovery of safety perceptions are not at all negligible.

Table 7.7. COI Estimates: UK Equilibrium displacement model (euro per month per capita)

Month	Blind (benchmark)			Fading			Newsp			Tvnews			Bud_nw		
	Cs	Ps	COI	Cs	Ps	COI	Cs	Ps	COI	Cs	Ps	COI	Cs	Ps	COI
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.192	-0.194	-0.002	0.167	-0.168	-0.001	0.099	-0.099	0.000	0.090	-0.090	0.000	0.131	-0.132	-0.001
3	0.192	-0.194	-0.002	0.130	-0.131	-0.001	0.063	-0.063	0.000	0.054	-0.054	0.000	0.049	-0.049	0.000
4	0.192	-0.194	-0.002	0.109	-0.109	0.000	0.051	-0.051	0.000	0.044	-0.044	0.000	-0.001	0.001	0.000
5	0.192	-0.194	-0.002	0.095	-0.095	0.000	0.043	-0.043	0.000	0.036	-0.036	0.000	-0.020	0.020	0.000
6	0.192	-0.194	-0.002	0.084	-0.084	0.000	0.037	-0.037	0.000	0.031	-0.031	0.000	-0.017	0.017	0.000

In the UK case (Table 7.7) COI figures are even lower than in the Italian case. Indeed, as the short run supply curve is rather inelastic in UK, only a minor change in the quantity exchanged is observed thus reducing the scope for misallocation of consumption. Notwithstanding a reallocation of resources takes place even in this simulation as producer losses are strongly reduced when positive information is assumed to be released from the second month onwards.

Tables 7.8 and 7.9 provide an illustration of how the Foster and Just (1989) traditional COI measures (COI*) differs from the loss calculated within an equilibrium displacement model. As the former version of the COI relies upon the assumption

of perfect elasticity on the supply side it gives rise to higher losses as it was discussed in Section 7.3. The traditional measure is about tenfold higher than the equilibrium displacement measure but it doesn't take into account the distributive effects of the demand shifts. This suggests that we should be cautious in using this measure for policy analysis at least in contexts where supply is known to be rather inelastic.

Table 7.8. COI estimates, Italy: comparison between partial equilibrium and traditional COI (euro per month per capita)

Month	Blind		Fading		Newsp		Tvnews		Bud_nw	
	COI	COI*	COI	COI*	COI	COI*	COI	COI*	COI	COI*
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	-0.024	-0.120	-0.010	-0.093	-0.004	-0.034	-0.004	-0.031	-0.007	-0.060
3	-0.024	-0.120	-0.007	-0.062	-0.002	-0.017	-0.002	-0.016	-0.002	-0.015
4	-0.024	-0.120	-0.005	-0.047	-0.002	-0.014	-0.001	-0.013	-0.001	-0.010
5	-0.024	-0.120	-0.004	-0.038	-0.001	-0.011	-0.001	-0.011	-0.001	-0.009
6	-0.024	-0.120	-0.004	-0.032	-0.001	-0.010	-0.001	-0.009	-0.001	-0.008

Table 7.9. COI estimates, UK: comparison between partial equilibrium and traditional COI (euro per month per capita)

Month	Blind		Fading		Newsp		Tvnews		Bud_nw	
	COI	COI*	COI	COI*	COI	COI*	COI	COI*	COI	COI*
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	-0.002	-0.013	-0.001	-0.009	0.000	-0.003	0.000	-0.002	-0.001	-0.006
3	-0.002	-0.013	-0.001	-0.005	0.000	-0.001	0.000	-0.001	0.000	-0.001
4	-0.002	-0.013	0.000	-0.004	0.000	-0.001	0.000	-0.001	0.000	0.000
5	-0.002	-0.013	0.000	-0.003	0.000	-0.001	0.000	0.000	0.000	0.000
6	-0.002	-0.013	0.000	-0.002	0.000	0.000	0.000	0.000	0.000	0.000

Note: all values are pounds per month per capita

7.6. DISCUSSION AND CONCLUSIONS

Even if the aim of this Chapter is just to assess the magnitude of consumers welfare losses due to needless avoidance behaviour, the use of a mix of an hypothetical artificial society with a real, albeit simple, equilibrium displacement model makes possible to draw some conclusions that may be relevant for either the methodological debate or the policy analysis of risk communication campaigns.

