Effects of Food-Safety Perceptions on Food Demand and Global Trade

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Abstract: Food safety has emerged as an important global issue with international trade and public health implications. How countries perceive and handle food safety risks is complicated and partly based on their access to and use of science, detection technology, and mitigation methods. Highly publicized food safety incidents affect consumer perceptions, leading to changes in food purchasing patterns.

Introduction

Global food trade will likely increase due to expected increases in global income levels, improved transportation networks, and growing populations requiring greater quantities of nutritious and safe food. Although, for the United States at least, there is no evidence that imported food, as a whole, poses higher food safety risks than domestically produced food (Zepp, Kuchler, and Lucier, 1998), globalization of food supply means that new food safety risks can be introduced into countries (*e.g.*, emerging bacteria), previously controlled risks can be re-introduced into countries (*e.g.*, cholera), and contaminated food can be spread across greater geographical areas and cause illness worldwide.

Food safety risks include risks from veterinary drug and pesticide residues, food additives, pathogens (*i.e.*, illness-causing bacteria, viruses, parasites, fungi, and their toxins), environmental toxins such as heavy metals (*e.g.*, lead and mercury) and persistent organic pollutants (*e.g.*, dioxin), and unconventional agents such as prions associated with bovine spongiform encephalopathy (BSE) in cattle. Scientists generally agree that food safety risks are low, though highest for foodborne pathogens such as *E. coli* O157:H7.

The U.S. Surgeon General states that food safety has emerged in the last decade as a significant global issue with international trade and public health implications (Satcher, 2000). Worldwide, foodborne pathogens have been estimated to cause 70 percent of the roughly 1.5 billion annual episodes of diarrhea and 3 million deaths of children under the age of 5 (WHO, 2000).[2] Countries are not equally at risk from foodborne disease—persons in developing countries with inadequate supplies of safe water and poor waste disposal are particularly susceptible. Food safety risk levels also vary greatly among countries because of differences in available technology (*e.g.*, refrigeration), plant and livestock host factors (*e.g.*, herds exhibit varying infection rates), food production practices (*e.g.*, access to and use of veterinary drugs), cultural differences (*e.g.*, routine consumption of raw seafood) and geographic or climatic differences (*e.g.*, colder climates may kill some pathogens) (Buzby and Roberts, 1999).

Currently in the United States, the bulk of all sporadic and outbreak cases of microbial foodborne illnesses are likely from domestically produced foods because food imports tend to make up only a small proportion of all foods consumed. For example, the average import share of U.S. food consumption was 9.2 percent for 1995-98, though import shares are higher for particular food categories that are often linked to

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[2] Waterborne pathogens also play a large role in causing diarrheal illness and death.

foodborne illness such as fish and shellfish (58.6 percent), fruit (fruits, juices, and nuts, 14.6 percent), and vegetables (10.3 percent). The potential for increased food-related illnesses from continued increases in internationally traded food will challenge government food safety systems and private firms to develop and implement improvements in prevention, inspection, and control systems.

As we shall see, consumer concerns about food safety risks vary across countries and change over time. Food Marketing Institute 1989-97 data indicate that over time, U.S. consumers have become increasingly concerned that foodborne bacteria pose a "serious health risk" while they have become less concerned about other food safety risks such as those from chemical residues, irradiation, and food additives (Food Marketing Institute, 1997).

Countries Vary in Their Perceptions and Acceptance of Food Safety Risks

Each country has its own unique set of health concerns and priorities (Patterson, 1990), though data measuring these concerns are limited. Consumer concerns may include foodborne bacteria, hormones, and irradiated foods for example. The level of consumer food safety concerns, and perhaps consumers' relative ranking of the different concerns and priorities, vary among countries and stem largely from country-wide differences in consumer perceptions about food safety. Figure G-1 presents a schematic to help clarify the relationships between consumer perceptions, concerns, and acceptance.

Consumer perceptions are the result of a complex function of factors such as differences in each country's: baseline food safety risks levels; food safety risks from internationally imported food; access to and extent and nature of information about food safety, risk levels, and related topics; trust in the different sources of information; and experience with major food safety incidents. There may even be basic differences in how people view symptoms of foodborne diseases. Some societies consider diarrheal diseases as a natural/normal occurrence due to factors such as teething, eating hot/spicy foods, indigestion, and even superstition, instead of perceiving diarrhea as a symptom of disease that can be transmitted through food and food handling (Motarjemi and Käferstein, 1997).

