Chapter 8

The Belgian Dioxin Crisis and Its Effects on Agricultural Production and Exports

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Summary

The Belgian dioxin crisis began in January 1999 when animal feed in Belgium was contaminated with cancer-causing dioxin and polychlorinated biphenyls (PCBs). Dioxin-contaminated feed was then fed to chicken, swine, and other food animals, subsequently affecting a large array of agricultural industries and temporarily interrupting trade with the United States and more than 30 other countries.[2] This chapter provides some analysis of agricultural exports and production effects of the crisis. It complements previous chapters by providing an example of a food safety crisis that resulted from an isolated event involving a persistent organic pollutant and that affected a wider range of food sectors than most other food safety issues.

Belgium-Luxembourg exports were adversely affected by the crisis in the short run. Export growth rates for the decade prior to the crisis were positive for five key agricultural categories (eggs, dairy products, swine products, poultry products, and "other" meat products). However, the percentage change in the growth rate between 1998 and 1999, representing the shortrun effects of the crisis, dropped and became negative for eggs, swine products, and dairy products, with the largest decline for "other meat" products (-32.1 percent). Although the growth rate for poultry products also fell dramatically, it remained positive at 2.3 percent during 1998-99.

The dioxin contamination originated in animal feeds, yet other production sectors were far more affected in percentage terms. This study use Belgium-Luxembourg monthly production data from the Belgian Ministry of Economic Affairs, National Institute of Statistics (NIS) (1999). Poultry meat products, meat and meat products, and slaughtering of cattle were especially hit hard by the crisis, Other product categories such as fish and fish products, actually benefited as buyers switched to products not implicated in the contamination. Feed production even increased slightly in July 1999 due to a temporary slaughter ban that initially kept many animals on the farms.

Dioxin and/or PCB contamination in feed has occurred in several countries since the Belgian dioxin crises, though to a lesser extent. This crisis was a large-scale, isolated event and did not represent an ongoing or evolving food safety problem. One challenge illustrated by the 1999 crisis is the fine balance between gathering sufficient information on such an event (e.g., source, cause, human and animal health risks) and the timely and accurate release of information to the public and to trading partners. Overcoming this challenge will be important for governments and implicated industries in order to minimize damage to food markets and maintain consumer confidence in both the food supply and in governments' ability to handle food safety crises.

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[1] Authors are economists with the Food and Rural Economics Division of the Economic Research Service.

[2] The terms "swine" and "swine products" are used hereinafter instead of "hogs" or "pork products" in order to be consistent with the category names used in the Belgian data.

Introduction

The Belgian dioxin crisis exemplifies a food safety crisis that: (1) arose from a large-scale, isolated contamination event as opposed to an ongoing or evolving problem, (2) involved a persistent organic pollutant as opposed to other food safety hazards, such as pathogens, (3) adversely affected multiple agricultural sectors and countries importing from these sectors, and (4) may have been the result of some form of deliberate contamination. Shortly after the Belgian government announced the crisis in late May 1999, the media alleged that the contamination was the result of the deliberate or accidental use of motor oil or some other industrial oil in an animal fat mixture (Lok and Powell, 2000). However, the Belgian government has not provided an official confirmation of the source of the contamination or how it occurred (Lok and Powell, 2000). A more recent and scientific article attributes the crisis to a fat mixture made with mineral oil containing PCBs—"most likely oil from discarded transformers originating from a waste recycling center" (van Larebeke et al., 2001). Because the public announcement of the crisis occurred at one point in time, it is possible to compare Belgian food production and trade before and after the crisis. However, this chapter is not meant to be a report of a comprehensive economic analysis.

Background on Dioxin

Dioxin is a general term for hundreds of chemicals that are highly persistent in the environment. Dioxins are created as a byproduct of chemical processes. Some are created from natural causes such as forest fires and volcanic eruptions; dioxins can be found throughout the natural world (in soil, water, and air, for example). Accidental and uncontrolled fires at landfills also add to dioxin levels. Exhaust emissions and processes such as pulp and paper bleaching, incineration, and the manufacturing of steel, chemicals, and paint also release dioxins and contaminate the environment (EC, July 20, 2001). Absorbed dioxins 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). Any dioxins released into the environment can accumulate over time in human and animal fatty tissue (EC, July 20, 2001). Contamination with polychlorinated biphenyls (PCBs) is often accompanied by dioxin contamination so both are often evaluated together.[3] The U.S. Food and Drug Administration (FDA) website provides extensive information on dioxins.[4]