First of all, the intrinsic complex pattern of interaction between centralised and decentralised information that characterise scare behaviour (and more generally all

cases of herding behaviour) makes more valuable an approach in terms of adaptative agents society. The model adopted in this work is rather simple, but further refinements are possible for example by taking into account the different speed of information diffusion through networks of friends depending on the agents belonging to the same cluster of friends or not. More generally a wider array of behavioural models is available to model complex patterns of information diffusion that cannot be studied employing traditional analytic tools.

Second, the welfare assessment exercise has pointed out that, depending on the adopted framework, different measures of the cost of ignorance are obtained. Noticeably, as welfare loss arises because of misallocation of consumption and production, considering perfectly elastic supply functions leads to overestimation of the welfare loss. The less elastic the supply, the narrower the scope for consumption reallocation, and consequently the lower the loss. Moreover, the traditional COI[*] measure fails to take into account the distributive impacts. When these impacts are relevant an equilibrium displacement model should be used.

Finally, the simulated information campaigns show little differences across media and type of campaign, although the pace of information release is important, given the structure of the beliefs updating process hypothesised. A pattern of reduction of the needless losses such as the one resulting from the simulation wouldn't generate benefits greater than the likely cost of the campaign. However, it should be borne in mind that all simulation run for this work refer to only a 10% drop in consumption at the heat of the scare. More dramatic drops would have caused higher losses and greater scope for welfare gains from risk communication campaigns.

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8. THE TRUST PROJECT: SUMMARY OF MAIN FINDINGS

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The major achievement of the TRUST project is its contribution to the understanding of the nature, determinants and processes of social diffusion of trust in food risk information. Aiming at this, a multidisciplinary research approach was adopted. Specific results of researches carried out by psychologists, sociologists, consumer scientists, and economists have been reported in Chapters 2 through 7. This body of knowledge can be summarised addressing the research questions raised in Chapter 1 (Figure 8.1), namely:

a) Why do food scares determine a change in people's behaviour?
b) How do these changes happen across the population?
c) When do these changes happen?
d) What are the effects determined by these changes?

This final Chapter is devoted to present the main project results with reference to each specific question and to provide some policy recommendations drawn on the project experience.

8.1. WHY DO FOOD SCARES DETERMINE A CHANGE IN PEOPLE'S BEHAVIOUR?

The project has investigated the determinants of trust at the psychological level, the evaluation strategies and cognitive models individuals adopt in context where they are exposed to food risk information. Moreover, the role of social interaction and culture has been examined in relation to the process of trust building regarding food risk management.

Psychological experiments (Chapter 2) pointed out that people often use heuristics (that is "rules of thumb") to make judgements and choices rather than relying on analytical information processing. For example, commitment ("I already ate it, therefore this means that there is no danger") seems to play a role in attenuating the impact of risk information on consumer choices even if the extent to which this heuristic drives food choices varies across food types.

Also attitudes strongly affect people's food choices. Attitudinal components such as the consumption experience ("it tastes good") and the moral evaluation ("it is shameful") appear to be more relevant than rational or instrumental considerations ("it is convenient').

The TRUST Project
A better understanding of the role of trust and food risk communication during food scares

WHY?
Sociological and psychological determinants
- What happens to people during a food scare
- Why they change their behaviour and attitudes

How policy-makers and food agencies should dialogue with people about food safety issues before and during a food scare: a blue-print

WHAT EFFECTS?
- Assessing the cost of information biaises in a food scare
- How much does it cost a longer than necessary food scare
- In which food scare it pays to intervene and in which it doesn't

Comparing the social costs of a food scare vis-à-vis the cost of an information campaign. Good practices for information campaigns on food safety issues

HOW?
- From lack of trust and risk perception to buying behaviour
- How different population segments act
- What the impact of lifestyles, attitudes and contexts

What policy-makers need to know to understand how a food scare affects consumption behaviour. Differentiate through segments, normal context and scare context

WHEN?
- Evolution of a food scare
- What happens when the same information is released through different media
- Differences between sparse and compact network contexts

The key elements a policy-maker should monitor to understand the dynamics of information spread. A tool to simulate the evolution of risk perceptions through different networks

Figure 8.1. – The TRUST project main results

Trust seems to be relevant only in its shared-value components. Neither, competence nor perceived truthfulness of the information appear to influence people intention to purchase a supposedly contaminated food. On the contrary, when information providers are trusted because they share the same values with consumers, trust positively affects the intention to purchase the risky food. Thus, even in this case, it is the affective and normative components that play a key role in explaining food consumption in a risky context such as a food scare.