Even if the food safety risks are the same across countries, countries may perceive and handle these risks differently. Assessments of similar risks may vary due to differences in access to and use of advances in basic science, detection technology, and mitigation methods (Buzby and Roberts, 1999). For example, countries vary in how they perceive and handle the risks from *Listeria monocytogenes* in foods that are not intended for further heat treatment (i.e., ready-to-eat foods such as luncheon meats). The United States has a zero-tolerance policy for this organism in all ready-to-eat foods, a tolerance so strict, that some countries have raised questions about this policy and claim it is a trade barrier that the United States is using to keep their perfectly safe products out of U.S. markets (Madden, 1994).[3]

Worldwide, consumers' knowledge and perceptions about risk-reducing technologies vary, and as a result not all countries are equally accepting of the different technologies. Consumer acceptance about innovative food technologies such as irradiation is the result of a complex decision-making process involving their assessments of the perceived benefits and risks of the new technology and its alternatives (Henson, 1995). Even within a country, acceptance of and willingness to pay for a new technology that reduces food safety risks varies. For example, only about half of U.S. adults are willing to buy irradiated meat and poultry, according to 1998-99 FoodNet survey data (Frenzen *et al*., 2000).

Reading up from the bottom of figure G-1, what countries accept, in terms of food safety risks in food imports, depends on what countries want—which in turn depends on both their tastes and preferences for foods with different bundles of attributes, and on what they are willing and able to pay to avoid food safety risks. Accordingly, wealthier countries with more information about food safety risks (even if it may be sensationalized) not only demand increased year-round access to a wider variety of internationally traded foods but they also tend to demand more stringent food safety standards on both domestically produced and imported food and are generally willing to pay more for these higher levels of food safety. For example, Denmark has gone to extraordinary efforts to minimize *Salmonella* contamination in pork and, as a

[3] The U.S. Department of Agriculture is in the process of issuing a new rule on *Listeria*.

Figure G-1—Food safety risks: Countries vary in perceptions, concerns, and acceptance

Each Country's Food Safety Risk Perceptions are a Function of:

- Baseline food safety risks from domestically produced food
- Food safety risks from internationally imported food
- Access to and extent and nature of information about food safety, risk levels, and related topics
- Trust in the different sources of information
- National experience with major food safety incidents (*e.g., Cyclospora* outbreaks, BSE, dioxin)
- Perception of science and risk assessments
- Current ability to avoid/control different food safety risks (*e.g.,* access to available remedies)
- Knowledge and acceptance of food technologies (*e.g.,* irradiation and organic methods)

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Each Country's Food Safety Concerns and Priorities

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Each Country's Tastes and Preferences for Different Foods with Different Bundles of Attributes:

- Price
- Sensory qualities (*e.g.,* flavor, color, etc.)
- Foods produced with or without certain food technologies (*e.g.,* irradiated versus non-irradiated foods)
- Perceived food safety risk level
- Other perceived risks and concerns (*e.g.,* environmental and animal welfare issues)

Willingness To Pay To Avoid Food Safety Risks which is also a function of factors such as income and ability to control particular food safety risks

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What Countries Want in Food

e.g., pathogen-free raspberries
e.g., beef with no risk of BSE/vCJD
e.g., poultry uncontaminated by dioxin

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What Countries Accept in Imports

e.g., raspberries from countries where raspberries are not contaminated with *Cyclospora*
e.g., beef imports from countries that have never isolated BSE in cattle
e.g., poultry from countries where feed was not contaminated by dioxins

society, is willing to pay for strong control measures. Trade patterns with neighboring countries have been affected because Denmark does not want to import pork from countries whose pork poses higher levels of risk from *Salmonella*.

Differences in tastes and preferences among countries have an effect on which foods are imported. Tastes and preferences for different foods are based on how consumers view the bundle of attributes that each food possesses when consumers are making their food purchase decisions (fig. G-1). For example, consumers clearly consider price, quality, and sensory-based attributes such as flavor and color, but may also consider if the food was produced using certain food technologies such as irradiation. This attribute bundle may also include food safety risk levels, as perceived by consumers, or by government oversight in the case of some internationally traded food. For example, some consumers in some countries such as France prefer cheese made from unpasteurized milk and are willing to accept the associated higher health risks from *Listeria* contamination. Other countries, such as the United States, ban the sale of most unpasteurized cheese, even though it constrains consumer choice.

Tastes and preferences for certain foods are influenced by issues other than food safety concerns and sensory-based attributes. One example is consumer reluctance, particularly in European countries, to buy food produced using biotechnology such as genetic engineering. For example, some biotech foods or crops have been genetically engineered to resist pests. In addition to food safety concerns, some consumers have expressed concerns about the uncertain long-term impact of biotech foods on the environment, particularly the consequences of cross pollination, the impact on ecosystems, and the development of pesticide resistance by certain pests from using some of the bio-engineered plant pesticides (Vogt and Parish, 1999). A second example is that in addition to food safety concerns, some consumers consider farm worker safety concerns and environmental concerns (*e.g.*, pesticide use) when deciding whether to buy organic or conventionally grown products.

