


3-12

Salmonella Control in Denmark and the EU

By:

Tove Christensen and
Lill Andersen

CASE STUDY #3-12 OF THE PROGRAM:
“FOOD POLICY FOR DEVELOPING COUNTRIES: THE ROLE OF
GOVERNMENT IN THE GLOBAL FOOD SYSTEM”
2007

Edited by:

Per Pinstруп-Andersen (globalfoodsystem@cornell.edu) and Fuzhi Cheng
Cornell University

In collaboration with:

Søren E. Frandsen, FOI, University of Copenhagen

Arie Kuyvenhoven, Wageningen University

Joachim von Braun, International Food Policy Research Institute

Executive Summary

Potential food safety hazards include foodborne pathogens,¹ use of antibiotics leading to resistant bacteria, chemical residuals in food products, medicine residues, growth hormones, and genetically modified organisms. The relative importance that consumers (and public authorities) place on each individual food safety issue varies noticeably across countries.² From an economic viewpoint, however, the common feature shared by these issues is that policy intervention to address them might improve social welfare. Two main arguments support the contention that public intervention is welfare improving: (1) insufficient information about the safety of different products prevents consumers from having a proper choice, and (2) food safety is not entirely a private matter because public expenditures on, for instance, public health costs and sick pay are linked directly to each case of human disease. Hence, public authorities have a direct economic interest in implementing optimal food safety policies.

Salmonella is a bacterial foodborne pathogen that causes human illness of varying severity, from mild cases to death. Salmonella control in the Nordic countries is considered leading-edge by international standards (Wahlström 2006; Wegener et al. 2003). In the late 1980s the Danish government, together with the industries concerned, formulated Salmonella control programs as a reaction to a substantial increase in the number of human cases of illness due to Salmonella. The policy succeeded in reducing the number of human cases of illness due to Salmonella in Danish-produced meat and eggs. The policy levied extra costs on food producers and the public sector, but economic analyses suggest that there are net benefits to society in the longer run owing to economic benefits from improved public health.

The international environment has created a challenge for Denmark's formulation of future food safety policies. Denmark has experienced a large increase in the volume of imported meat products

in recent years, and the prevalence of Salmonella (as well as other bacteria, especially *Campylobacter*) in imported meat is significantly higher than in Danish-produced meat. As a basic rule, European Union (EU) legislation does not permit countries (except Finland and Sweden) to ban imported meat on the basis of prevalence of bacteria. Recent documentation of large variations in infection levels in products from different countries (Danish Veterinary and Food Administration 2006), however, has made the EU more inclined to allow country-specific rules regarding food safety. In addition, the EU implemented new criteria for hygiene and food safety processes in January 2006 to increase food safety in Europe.

Your assignment is to identify opportunities and obstacles for improving Danish food safety policy using Salmonella control as a case. Discuss the advantages and disadvantages of the options mentioned in this case study for each stakeholder group. The assignment should include a discussion of the consequences of increased food safety in rich countries for the trading opportunities of developing countries. For example, is there necessarily a trade-off between the best possible food safety in Denmark and the welfare of people in developing countries that wish to export food products to Denmark?

Background

Food Safety

Food consumption has always been a matter of keen interest and concern. Historically, concern has focused on securing sufficient intake of food to avoid malnutrition and starvation. Food risk was associated with lack of food, as is still the case in many parts of the world. In industrial countries, however, the focus on food consumption has changed dramatically and now centers on how to limit the intake of food in order to avoid obesity³ while at the same time securing a safe, nutritious, and tasty diet. Food safety in industrial countries today is concerned with guaranteeing that the risk levels from hazards like microbiological bacteria (such as *Salmonella* and *Campylobacter*), natural

³ This concern also extends to obesity-related risk of illness.

¹ Apart from bacteria, foodborne pathogens also include parasites, viruses, and prions.