Sociological research (Chapter 3) showed that the overall picture of the connections between trust, food safety, risk information and consumption is "somewhat blurred". Recent major food scares are not the cause of general mistrust and pessimism even if they worsened both. Food scares are understood to be extraordinary events. However, people do not understand them as something totally unpredictable and independent from the broader context of present food production, commercialisation and consumption nor are food scares obsessively present in people's minds.

Indeed, group discussions showed that "reflective" responses to food safety issues predominate, with "reactive" ones mostly concentrated in the initial phases of a crisis. This reflective behaviour is linked to a more general worldview which drawn on attitudes, values, opinions and normative and factual beliefs on more general matters than just food related crisis, such as the pros and cons of science and technology, the reliability of public authorities, the role of the EU, the reliability of one's own network of relations.

In a sense the scenario is a complex one and any policy aimed at restoring people trust in the food chain should deal with a broader set of value commitment and factual consideration about political, economic, scientific and cultural institutions, that is the complex world within people live and make, among others, food choices. Credibility and trust – including consumers' trust in their own ability to choose safely and responsibly – are unlikely to be obtained without a sustained effort to behave consistently and reliably on the part of the political, economic and scientific parties in the food sector. This finding supports the prevalence of the value sharing aspect of trust highlighted by the psychological research (Chapter 2).

8.2. How do changes in people's behaviour happen across the population?

The project has investigated how trust in alternative information sources and in risk managers varies across segments of consumers identified by levels of trust, social, demographic, and psychographic characteristics across five EU countries. The cross-country survey (Chapter 4) pointed out that food safety is generally considered to be "extremely important" (52.5%) with 93.7% of people ranking food safety as above a 5 on a 7-point scale of degree of importance. The French are the most ambivalent towards food safety (11.9% reported a 4 or less on the 7-point scale). The Italians appear to be the most concerned about food safety (97% concluded that food safety should be awarded a score greater than 5).

Television advertising is the least trusted source of information across all countries on average, followed by political groups, processors, the government and magazines. The most trusted information sources across all countries are on average doctors and other health authorities, National Food Safety authorities, university scientists and consumer organisations. The EFSA appears to be not as trusted as the national food safety authorities. However, the average level of trust towards food chain actors shows differences across countries. The French are the most trusting farmers in general and organic farmers in particular, while they trust to a lesser extent brand producers; the Italians trust the farmers least; the Dutch trust the industrial poultry breeders least, but on average appear to be the most trusting people.

Food behaviour and trust in the food chain was analysed adopting two different analytical strategies. On one hand research has been carried out in order to obtain a sensible segmentation with respect to food behaviour; on the other hand a causal model has been set up to provide insights about the determinants of intention to purchase a common food such as chicken, under standard and food scare situations.

Consumers can be segmented in several ways, i.e. according to lifestyles, demographic characteristics, and trust in sources of information. However, taking into account only demographic or lifestyle variables does not provide a very informative classification and the interaction between these variables is limited. Indeed, the weak relevance of socio-demographic variables in explaining trust and food behaviour in risky contexts was found in the psychological research too (Chapter 2), suggesting that the impact of food safety information depends on the source and its reliability, rather than on the individual characteristics of the consumer processing it.

Conversely, the most significant segmentation is based on trust variables that is classifying people according to the type of information source or media they trust more. Three different groups of consumers can be identified: "Non-trusters", especially in independent sources, "Mixed trusters", characterised by distrust in food chain actors and trust in independent sources, and "Trusters", especially confident in all sources of information, although with different intensity (they trust more food chain actors and less media sources).

The determinants of purchasing a standard food such as chicken have been investigated both in a day to day situation and under a hypothetical salmonella outbreak (Chapter 5). In a standard situation attitudes toward chicken ("it tastes good", "it is good value for money", etc.) are the most important determinants of intention to purchase the food while risk perception does not appear to be relevant.