Differences in what food products countries want and what they will accept in imported food ultimately affect patterns of food demand and global trade, and complicate the development of workable trade rules that are acceptable to different trading partners. Countries also vary in how consumer behavior, firm behavior, and policies/regulations change with new information on food safety risks (such as from outbreaks) and the development and acceptance of new risk management technologies.[4]

Food Safety Incidents and Publicity Affect Food Demand and Trade

Highly publicized international food safety incidents may lead to lasting changes in consumer perceptions about food safety and their food purchasing patterns. In some instances where the public outcry has been particularly strong, there have been changes in government regulations affecting domestic and/or imported food products. Here, the hypothesis is that following the resolution of the problem that caused a major international food safety incident, consumer perceptions about the implicated food product and about the exporting country's ability to produce safe food may be slow to change, and these perceptions have a lasting influence on food demand and global trade.

To explore this hypothesis, three international food safety incidents are presented: (1) the 1996 outbreaks from the pathogen, *Cyclospora*, on Guatemalan raspberries in the United States and Canada, (2) the ongoing bovine spongiform encephalopathy (BSE) crisis in the United Kingdom (UK), and (3) the 1999 contamination of feed in Belgium by cancer-causing dioxin. Each case study begins with a brief description of the incident and with supporting economic impact data. Each case study concludes with a discussion of consumer perceptions and reactions, and how they relate to the hypothesis that these changes in consumer behavior affect trade. The economic impact data illustrate how severe international food safety incidents can be on the exporting country and the implicated industry, particularly during periods where the implicated exports were reduced, suspended, or denied entry. And as we shall see, it can often be difficult for the exporting market to recover from an outbreak or illness linked by fact or by rumor to an exported food (Satcher, 2000).

Cyclospora in Guatemalan Raspberry Exports to The United States and Canada

In 1996, *Cyclospora* outbreaks in the United States and Canada caused 1,465 illnesses (Herwaldt and

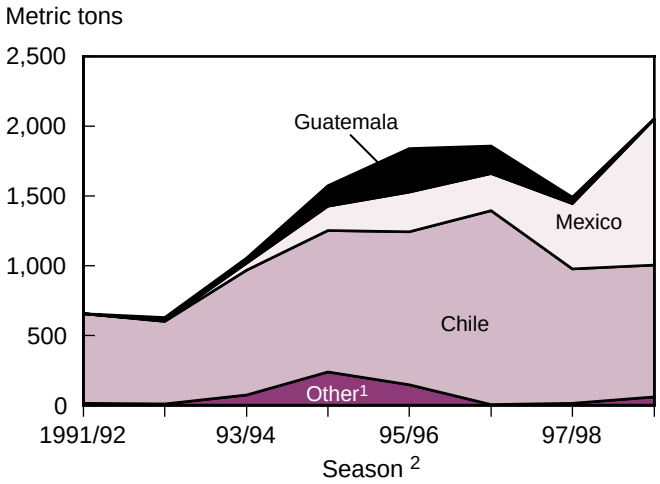
[4] Food industry's response to consumer food safety concerns is discussed in Chapter 10.

Ackers, 1997). At first, California strawberries were erroneously implicated, and this caused $20 to $40 million in lost strawberry sales (Powell, 1998). By July 1996, the U.S. Centers for Disease Control and Prevention declared Guatemalan raspberries as the likely source of these illnesses. After additional outbreaks in 1997, Guatemalan raspberry exporters temporarily suspended exports to the United States, resulting in an estimated income loss of $10 million to Guatemalan producers and workers (Powell, 1998). In response to the outbreaks, the U.S. Government issued an import alert for Guatemalan raspberries for the spring 1998 season. Although Canada faced similar risks, it did not institute a similar ban at this time. Canada later banned Guatemalan raspberry imports after another outbreak in Toronto caused 305 illnesses in 1998—a ban that remains in place today. In contrast, the U.S. opened its doors in 1999 to Guatemalan raspberries from approved farms using a new food safety program.

Prior to these outbreaks, in 1995/96, Guatemala was a major player in raspberry exports to the United States. Although the problem appears to have been resolved to the satisfaction of the U.S. Food and Drug Administration (FDA), the demand for Guatemalan raspberries has only been restored to about one-third of the pre-outbreak levels (Calvin *et al*., 2000). The trade restrictions coupled with the time needed to implement the complex system of production controls gave other countries, particularly Mexico, the opportunity to take over much of Guatemala's role as a raspberry supplier (fig. G-2). Only six Guatemalan raspberry farms remain in business, down from the 1996 estimate of 85 farms before the first outbreak (Calvin *et al*., 2000).