Studies suggest that 80 percent (EC, July 20, 2001) to 95 percent (preliminary EPA estimate, 1994) of human exposure to dioxin is through the food supply, primarily through the dietary intake of animal fats from meat, poultry, and dairy products. At least in the United States, human exposure has also occurred historically from industrial accidents and from working in industries that produce dioxin as a byproduct, or through drinking contaminated breast milk. Dioxin in feed is thought to be the main contributing factor to the dioxin level in food from animals and animal products, though animals can also be exposed through contaminated soil, air, and water (EC, July 20, 2001). There is no international agreement on target levels for several reasons, including analytical method difficulties, lack of data (e.g., typical levels), and the lack of a clear distinction as to what level of dioxin is considered as "safe." However, the World Health Organization has elaborated a "tolerable daily dose."

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). In general, dioxin contamination comes from either "background" contamination from the sources previously described or from specific, isolated incidents, which are rare. In July 1997, U.S. agencies found elevated levels of dioxin in some chicken, eggs, farm-raised catfish, and animal feed (FDA, March 13, 2003). A lengthy investigation traced the source of this incident to feed produced with "ball clay" from one Mississippi mine. The clay was used as an anticaking agent in soybean meal and has since been prohibited by FDA from use in any animal feed.

[3] PCBs are fluids that used to be used as transformers and insulators in some industrial settings in the United States. PCBs are more readily measurable, though dioxins drive health concerns. For simplicity, the term "dioxin" is sometimes used to cover both dioxin-like PCBs and dioxins.

[4] The Interagency Working Group on Dioxin (IWG) has developed very detailed information about dioxins on their website and this covers four topics: (1) general information about dioxins, (2) overview of the draft EPA dioxin report, (3) food safety questions and answers, and (4) risk assessment questions and answers. *www.cfsan.fda.gov/~lrd/dioxinqa.html*

Governments move quickly to stop dioxin contamination at the source if the source can be identified and removed. Countries have different ways of dealing with contamination, though both the United States and European Union have stringent laws for industrial sources that are driven by what technology can control (Winters, 2002). The European Commission (EC), the EU's governing body, recommends an overall strategy to reduce exposure to dioxins, including actions that reduce dioxin levels in the environment, animal feed, and food, with emphasis given to the sources of major importance (typically fish oil and fish meal) (EC, July 20, 2001). Although, in principle, a similar broad-based strategy is followed in the United States, the EU has set regulatory limits for dioxin in food whereas the U.S. doesn't have such limits because of concerns about lack of scientific basis. Some countries seek dioxin testing certification which is very expensive and only available from private sources (FAS, 2003).

Efforts to reduce dioxins over the past two decades have resulted in a downward trend in dioxin exposure for Europeans (EC, July 20, 2001). Similarly, dioxin levels in the U.S. environment have declined since the 1970s. The U.S. Environmental Protection Agency (EPA), State governments, and industry are working together to reduce the production of manmade dioxins (FDA, July/Aug. 2000).

The Belgian Dioxin Crisis

The Belgian dioxin crisis began in January 1999, quickly spread across national borders, and had serious trade impacts. The crisis occurred when 60-80 tons of fat used in animal feed in Belgium was contaminated with almost 1 gram of cancer-causing dioxin and 40-50 kilograms of PCBs (van Larebeke et al., 2001). The contamination occurred when a fat smelting company added dioxin-contaminated oil to a mixture of fats for later use as a feed ingredient. This contaminated fat was then purchased by at least 10 feed mills and was used to make approximately 500 tons of contaminated animal feed—versus over 28,000 tons/week average production and use of feed in Belgium (van Larebeke et al., 2001). The contaminated feed was distributed mostly to poultry farms but also to rabbit, calf, pig, and cow breeding and raising farms in Belgium, with some distributed to Germany, France, and the Netherlands (van Larebeke et al., 2001). In Belgium alone, 746 pig farms, 445 poultry farms, 393 bovine farms, and 237 dairy farms used feed from the 10 producers of contaminated feed (van Larebeke et al., 2001). The following chronology of the crisis is abbreviated from a description in Lok and Powell (2000), which was based primarily on a 1999 Belgian government website:

- January 18-19, 1999—Fat mixture was contaminated with dioxin at Verkest, a fat and oil processing plant.
- End of January 1999—Contaminated fat was supplied to feed manufacturers and used to make feed, which was sold to broiler chicken, egg, pork, and beef producers.
- During February 1999—An animal feed manufacturer, the Da Brabender firm, noticed problems with hens used to produce 1-day old chicks.[5]
- March 3, 1999—Da Brabender notified their insurance company and this led to an investigation by Dr. Destickere, a veterinarian [and head of the West Flanders Inspectorate].
- Next 2 weeks in March 1999—Dr. Destickere concluded that the most likely source of the problem was the fat in animal feed.
- March 18, 1999—Da Brabender sent a sample of suspect animal feed produced in January 1999 for analysis.
- March 19, 1999—Da Brabender notified the Belgian Ministry of Agriculture.
- A few days later—The Belgian government began investigating and testing.
- April 21, 1999—Dr. Destickere reported his suspicions about dioxin as the source to the Belgian Ministry of Agriculture.
- April 26, 1999—Test results found high dioxin concentrations in feed and chicken fat samples.
- May 26, 1999—Test results found high dioxin levels in breeding eggs for hatching and in mother hens on farms that purchased from suspect feed manufacturers. This meant that there were high levels of dioxin in eggs and chicken on the market in April.

[5] The media reported that the first signs of contamination detected by poultry farmers included direct biological health effects such as hens laying fewer eggs or not thriving, nervous system problems in chicks, and a declining ratio of hatched eggs.

- May 27, 1999—The Belgian Ministry of Agriculture notified the public and the European Commission (EC) about the situation.

On May 28, 1999, Belgium banned the domestic sale of all Belgian-produced chicken, meat, and eggs, withdrawing these products from retail stores (Ashraf, 1999). Later the Belgian government widened the list of products potentially contaminated with dioxin (FAS, June 7, 1999). As a result of the crisis, more than 200 butcher shops closed temporarily in Belgium and consumers rushed to buy organic eggs and other products that were not suspect (FAS, June 7, 1999). Lok and Powell (2000) detail the actions the Belgian government took to mitigate and resolve the crisis.

On June 4, 1999, the U.S. Food and Drug Administration (FDA) issued an import bulletin to detain certain products at the port of entry. On June 11, 1999, FDA issued an import alert (No. 99-24) to detain certain 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, June 11, 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, June 11, 1999). This list was later expanded to include milk-containing products such as soups and cheese (FDA, June 23, 1999). The Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture (USDA) also issued import alerts and took subsequent actions. The U.S. import alerts from this crisis were canceled in early 2000 (personal communication with FDA on Sept. 21, 2000).

Within 2 to 3 weeks of the May 27 announcement, more than 30 countries issued different combinations of temporary consumer advisories, import bans, and import alerts of potentially contaminated foods and animals from Belgium, select EU countries, or the EU as a whole (Lok and Powell, 2000).[6] More products were added to the lists of suspected products as the crisis unfolded (e.g., chocolates) (Lok and Powell, 2000). Much later, the EU raised objections to the emergency measures of nine of its trading partners who maintained restrictions on animal products when these actions were no longer justified in the view of EU officials (see chapter 3).

As dioxin risks are long-term health hazards and hard to detect and attribute to specific causes, it will take time to determine if international measures to mitigate the crisis were successful in terms of protecting human health: to date, no human illnesses have been linked to this incident. Van Larebeke et al. (2001) estimate that the stochastic incremental cancer risk associated with the Belgian PCB and dioxin crisis varies between 44 and 8,316 cancer deaths in the Belgian population (roughly 10 million). They caution that huge uncertainties exist with their estimates, such as the pathogenic potency of the PCBs and dioxin.

Estimated Economic Impacts of the Belgium Dioxin Crisis

Ideally, an economic analysis of the Belgium dioxin crisis would require careful evaluation of the: (1) domestic products that are directly and indirectly affected by the contamination, (2) agricultural sectors providing these products to domestic and international markets, and (3) shortrun and longrun effects of the crisis. For example, costs from the crisis would include costs from new regulations for feed ingredients. However, it would be difficult to estimate these costs as BSE and foot and mouth disease also likely contributed to such legislation (FAS, 2003). Because of data availability and the more descriptive goals of this chapter, we focus here almost exclusively on the direct effects of the crisis on Belgian food production and exports in select markets or sectors.

Estimated Impact on Exports

To analyze the impact of the Belgian dioxin crisis on Belgium-Luxembourg exports of agricultural products, we aggregated data from the United Nations Statistics Division on agricultural products into five product categories: dairy, swine, "other meat" (i.e., nonswine and nonpoultry), and poultry products, and eggs (see attachment A).

In general, Belgian exports of dairy products far exceed other categories of Belgian agricultural exports (table 8.1). Between 1990 and 1995, the exports of dairy products grew steadily and then showed a few years of declining exports. Part of the

[6] For example, countries that took action included Australia, Canada, Cyprus, Germany, Hong Kong, Portugal, Russia, Saudi Arabia, Singapore, South Africa, and Thailand.