Country specific models highlight somewhat different patterns across Europe. In the UK increased trust in food safety information from media (TV and newspapers) appears to lower the likelihood to purchase chicken. It looks as if food safety information from these sources tend to negatively affect intention to purchase. This effect is partially outweighed by an increasing level of education. In Italy, trust in food safety information provided by food chain actors (farmers, processors, retailers, etc.) has a very large positive effect on purchasing intentions. This effect becomes smaller as age increases. In France, trust in food chain actors can positively affect purchasing behaviour.

Socio-demographic factors play a significant role in moderating such effects (higher income levels) or amplifying them (age and education). However, in a food scare situation attitude are still relevant but perceived social control (what the others think one should do) and perceived capacity to act and control one's own behaviour become important determinants of intention to purchase. Differently from the day to day context, risk perception shows a relevant (and negative) impact under a food scare, this is more significant for those who are "Trusters", French or Italian, reducing their intention to purchase.

Trust in media negatively affects intention to purchase across all countries while trust in information from food chain actors loses relevance, but remains an important (and reassuring) factor. Alternative sources of information, such as consumer organisations, play a relevant role after a food scare, especially in Germany as well as in Italy's larger towns. Those that trust information from these sources are less likely to purchase chicken in this context.

Overall, the trust project research suggests that socio-demographic groups are not relevant in relation to their trust in food safety information. The impact of this information depends mainly on the type of source and on its reliability rather than on socio-demographic characteristics of the targeted audience. Moreover, the causal model points out that information from experts and food chain actors reduces risk perception, while information provided by alternative sources tends to increase it, depending on the (positive or negative) content issued by these sources. Thus, people significantly differ in terms of the sources they trust even if this is not related to socio-demographics. Rather, cultural specificities within Europe have to be stressed giving rise to different impacts of the different information sources across countries.

Finally, food choice behaviour differs between standard and food scare contexts depending on the segment consumers belong to. Non trusters tend to be less sensitive to risk perception and rely more on their social network, while trusters and mixed trusters (especially in food safety authorities) are the most sensitive to changing risk perception levels. Thus public authorities can and should play a key role in reassuring food consumers during a scare.

8.3. When do changes in people's behaviour happen?

The project investigated the evolution of a food scare, through an adaptive agent simulation model, with emphasis on the social diffusion of trust (Chapter 6). The study drew on the empirical evidence that past food scare cases all had showed a sudden dramatic drop in consumption of the affected food, followed by a slow recovery that in certain cases failed to recover to the pre-crisis level leaving a permanent downward shift in demand. A similar pattern of behaviour was acknowledged also by the sociological studies (Chapter 3) that pointed out how people show an array of different individual reactions to food scares that can be summarised as follows:

a) temporary change of behaviour: This is the prevailing and most immediate reaction and it ranges from temporary interruption to reduction of consumption of "hazardous" foods;

b) durable change of behaviour: This is a rather frequent response. It may be the consolidation of an already present consumption pattern (e.g. eating less meat) or a change in shopping preferences. Once taken up, new habits are generally considered healthier than the previous ones, beyond the specific protective function (for example, some consumers became vegetarian after the BSE scare);

c) no change of behaviour: This reaction characterises a minority of participants, who judge problems as minor ones, while a few declare their "antagonism" towards official warnings.

Reasons for resuming original behaviours are multifaceted as well. A first reason is about tedium with the issue, feeling that "enough is enough". This is usually connected with an overload of information from unremitting media coverage. Others feel a sense of forgetfulness, a gradual "fading away" of personal concern. This usually parallels a decline in media coverage. A further reason deals with the issue of practicality, i.e. difficulties in persisting with diet restrictions. Few mention reassurance from the media, friends, shopkeepers as a motive to resume normal behaviour or judge it as the least relevant, although several complain about the lack of clarity as to the end of a crisis.

The above mentioned features can be replicated through simulation, employing an agent-based model (artificial society), whereby a set of individuals update their beliefs about the safety of a particular food category (Bayesian updating) following the release of information from media and word of mouth through a network of friends and relatives. Empirical temporal patterns of demand changes during a food scare can be reproduced by setting to appropriate levels the population parameters (such as the fading away or tedium parameter, the intensity of the network of friends or the initial level of trust in the safety of food). Timing of information release (both positive and negative) mirrors possible policy instruments affecting the time and scope of demand recovery.