During the early days of this incident, there was a temporary reduction in demand for all berries from all sources, with strawberries particularly hard hit (Calvin *et al*., 2000). Retail and commercial buyers eager to protect their business and the health of their customers, and consumers knowledgeable about the outbreak, switched to other types of produce. Later when Guatemalan raspberries were identified as the source of the outbreak, consumer demand dropped for Guatemalan blackberries as well, and the demand for raspberries as a whole declined regardless of the country of origin (Calvin *et al*., 2000). Although this problem has been resolved, lingering changes in consumer demand and trade continue to persist today. Consumer confidence about Guatemalan raspberries

Figure G-2
U.S. fresh raspberry imports



1 Not including Canadian imports of fresh berries which are often technically still fresh berries but destined immediately for processing facilities.
2 Season defined from September through August of the following year.

Source: U.S. Department of Commerce data published in Calvin *et al*., 2000.

(and other Guatemalan products) is changing slowly though it has not yet been completely restored (Calvin *et al*., 2000), and some buyers continue to avoid it.

The highly publicized Guatemalan raspberry crisis raised consumer awareness about the potential for imported produce to bear foodborne pathogens (Zepp, Kuchler, and Lucier, 1998).[5] This resulted in the interests and concerns of consumers being intertwined with the marketing actions of retail and other commercial buyers. At the top of figure G-1, this experience with *Cycolospora* in imported raspberries can be considered as a shock to the food safety risk perceptions in the United States. This in turn alters the tastes and preferences for raspberries if buyers and consumers now see the bundle of attributes possessed by raspberries, and perhaps by other berries, as containing higher food safety risk levels. These updated tastes and preferences are reflected in what the United States wants in these products (*Cyclospora*-free raspberries), and in what the United States will accept in imports (*e.g*., raspberry imports from countries where *Cyclospora* is not a problem).

[5] In October 1997, following media attention on these outbreaks, the President announced a food safety initiative on the safety of imported and domestic fruits and vegetables to upgrade standards for fresh produce and to ensure that imported produce is as safe as domestic produce (Vogt, 1998).

This incident illustrates that consumer perceptions about the implicated food product and about the exporting country's ability to produce safe food are slow to recover after an international food safety incident, and that these perceptions have a lasting influence on food demand and global trade. This case study also illustrates that after a food safety incident, industries implicated by rumor, fact, or association can be economically vulnerable, countries can respond to similar risks differently, and consumption and trade patterns can adapt and change, potentially involving substitution away from the implicated product or away from a country's exports of that product.

Bovine Spongiform Encephalopathy (BSE) In The United Kingdom

In 1996, Britain announced that there was a possible link between bovine spongiform encephalopathy (BSE), known as "mad cow disease" in cattle and a new strain of Creutzfeldt Jakob Disease (vCJD) in humans. This rare but invariably fatal human strain causes progressive deterioration of brain tissue and has caused 87 deaths as of December 2000 in the United Kingdom (U.K. Dept. of Health, 2000), two in France (and one probable), and one in the Republic of Ireland. Science has not provided a definitive understanding of how BSE is linked to this human strain. However, many scientists now believe that humans become ill by eating bovine products contaminated with some kind of causative agent of BSE.

Immediately after the 1996 announcement, domestic sales of beef products in the United Kingdom fell by 40 percent and within a month, household consumption of beef fell 26 percent from the previous year's level (Atkinson, 1999).[6] Table G-1 shows that the significant export trade in live cattle and beef developed by the United Kingdom during the early 1990s was hard hit by the European Union's (EU) March 1996 ban of U.K. live cattle and bovine products (Atkinson, 2000). Other export markets followed the EU's ban on British live cattle and products, lowering real producer cattle prices in the United Kingdom.

In the first year of the crisis (1996), the total economic loss from BSE to the United Kingdom was estimated to range between £740 million and £980 million (Atkinson, 1999) (US$1.2 to US$1.6 billion).[7] Although this figure has not been updated, the cumulative gross budgetary cost of BSE to the United Kingdom between March 1996 and March 31, 2000, was roughly £3.5 billion (US$5.6 billion) and is expected to total £4 billion (US$6.4 billion) by March 31, 2001 (Watson, 2000). The number of newly confirmed BSE cases in animals peaked in 1992 and has since been decreasing due to prevention and control efforts.[8] As of August 1, 1999, exports of U.K. beef to the EU are permitted. However, sales are expected to be slow, and any short-run benefits will probably come from increased consumer confidence about beef in the United Kingdom (Atkinson, 1999).