Table 8.1—Belgium-Luxembourg world exports of key agricultural products, 1989-99

Product category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
					— Metric tons —						
Dairy products	1,184	1,156	1,402	1,586	1,586	1,719	1,890	1,711	1,622	1,741	1,676
Swine products	391	382	459	482	540	562	604	630	635	685	588
Meat products[1]	176	198	234	239	271	259	262	281	333	308	209
Poultry products	68	81	98	123	149	160	188	218	293	328	335
Eggs	89	94	93	98	83	110	108	105	127	118	111

[1] Here "meat" refers to meat other than swine and poultry.

Source: Computed from United Nations Statistics Division's COMTRADE database, 2002.

drop between 1998 and 1999 is likely due to the Belgium dioxin crisis because many countries, including the United States, banned the import of milk products from Belgium. Exports of swine products and "other meat" products also dropped between 1998 and 1999. Poultry exports grew consistently over this time period while egg product exports changed little (fig. 8.1).

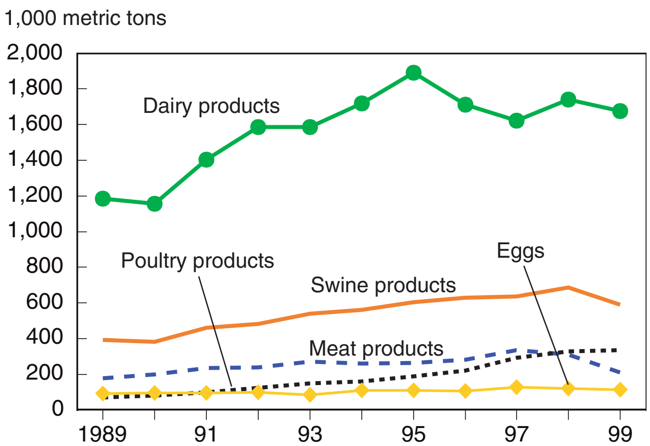
To more closely analyze the short-run economic effects of the Belgian dioxin crisis, we compared the longrun growth of exports of eggs and poultry, swine, other meat, and dairy products over the decade prior to the 1999 crisis against the shortrun effects, as measured by the percent change in exports between 1998 and 1999 (table 8.2 and fig. 8.2). These data suggest that the Belgium dioxin crisis had a shortrun economic impact on the export market. The estimated growth rates for the 10 years between 1989 and 1998 were positive for all five product categories. However, between 1998 and 1999, the growth rate dropped and became negative for eggs, swine, and dairy products, with the largest decline for other meat. The change in poultry exports between 1998 and 1999 remained positive but dropped dramatically from its longrun growth rate of 19.1 percent.

Table 8.2—Comparison of the growth of Belgium-Luxembourg exports of key agricultural products

Product category	Rate of growth (1989-99)	Change of growth (1998-99)
	Percent	
Eggs	3.1	-6.0
Meat products	6.5	-32.1
Swine products	6.4	-14.2
Dairy products	4.4	-3.7
Poultry products	19.1	2.3

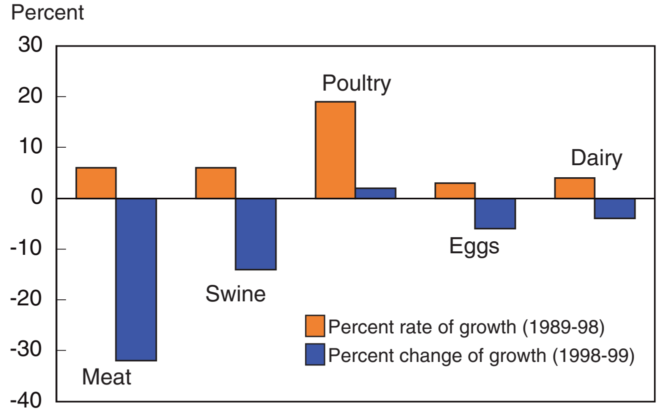
Source: Computed from United Nations Statistics Division's COMTRADE database, 2002.

Figure 8.1
Belgium-Luxembourg world exports of key agricultural products



Source: Computed from United Nations Statistics Division's COMTRADE database, 2002.

Figure 8.2
Comparison of the growth of Belgium-Luxembourg world exports of key agricultural products using percent rate of growth between 1989-99 and 1998-99



Source: Computed from United Nations Statistics Division's COMTRADE database, 2002.