8.4. What are the effects determined by changes in people's behaviour?

The project reviewed current public information campaigns across Europe and assessed the economic impacts of alternative risk communication strategies evaluating their costs and benefits employing a market model (Chapter 7).

Public communication campaigns are implemented to shape food consumption and/or food processing behaviour towards socially desirable outcomes. Even if public intervention is not always exclusively related to the use of media channels (for example some information policies rely on educational programs targeted at primary schools), the research focussed on the cost of providing information through these channels.

In order to assess the average budget of food information campaigns, fourteen public information campaigns across the five involved EU countries were investi-

gated. Most campaigns adopted a scientific approach for the developing of good communication through qualitative and quantitative market research methods, mainly with the help of external marketing agencies. The costs of information campaigns ranged from € 800,000 to € 7 million, depending on the communication media employed, the scope of the campaign, the targeted population and the country's specific advertising market structure. A dataset with average costs across countries and media type was set up showing noticeable differences in unit costs across countries.

A market model of the poultry sector was estimated to simulate the impact on demand of information campaigns drawing on estimates of elasticities of supply and demand obtained for Italy and UK (Chapter 7). Shifts in demand and timing of the recovery process after a scare provides a measure of social benefits of information campaigns. Indeed, the loss of social welfare caused by underestimation of the actual level of safety are caused by reduced market exchanges under asymmetric information. A likely assumption of an initial drop of 10% in consumption in the first month of the crisis was maintained. Recovering of demand towards pre-crisis levels was simulated drawing on the agent based simulation model described in Chapter 5 and taking into account the impact of information release from a budgeted media campaign.

In a country of 50 million people, such as Italy, an information campaign that speeds up the recovery to 80% of the pre-scare consumption within 4 months (by 2nd instead of the 6th month since the beginning of the scare) would save about 250,000 Euro a month only, that is short of the average cost of an information campaign. Indeed the model assumes a constant marketing margin and perfect price transmissions. Different results would be obtained when asymmetric price transmission is in place.

Furthermore, things look differently when examining producer losses. The same impact on the speed of demand recovery could save up to 25 million Euro a month about 4% of the value of poultry consumption at current consumer prices. Similarly, in the UK the savings would amount to a figure of about 4-5% of poultry consumption valued at consumer prices.

8.5. RECOMMENDATIONS

Such findings call for a comprehensive and articulated food risk communication strategy. Noticeably, the TRUST project highlighted several issues that should be taken into account in designing risk communication such as: the relevance of emotional and normative, rather than cognitive aspects in shaping intention to purchase; the relationship between trust in the food chain and wider attitudes towards institutions, technology and society at large; the importance of shared values in building up a trust relationship; the need to differentiate information policies due to cultural differences across countries; the key role played by food safety authorities. Taking into account such aspects, the building blocks of a possible risk communication strategy are as follows:

a) design and implement different actions according to different temporal horizons:
   - before the food scare it is necessary to create and cultivate a trustful re-lationship between risk managers and citizens not only limited to food safety issues;
   - during a food scare the risk managers should provide clear and accessible information using the most trusted sources and the most trusted media for each country-culture. In this respect, experts and independent agencies can play a crucial role. Furthermore, information campaign should leverage on the diffused networks (relatives, friends) that play a crucial role in the social amplification of risk;
   - after the food scare the risk managers should act to recover and maintain a trustful relationship.

b) with specific reference to the content of communication during a food scare:
   - it is crucial to be credible. This means to focus the communication cam-paign on shared values. The emotive and normative aspects of the issues as well as the cognitive ones should be taken into account;
   - in terms of contents, the campaign should describe the issue clearly, avoid-ing the use of technical jargon and without providing too many data. Also important is to state clearly what is known and what is not, acknowledging explicitly the risks and levels of uncertainty, identifying its nature and ex-plaining what actions are put in place to deal with it;
   - people during a food scare need practical information on what to do and why. In providing such information, risk managers should make reference to sources, e.g. where does this information come from and who is respon-sible for it (accountability);
   - people feel reassured if they will get credible information about risk man-agement measures, e.g. what are the actions currently put in place, who is in charge of such actions, what is expected to happen and when, and if they do not feel abandoned, e.g. it is crucial to describe the next steps, including when updated information will be provided and who will provide the next information.

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