In addition to the financial toll, the emotional toll of this crisis was particularly high. Incidences of human illness caused enormous concern worldwide and left a lasting impact on food safety risk perceptions. The media emphasized the unusually high severity of the human illness that is relentlessly progressive, untreatable, and invariably leads to a traumatic decline and death. Consumer concerns were fueled higher when the media told human stories where families of victims essentially saw loved ones waste away and when the media emphasized that because of a lack of scientific knowledge about the incubation period and how to prevent and control the disease, no one knew for certain how high the human health toll would reach. Recently discovered cases of BSE in other EU countries have continued to fuel consumer concerns worldwide and have caused economic disruptions in these countries. For example, between November 2000-February 2001, 29 BSE cases were discovered in Germany, and beef consumption in Germany fell by more than 75 percent during the same period (Reuters, 2001).

However, until the recent foot and mouth disease outbreak in Europe, in the United Kingdom at least, there were several signs that consumer confidence in the safety of beef was beginning to return. During the four-week period ending May 28, 2000, total beef consumption in Great Britain increased 4 percent, compared with consumption a year earlier (though still 9 percent below the 1995 level) and the percent of homes that purchased beef increased 1 percent

[6] A detailed chronology of events can be found on <*http://www.maff.gov.uk/animalh/bse/default.htm*> as accessed on June 5, 2000.

[7] Assuming an exchange rate of 1 pound sterling is equal to US$1.60.

[8] Although BSE cases in animals existed during the 1980s, the 'BSE crisis' followed the British Government's announcement of a possible link to vCJD in humans in 1996.

Table G-1—United Kingdom exports of beef and veal and cattle, 1990-1999 [1]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Beef and Veal:										
Quantity (*metric tons*)	81,837	80,252	74,419	117,771	141,706	148,304	31,893	269	995	322
Value (*1,000$*)	298,232	270,043	288,535	353,597	486,241	531,066	105,084	832	2,799	1,400
Cattle:										
Quantity (*head*)	351,501	399,990	429,129	424,589	468,715	392,157	57,067	36	126	17
Value (*1,000$*)	77,861	88,748	110,444	126,217	133,119	103,027	13,276	5	36	4

[1] In 1996, the European Union banned imports of U.K. bovine products and live cattle.

Source: FAOSTAT Agricultural Data, *http://apps.fao.org/page/collections?subset=agriculture*, accessed Feb. 26, 2001.

compared with purchases a year earlier (though still 4 percent below the 1995 level) (MAFF, 2000). Beef's share of total meats consumed recovered in 1997 and was stable in 1998 (Atkinson, 1999). Part of the increase in beef consumption is due to lower real beef prices (Atkinson, 1999) and part is likely to be explained by increased confidence by some U.K. consumers in the safety of beef. Following the BSE crisis, the U.K. Government undertook policy changes aimed at eradicating BSE, preventing its transmission to other animal species, and protecting consumers of beef products in the United Kingdom and worldwide (Atkinson, 1999). For example, all cattle over 30 months of age were banned from entering the animal or human food chain by the U.K. Government. Other measures were undertaken to cushion U.K. beef producers and the rendering industry from the full economic impacts of the crisis and to restore public confidence.

Figure G-1 can also be used to understand how food safety risk perceptions by U.K. consumers are changing following improvement in government control over the BSE crisis. Confidence in the beef supply by U.K. consumers is beginning to return due to changes in food safety risk perceptions which are in turn influenced by improvements in access to and extent of information about the disease, greater trust in the different sources of information, and belief that the current ability to avoid this risk has been improved by the U.K. Government's control and prevention actions.

1999 Contamination of Feed in Belgium

Another significant food safety issue that quickly spread across national borders and caused serious trade impacts occurred when fat used in animal feed in Belgium was inadvertently contaminated with polychlorinated biphenyls (PCBs) and/or cancer-causing dioxin in January 1999. The feed was later fed to chicken, swine, and other food animals, potentially resulting in contaminated food products. To date, human illnesses have not been linked to this incident though long-term surveillance may find otherwise.

Although dioxin can be found throughout the natural world (soil, water, and air for example), 90 percent of human exposure is through the food supply (WHO, 1999). Dioxins are persistent organic pollutants that accumulate in body tissue and pose cancer and other human health risks—in general, the higher up the food chain, the greater the accumulation (WHO, 1999). Consumers have only a limited ability to restrict their exposure to foodborne dioxins (*e.g.*, consuming low-fat dairy products and trimming fat from meat) and therefore national governments have essential roles in monitoring food safety and acting to protect public health (WHO, 1999).

The European Commission (EC), the executive body of the EU, and the rest of the world were not notified of the dioxin crisis until late May 1999. On June 11, the U.S. Food and Drug Administration (FDA) issued a precautionary import alert that recommended detention of products at ports of entry until importers provided lab test results showing that shipments were free of detectable levels of PCBs and/or dioxins (FDA, 1999). Products in this initial import alert included eggs, products containing eggs, game meats from Belgium, France, and the Netherlands, all animal feeds and feed ingredients, and pet foods from all European countries (FDA, 1999). This list was later expanded to include milk-containing products such as soups and cheese.[9] Countries around the world also issued different combinations of temporary consumer advisories, import bans, and import alerts of potentially contaminated foods and animals from Belgium, select

[9] The import alerts from this crisis were later canceled in early 2000 (personal communication with FDA on September 21, 2000).