The Belgium Foreign Trade Bulletin (FGTB) reports that "it is interesting to note that the statistical data for September, October, November, and December show a recovery in exports, so that it seems that the effects of the dioxin crisis had become virtually nonexistent by then."[7] Any estimation of the exact amount of the long-run effect on exports will require more detailed data for a longer time period for these industries and other directly and indirectly affected industries.

Estimated Impacts on Production

The Belgian Ministry of Economic Affairs, National Institute of Statistics (NIS) conducted a study on the impact of the dioxin crisis on meat production (1999). Data in this report were based on an index of production per working day (1995=100). The NIS report (1999) compared the change in production, processing, and preserving of key agricultural products in Belgium during the first 9 months of 1999 with data for the first 9 months in 1998. Although the dioxin contamination began in January 1999, the major impacts were felt in June, immediately after the Belgium public, the EU, and the rest of the world were notified of the crisis in late May. Overall, when considering the relative importance of the different subsectors, the dioxin crisis caused an estimated decrease in total food industry production of 10 percent in June 1999, 2.5 percent in July and August, and 1.5 percent in September (NIS, 1999). If construction is excluded, the net impact on the total food industry was a decline of 1.2 percent, 0.3 percent, 0.3 percent, and 0.2 percent respectively for the months June through September (NIS, 1999).

Here we take a closer look at 6 of the 15 agricultural sub-sectors in the NIS report, those that were either directly and adversely affected or profited from the crisis:[8]

1) Poultry meat products,
2) Meat and meat products,
3) Slaughtering of cattle,
4) Dairies and cheese making, and
5) Fish and fish products,
6) Prepared feeds for farm animals.

[7] Source: BFTB - Statistics / Annual Study Belgium's Foreign Trade in 1999. URL: *www.obcebdbh.be/import_en/info-centerr/trade-statistics/annual-study/1999/as-sbreakdown_en.html*

[8] Other categories not covered here include a wide range of products such as beverages, tobacco, cocoa, bread, condiments, and seasoning.

Monthly production indices (1998-99) for each of these six product categories are provided in attachment B. Table 8.3 presents the change in the production index for each product category for the first 9 months of 1999 from its corresponding index for the first 9 months of 1998. We developed figure 8.3 so that the impacts from the crisis and patterns of change for these six categories could be more easily identified and compared.

In general, the three meat industry categories (poultry meat production, meat and meat product production, and slaughtering of cattle) were the subsectors hit hardest in terms of declines in monthly production/processing and preserving. Clearly, the sharpest production declines occurred in June 1999, right after the public announcement about the crisis in late May. An analysis of the long-term effects of the crisis would require more recent data. However, the worst impacts for all six categories seemed to be over in July 1999 with the different subsectors gradually returning to pre-crisis levels over subsequent months.

Poultry meat products had the steepest drop in the data series, 53.5 percent lower in 1999 than in 1998. This is not surprising because the first bans resulting from the crisis included the domestic sales of Belgian-produced chicken meat and egg products and exports of Belgian chicken products. Although one might expect a larger drop for feed production, the amount of feed contaminated by dioxins was small compared with that produced and used each week in Belgium, and the feed that was contaminated was distributed widely, mostly to poultry producers.

There were negative percent (index) changes during the entire first 9 months of 1999 for the production, processing, and preserving of meat and meat products. This is consistent with the declining trend in the demand for these products. During 1995-98, consumption of fresh meat in Belgium declined heavily, as it did in most of the other EU countries (Verbeke and Ward, 2001). In particular, the gradual long-term decline in per capita beef consumption is likely caused by long-term changes in the eating habits and demographics of EU consumers (EC, 1997; EC, 1998; see chapter 4). However, the largest drop in Belgian production of meat and meat products was observed during June 1999 (-42.4 percent). The decreased cattle slaughter was likely a function of several factors such as temporary slaughter bans, which kept many animals on the farms.