EU countries, or the EU as a whole.[10] Many foreign buyers demanded price concessions or refused to buy select Belgian products. Belgium also banned domestic sales of many products.

According to a report from the Belgium Ministry of Economic Affairs on the impact of the dioxin crisis on meat production, there was a sharp decline in Belgian meat production in June 1999, some recovery in July-August, and a September production level at 5-15 percent below normally expected levels (FAS, 2000).[11] Production of other food products such as milk and eggs also faced a more subtle but marked decline in June, though these dioxin effects had largely disappeared by September (FAS, 2000). Overall, when considering the relative importance of the different subsectors, the dioxin crisis caused an estimated food industry production decrease of 10 percent in June 1999, 2.5 percent in July and August, and 1.5 percent in September (FAS, 2000). Interestingly, there was a production increase in July for animal feeds which was likely due to a temporary slaughter ban that initially kept many animals on the farms (FAS, 2000).

The combination of slaughter bans, large price concessions, and reduced markets posed an economic burden on food producers. In particular, the Belgian swine industry suffered when test results in June 1999 confirmed dioxin contamination of swine on some farms (FAS, 1999). Contaminated swine farms were depopulated and the swine were destroyed. On other farms, stables of piglets and slaughter hogs became overpopulated because of reduced demand, adding unnecessary feed costs, limiting stable space, and prohibiting fatteners from buying piglets and starting new fattening cycles. A higher amount of pork was put into storage because of reduced markets. The Belgian pork sector received limited financial aid from the Belgian Government for this crisis and did not receive any financial aid from the EU Commission (FAS, 1999).

It is difficult to gauge the international trade and other economic impacts of this crisis. As of yet, 1999 data on Belgium exports are only available for quantities of beef, veal, pork, live cattle, and swine traded (table G-2). Although exports in 1999 decreased by 16 percent for beef and veal and by 5 percent for pork, exports of live cattle increased by 20 percent and 71 percent for swine. It is unclear what percent of any trade adjustments are due to the crisis or due to other factors and how prices affected net farm returns.

The estimated cost of this food safety incident to the Belgian economy exceeds $750 million (Ekperigin, 2000). And as other EU countries were also affected by export bans, the cost of this incident worldwide is likely to be higher. These costs are, however, offset to some extent by gains obtained by industries and countries that provided substitute products. In response to this scare and the temporary removal of some food products from Belgian supermarkets, Belgian consumers became more concerned about food safety and many began consuming more produce, organic eggs, and other organic products. The dioxin crisis also prompted increased consumption of mutton, lamb, and horsemeat (FAS, 2000). The clearest example of a Belgian food industry that profited from the dioxin crisis is that the production of fish products increased appreciably in June and July 1999 (FAS, 2000). And, in the German market, there appears to have been a temporary extra demand for pork and slaughter hogs (FAS, 1999).

As with the BSE crisis, the dioxin scare illustrates that a food safety crisis can pose high financial costs on industries and countries. Reverberations from the dioxin scare contributed to the Belgian Government's collapse later that year (Orden, Josling and Roberts, 2000). The dioxin scare also illustrates that delays in identification and mitigation actions can increase the extent and impact of the incident as trade and consumption of contaminated products continues unhindered. On the other hand, the financial stakes in the dioxin crisis were so high that Belgian regulators had some reason to be cautious about alerting the public and trading partners about the potential crisis until there was sufficient information on the source, extent, and risk posed by the crisis.

The dioxin crisis caused a high awareness and anxiety about food safety in Belgium that served as background stress for consumer reaction to another scare, this time over Coca-Cola (Nemery *et al.*,1999). Within a month of the announcement about the dioxin crisis, school children and other individuals across Belgium began complaining about nausea, headaches, and other symptoms that they believed were caused by drinking bottled Coca-Cola. There were never any significant

[10] For example, countries that took action included Australia, Bulgaria, Canada, Cyprus, Germany, Portugal, Saudi Arabia, Singapore, South Africa, and Thailand.

[11] Data are based on an index of production per working day (1995=100).