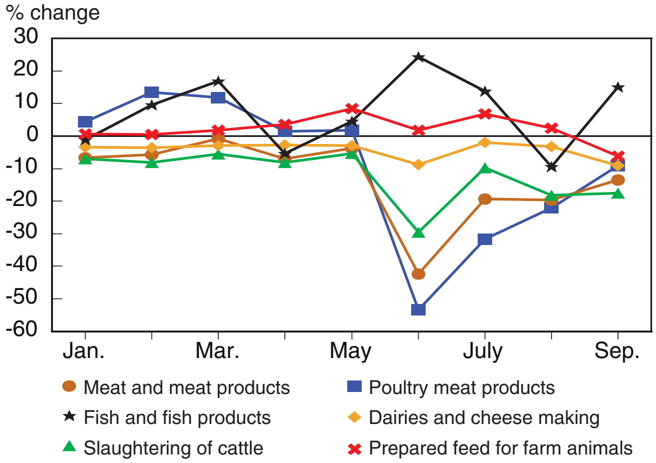
Table 8.3—Monthly change in Belgium-Luxembourg production/processing and preserving of agricultural products indices between 1998 and 1999

Product category	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.
					Percent				
Poultry meat products	4.3	13.4	11.9	1.5	1.8	**-53.5**	-31.6	-22.1	-9.1
Meat and meat products	-6.6	-5.7	-0.9	-7.0	-3.8	**-42.4**	-19.3	-19.7	-13.5
Slaughtering of cattle	-7.0	-8.1	-5.6	-8.2	-5.4	**-29.5**	-9.8	-18.2	-17.6
Dairies and cheese making	-3.4	-3.6	-3.0	-2.7	-2.9	**-8.7**	-2.0	-3.2	-9.1
Fish and fish products	-1.1	9.6	16.8	-5.4	4.6	**24.4**	13.8	-9.5	15.1
Prepared feeds for farm animals	0.7	0.5	1.8	3.5	8.5	**1.7**	6.8	2.4	-6.1

Source: Belgium Ministry of Economic Affairs, National Institute of Statistics, 1999.

Figure 8.3

Monthly change in Belgium-Luxembourg production/processing and preserving of agricultural products indices between 1998 and 1999



Source: Belgium Ministry of Economic Affairs, National Institute of Statistics, 1999.

In the production category "dairies and cheese making," declines were more subtle and seemed to quickly return to monthly decreases. The NIS report considers this category one of the indirectly affected subsectors.

While several production categories showed marked declines after the announcement, others, such as fish and fish products, showed increased production and profited from the dioxin problem. Monthly changes for fish and fish products show some natural fluctuation, perhaps due to seasonal changes or harvest factors. However, the June 1999 index was 24.4 percent higher than in June 1998. This likely reflects consumers' belief that these food products posed lower risks from dioxin contamination, and consumers may have substituted fish products for meat and swine products. In particular, according to the U.S. Foreign Agricultural Service (FAS), Belgian seafood consumption rose 50 percent in June 1999 due to the crisis, with increased shellfish sales offsetting a decreased market for other kinds of seafood (FAS, June 13, 2001).

Another production category that appeared to benefit from the crisis, at least in the short run, was prepared feeds for farm animals. The July increase was likely due to the temporary slaughter ban that kept many animals on the farms, creating a greater demand for animal feeds (NIS, 1999). Although the dioxin contamination originated in animal feeds, other production sectors were far more affected in percentage terms.

The Belgian swine industry suffered when test results in June 1999 confirmed dioxin contamination of swine on some farms (FAS, Aug. 1, 1999). Contaminated swine farms were depopulated. On other farms, swine facilities became overcrowded because of reduced demand, adding unnecessary feed costs, limiting stable space, and prohibiting fatteners from buying piglets and starting new fattening cycles. Increased quantities of pork were put into storage because of reduced markets. The Belgian pork sector received limited financial aid from the Belgian government for this crisis and received no financial aid from the European Commission (FAS, Aug. 1, 1999).

Summary of Impacts

The combination of slaughter bans, large price concessions, and reduced markets after the dioxin crisis posed an economic burden on consumers, food producers, and food exporters. On August 16, 2003, the EC approved a Belgian aid agreement that would reimburse farmers 80 percent of market price of their losses (Lok and Powell, 2000). The Belgian government estimates that the dioxin crisis cost €465 million ($493 million), with about €100 million ($106 million) attributed to the loss in the swine sector (where 1999 €1.00= US$ 1.06) (FAS, Feb. 1, 2001, pg. 18, 19).[9] And as other EU countries were also affected by export bans, the cost of this incident worldwide will likely be higher.

The economic impact of the Belgian crisis was relatively small compared with the Belgium economy's GDP (1999) of $266 billion in 1999, but was important for agriculture, which accounted for 1.4 percent of GDP or $3.7 billion.[10] In 2000, on the heels of the Belgian dioxin crisis, Belgium confirmed its first case of bovine spongiform encephalopathy (BSE). This BSE crisis cost Belgium an additional €250 million (FAS, Feb. 1, 2001) (chapter 4 provides more details on BSE).