Table G-2—Belgian-Luxembourg exports, 1989-1999[1]

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Change[2]
						Metric tons						*Percent*
Bovine meat, fr, ch, w.bn	95,803	110,098	123,608	117,085	111,447	94,805	86,958	80,303	83,850	74,097	59,686	-19
Bovine meat, fr, ch, bnless	8,753	16,012	14,065	11,228	13,418	11,718	12,894	12,778	14,988	14,735	18,413	25
Bovine meat, frz, w.bone	4,680	1,089	1,566	5,831	3,461	981	988	3,344	4,519	2,291	2,141	-7
Bovine meat, frz, boneless	7,579	10,197	23,548	28,303	35,441	33,395	39,983	42,082	36,044	21,651	13,528	-38
Meat of swine, fr, chlld	163,253	164,759	225,308	255,158	303,100	312,721	380,216	389,984	375,100	422,131	400,652	-5
Meat of swine, frz	127,924	113,315	122,308	111,642	108,060	120,409	100,011	103,040	100,301	102,969	94,898	-8
Poultry, whole, fr, ch	4,692	9,086	11,311	13,651	18,734	18,372	17,128	21,617	25,405	27,868	28,598	3
Poultry, whole, frz	24,076	23,878	26,379	29,396	29,821	23,792	21,305	19,559	26,313	27,625	19,577	-29
Edible offal, bov. fr, ch	1,843	2,364	2,028	2,583	6,051	5,797	9,666	10,126	10,929	15,554	3,621	-77
Edible offal, bov., frz	4,791	5,461	7,950	9,441	10,175	10,050	9,999	12,281	10,802	7,126	23,699	233
Edible offal, swine, fh, ch	3,740	3,555	4,724	6,007	14,476	12,928	13,596	19,036	24,564	27,200	20,494	-25
Edible offal, swine, frz	17,546	17,336	17,872	20,894	20,695	25,518	23,130	24,449	29,002	31,743	218	-99
Sausage of meat, offl. etc	10,315	11,057	15,661	16,490	31,142	34,360	35,611	48,548	90,626	87,611	31,676	-64
Milk, fat cont. 1% or less	112,910	108,801	136,778	117,727	109,296	109,303	117,855	89,192	102,680	93,358	68,845	-26
Milk, cream fat cont.1-6%	513,589	478,418	564,070	693,685	683,570	801,064	823,817	779,161	682,509	690,327	693,046	0
Cream, fat content 6%+	23,402	18,186	21,645	33,628	21,850	34,248	30,397	45,477	45,926	91,210	93,388	2
Milk, solid, to 1.5% fat	84,832	63,038	83,660	90,003	102,217	76,406	150,836	88,946	65,808	62,361	90,491	45
Milk, crm solid 1.5%+ fat	36,126	34,430	69,614	72,173	99,578	119,699	176,401	115,213	92,427	90,237	71,961	-20
Milk, cream unsweetened	20,370	30,875	41,327	62,800	24,765	25,477	28,560	18,271	34,342	78,552	54,366	-31
Milk, cream, sweetened	12,576	16,626	20,423	20,940	20,057	11,936	20,329	16,185	12,239	12,854	15,663	22
Whey	102,768	103,497	106,480	122,462	94,220	66,948	76,097	78,660	94,564	88,949	56,171	-37
Milk products nes[3]	452	1,355	734	11,914	24,546	53,470	29,264	40,833	31,349	30,670	15,159	-51
Butter, other fat of milk	116,658	107,278	132,469	119,244	133,541	127,367	125,094	105,345	111,332	116,825	107,338	-8
Egg, unshelld; yolks, dried	664	893	1,175	1,117	1,728	2,177	1,343	1,848	3,477	3,488	4,295	23
Egg, unshelld; ylk, not dry	32,690	37,022	36,015	34,552	29,876	24,476	30,142	22,358	27,624	25,872	19,340	-25

[1] Select exports to the rest of the world in metric tons. [2] Percent change between 1998 and 1999. [3] nes = Not elsewhere specified.

Source: United Nations COMTRADE database, 2000.

lab or physical findings to support these claims and some people believed that features of this outbreak pointed to mass hysteria or mass sociogenic illness (MSI) (Nemery *et al*., 1999).[12] There was intense media coverage about the Coca-Cola crisis on the tails of intense media coverage about the dioxin incident.

The point here is that major food safety incidents can greatly increase consumer concerns about food safety. Even though this incident of dioxin-contaminated feed was identified and resolved at its source and there have been no apparent human illnesses, perceptions about food safety by the Belgian public and perceptions about the safety of Belgian agricultural products by foreign buyers may be slow to recover. This may be particularly true because so many different kinds of products were implicated and perhaps because it does not appear that accurate and sufficient information was supplied to the public and importing nations early in the crisis to assure people that the crisis was under control.

Looking Ahead…

Currently, the two most prominent conflicts with the potential to jeopardize trans-Atlantic food trade are the beef-hormone dispute and the EU's approval procedure for introducing genetically engineered products into the food chain (Josling, 1998). The issue about growth-promoting hormones in cattle is one example where risk perceptions vary internationally. These hormones are widely accepted as safe and are used on most farms throughout the United States and Canada, whereas the EU believes they pose human health risks and has banned their use in domestic and imported beef. The U.S./Canadian complaint that this ban is a protectionist measure is the only outcome of a food safety dispute that has advanced to the World Trade Organization (WTO) Appellate Body (Buzby and Roberts, 1999). As of May 2000, recent scientific reviews presented to the European Commission (EC)

[12] "MSI can be defined as a constellation of symptoms of an organic illness, but without identifiable cause, which occurs among two or more persons who share beliefs related to those symptoms" (Philen *et al*., 1989).

led the EC to conclude that the evidence that the hormone 17ß oestradiol could cause cancer in humans is sufficiently strong to justify permanently banning all of its uses for farm animals, and that the provisional ban on five other hormones should be continued because they need further study. The debate continues and some retaliatory tariffs on European products remain in place.

Similarly, European consumers are less likely than U.S. consumers to view biotech foods as safe. These differences are largely due to two main factors. First, European consumers are generally less trusting of food safety regulatory systems than are U.S. consumers because of recent incidents where European agencies initially failed to detect the extent of food safety problems and downplayed the likely consequences (Feldmann, Morris, and Hoisington, 2000). Second, European consumers are more aware than are U.S. consumers about the extent to which foods contain biotech ingredients (Feldmann, Morris, and Hoisington, 2000).

Labeling, in general, is a prominent issue relevant to domestic and internationally traded food. In addition to process-based biotech labeling to provide information to consumers concerned about genetically engineered foods, some of the proposed and new food labeling regulations include eco-labeling to promote environmental quality, mandatory country-of-origin labeling to promote domestic agriculture, and health and nutrition labeling to encourage healthier diets. Country-of-origin labeling can also provide consumers with information if they are seeking to avoid certain food imports from certain countries associated with previous or current food safety scares or lapses. To date, most countries do not use labeling as a regulatory tool for food safety (Caswell, 1998). Labeling may help consumers make informed purchase decisions, thereby increasing market efficiency and consumer welfare (Golan, Kuchler, and Mitchell, 2000). However, labeling raises costs of producing and marketing the products and will rarely be sufficient in correcting production externality problems (Golan, Kuchler, and Mitchell, 2000). And, some consumers and governments believe that labeling is an unfair trade barrier and will restrict trade.

As the three case studies have illustrated, an international food safety crisis can have profound impacts on the implicated industry, the exporting country, and international trade in general. For example, the relatively minor outbreak from Guatemalan raspberries had a tremendous impact on the industry, and other Guatemalan exports suffered as well. The BSE crisis virtually stopped international trade of U.K. live cattle and bovine products, and the dioxin crisis affected a large array of agricultural industries in Belgium.

The three case studies also illustrate that even after major international food safety incidents have been resolved or largely controlled, consumer perceptions about the implicated foods and the exporting country's ability to produce safe food may be slow to recover. However, a timely and appropriate response to a food safety crisis by the government and by the implicated industry can help minimize damage from the crisis to food markets and consumer confidence. The extent of scientific uncertainty about a food safety issue clearly plays a role in shaping food safety perceptions, and these perceptions affect what countries will accept in terms of food safety risks in domestic and imported food.

The mix of private and public strategies to control food safety risks is changing both in the United States and abroad, and in turn, the patterns of international food trade are also changing. Private control strategies include self-regulation, vertical integration (to ensure quality/safety of inputs, for example), Hazard Analysis and Critical Control Point (HACCP) systems, and third party certification such as the International Organization for Standardization (such as, the ISO 9000 series or "EN 29000" in Europe) (Buzby and Roberts, 1999).[13] Public control strategies range widely and include regulatory reorganization efforts for food safety as well as regulations for domestic and internationally traded food.

In general, countries are responding to arbitrage pressures and other trade-related tensions by adopting multilateral coordination mechanisms such as mutual recognition, coordination, and harmonization (Sykes, 1995). Mutual recognition means a country explicitly accepts the standards, certification procedures, and regulations of other countries (for example, U.S. inspection of meat is accepted for their imports). Coordination takes convergence one step further by jointly designing adjustments to each country's policies (using, for example, World Health Organization (WHO) control procedures for communicable diseases). Harmonization

[13] See Caswell and Henson (1997) for a discussion on the interaction of private and public systems to control food quality.

entails even higher levels of convergence such as regional or world standards or agreements.

Private-sector approaches are often intertwined with each other (ISO standards often use HACCP, for example) and with multilateral coordination mechanisms (such as Codex HACCP standards). Countries and firms within countries may use private system approaches differently, and this difference influences the marketing of food safety internationally. In general, the greater the coordination of multilateral mechanisms and private approaches among firms and nations, the more they will be able to provide verifiable and valuable information to trading partners and facilitate trade.

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