These costs of the dioxin crisis are, however, offset to some extent by gains obtained in industries and countries that provided substitute products. In response to the Belgian dioxin 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, April 17, 2000). The clearest example of a Belgian food industry that profited from the dioxin crisis is the appreciably increased production of "fish and fish products" [includes shellfish] in June and July 1999 (NIS, 1999). And, in the German market, there appears to have been temporarily increased demand for pork and slaughter hogs (FAS, Aug. 1, 1999).

Although one might expect that food imports may have helped reduce or mitigate some of the impacts of the Belgian dioxin crisis on the domestic economy, United Nations trade statistics for 1989-2001 show that meat imports into Belgium-Luxembourg actually fell in 1999 from its 10-year high. The fall in meat imports in 1999 likely reflects, in part, the decreased demand for meat following the crisis. For example, per capita consumption of beef and veal in Belgium also decreased in 1999, probably partly due to the dioxin crisis (FAS, Feb. 1, 2001, p. 7).[11]

[9] Of this amount, €165 million was for the Ministry of Agriculture and €300 million was for the Ministry of Public Health (FAS, Feb. 1, 2001). No further description was provided in the publication.

[10] *www.state.gov/www/background_notes/belgium_0006_bgn.html*, accesssed May 17, 2002.

[11] Pork consumption also fell in 1999 due to the dioxin crisis (FAS, Feb. 1, 2001, p. 14) and live pig exports increased considerably, particularly to Dutch slaughterhouses (FAS, Feb. 1, 2001, p. 14). Another factor affecting pork production is EU legislation against nitrate emissions (FAS, Feb. 1, 2001, p. 13).

Public and Private Sector Response

As with the BSE crisis, the dioxin scare illustrates that a food safety crisis can impose high financial and political costs on industries and countries. The Public Health Minister and the Agriculture Minister resigned after if became clear that the Belgian government had known about the dioxin crisis for weeks before announcing it to the public and the EC (Ashraf, 1999). The Dutch Minister of Agriculture also resigned after similar criticism (Lok and Powell, 2000). Public confidence in both the food supply and the Belgian government was shaken and, partly because of this, the ruling party was later ousted in a national election (Lok and Powell, 2000).

In addition to mitigation actions, the dioxin crisis and general concerns about dioxins resulted in several responses by the public sector. First, the Belgian government created a new agency called the Federal Agency for Safety of the Food Chain in response to the lack of public communication and internal mechanisms that exasperated the crisis (FAS, Aug. 17, 2000). This new agency has broad responsibilities that ensure food safety from farm to table and once fully implemented, it will be placed under the Ministry of Public Health (FAVV, 2002).[12] Second, this new agency instituted a traceability and monitoring system to extend the existing SANITEL system for the mandatory identification of cattle. A meat traceability component extends the system to other animals and beyond the slaughterhouse (BELLTRACE) and a monitoring component—Contaminant Surveillance System (CONSUM)—tests for chemical and microbiological contamination of feedstuffs and all animal food products such as eggs, oils, fats, dairy, fishery, and derived products (FAS, Nov. 5, 2001). The goal of this monitoring system is early detection of contamination. Third, the Belgian government will execute certain decisions taken by the EC concerning dioxins.

For example, the EC asked the EU's Standing Committee on Animal Agriculture and Nutrition (SCAN) and the Scientific Committee on Food (SCF) for scientific opinions about the contamination of feed and food by dioxins and closely related PCBs. As a

[12] Previously, food safety in Belgium was controlled by five agencies and is now covered instead by one new agency that falls under the authority of the Ministry of Public Health. See FAS June 26, 2000 report for details on the agency's seven assignments.

result, two reports were released in November 2000. The SCF report established a temporary tolerable weekly intake (TWI) for dioxins and dioxin-like PCBs of 14 pg/kg body weight (EC, Nov. 22, 2000). These were updated on May 30, 2001. Meanwhile, the SCAN report's main conclusion is that fish oil and fishmeal are the most heavily contaminated feed materials, followed by animal fat (EC, Nov. 6, 2000). The report recommended an emphasis on reducing the most contaminated materials. Both reports recommended an integrated approach that would reduce dioxin contamination all along the food chain, a more systematic and coordinated generation and collection of comparable and reliable data, and a continuing reduction of emissions to the environment.

Given these two reports and an earlier White Paper on Food Safety that identified the need to set standards for contaminants in feed and food (EC, Jan. 12, 2000), the EC proposed a strategy to reduce dioxin in animal feed, the environment, and food in July 2001 (EC, July 20, 2001). In October 2001, the EC adopted this strategy (EC, Oct. 25, 2001). In essence, this strategy has two parts. The first part identifies short to medium-term (5 years) and long-term (10 years) actions that combined are intended to provide a comprehensive understanding of the dioxin/PCB problem and existing trends to assist future evaluation and policymaking. The second part has three components: (1) *maximum levels* to set regulatory limits for dioxin in foods and feeds, (2) *action levels* to serve as early warning indicators of undesirable dioxin levels so measures can be taken to eliminate the sources and pathways of contamination, and (3) *target levels* to bring food and feed, over time, down below the SCF's recommended TWI of 14 pg/kg body weight for dioxins.

The U.S. government also monitors potential dietary sources of dioxins. Since 1995, the FDA has tested several hundred samples a year, primarily fish and foods sold at retail outlets (FDA, 2000). Meanwhile, EPA and the FSIS test for dioxins in U.S. beef, pork, and poultry. In 1999, as part of the Total Diet Study, FDA started dioxin monitoring in 200 of the most commonly consumed foods in the United States (FDA, 2000). The U.S. also began monitoring animal feeds that may contribute to the dioxin levels in some foods (FDA, 2000). FDA's monitoring program has been successful in identifying elevated levels of dioxin in some mineral components of animal feed and is taking action to stop distribution of any contaminated product (for example, see FDA, February 28, 2003).

Dioxin Crisis and Belgian Consumers

During the crisis, Belgian consumers switched to other food products to avoid dioxin-contaminated products either voluntarily or as a result of limited access to foods in supermarkets and stores. Some apparently crossed into England, France, or Germany in search of untainted food. Meanwhile, some Belgian towns opened dump sites so that local residents could leave suspect foods for destruction (BBC news, June 5, 1999).

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, schoolchildren and others 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 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 (Nemery et al., 1999).[13] There was intense media coverage about the Coca-Cola scare on the tails of intense media coverage about the dioxin incident.

Conclusion

The Belgian dioxin crisis illustrates that an international food safety crisis can have significant, short-term impacts on the implicated industries and the exporting country. The dioxin crisis affected a large array of agricultural industries in Belgium (e.g., feed, meat, poultry, cattle slaughter, dairy and cheese making) and interrupted trade with the United States and more than 30 other countries (Lok and Powell, 2000). The crisis also illustrates how consumers react to crises in the short run, switching to nonsuspect products (e.g., organic eggs). More recent data and more research are needed to clarify if there are longrun impacts from the crisis, the extent of such impacts, and whether the possibility that the contamination could have been intentional (in some way) had any impact on consumer food safety perceptions.

[13] Mass sociogenic illness "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).

As a result of this crisis, Belgium took multiple actions to minimize the spread of the contamination, resolve the problem, and be better prepared for similar crises (e.g., creation of a single federal agency to cover food safety from farm to table). However, the month-long period between when the government was first notified of the problem and when it was publicly announced was seen as irresponsible by many stakeholders and therefore, the Belgian government lost credibility, trust, and authority and received little credit for all the positive and proactive measures that were taken (Lok and Powell, 2000). Despite the government's explanation that the delay was to first confirm whether the dioxin had entered the human food supply, by the time of this explanation, criticism and discussion focused on the government instead of on those responsible for the contamination or on the extant regulation, surveillance, and enforcement that allowed the crisis to occur (Lok and Powell, 2000).

In general, many factors come into play in the identification of a food safety crisis, including the existing surveillance systems and the way that the contamination manifests itself in animals and humans (e.g., declining ratio of hatched eggs, time to develop acute or chronic illness in humans). On the one hand, the financial stakes of erroneously announcing a crisis can be high, so regulators have some reason to be cautious about prematurely alerting the public and trading partners about a potential crisis until there is sufficient, accurate information on the source, extent, and risk posed by the crisis. For example, the California Strawberry Commission estimated that growers in the central coast of California lost $16 million in revenue to during June 1996 when their products were falsely implicated as the cause of the *Cyclospora* outbreak later attributed to Guatemalan raspberries (Mishen, 1996) (see chapter 5). On the other hand, a greater time lag between the initial contamination and its identification and control can extend and magnify the impacts of a food safety crisis on production, trade, and consumption. And, any public information lag about a potential food safety crisis can be a point of criticism used against governments.

A persistent challenge in major food safety crises will be the fine balance between gathering sufficient, accurate information on such an event (e.g., source, cause, human and animal health risks) and the timely release of information to the public and trading partners. Overcoming this challenge will be important for governments and implicated industries to minimize damage to food markets and maintain consumer confidence in both the food supply and in governments' ability to handle food safety crises.

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