² For example, genetically modified organisms and growth hormones are widely accepted in the United States but are considered food safety problems by consumers and public authorities in Europe.

toxins, chemicals, and medical residuals in food products are sufficiently low. For some consumers, absence of genetically modified organisms, growth hormones, and radiation are also important attributes for their perceptions of food safety (see, for example, Andersen and Christensen 2004).

Salmonella in Denmark

Salmonella was the main source of zoonotic infections in Denmark in the 1980s and 1990s. From 1980 to 1997, the number of registered human cases of illness due to Salmonella infection rose fivefold in Denmark, reaching 5,015 (Ministry of Food, Agriculture, and Fisheries 1998). Moreover, many infections occur without physician consultation or hospitalization and are therefore not registered. It is estimated that only between 5 and 20 percent of the total number of human infections are registered (Korsgaard et al. 2005). This estimate implies that the actual number of Salmonella infections in Denmark was likely between 25,000 and 100,000 human cases in 1997—in other words, between 0.5 and 2 percent of the population had a Salmonella infection.⁴ Moreover, there is a small increased risk of mortality shortly after hospitalization, as a direct or indirect result of Salmonella infection. Based on a study by Helms et al. (2003), for most types of Salmonella, the excess mortality rate during the first year after infection is estimated to be 2 percent of the registered number of cases. Thus it is estimated that 100 Danes died prematurely in 1997 as a consequence of Salmonella infection.

The increase in Salmonella infections led the Danish government, together with the industries concerned, to formulate a new food safety policy to reduce the number of human cases of illness due to Salmonella in pork, poultry, eggs, and beef. In 1992 the first public Salmonella program was implemented to control Salmonella in broiler and egg production. In 1994 a public Salmonella control program for pig and pork production was implemented; in 1996 an intensified program to control Salmonella in broilers and eggs was implemented

⁴ The uncertainty of estimates of the actual number of cases is also illustrated in Ryan et al. (1987). In 1985 the United States had a Salmonella outbreak with 16,000 culture-confirmed cases; 200,000 additional symptomatic cases were found in a door-to-door survey of consumers, and 2 percent of those were found to have new arthritis symptoms after the outbreak.

(the program for eggs did not take effect until 1998). Since 2002 cattle and beef production have been regulated.

Current Danish Salmonella control programs involve several policy instruments. The programs prescribe surveillance in all parts of the production chain through tests of meat juice, blood, pen fecal samples, and eggs, as well as increased hygiene requirements. When Salmonella is discovered in a poultry flock, the animals are slaughtered separately from noninfected flocks, infected breeding flocks are destroyed, and eggs from infected flocks are pasteurized. Pigs from herds with high levels of Salmonella are slaughtered under special hygiene conditions, and slaughterhouses reduce the payments for pigs delivered from these farms (Ministry of Food, Agriculture, and Fisheries 2006; Wegener et al. 2003). In Denmark, there is zero tolerance for a specific type of Salmonella called MRDT104 in all food.

The Salmonella control programs have succeeded in reducing the number of human cases of illness due to Salmonella. The number of registered human Salmonella infections fell from 4,276 cases in 1994 to 1,775 cases in 2005 (Figure 1). It is estimated that the actual number of human cases of illness has been reduced by between 150,000 and 600,000 since 1994.⁵ In addition, approximately 600 premature deaths may have been avoided during that period.⁶

⁵ It is assumed that, in the absence of the programs, the annual number of human cases of illness would stay at the level observed the year before implementation of the program. Accordingly, since the first Salmonella control program for pork was fully implemented in 1994, the annual number of cases in the absence of the pork program is assumed to be the same as in 1993. Likewise, since the extended public control of Salmonella in broiler and egg production became effective in 1996 and 1998, respectively, the annual number of cases in the absence of the poultry program is assumed to be the same as in 1995 with respect to broilers and in 1997 with respect to eggs. The interval end points (150,000 and 600,000) are the estimated reduction in the actual number of human cases of illness, for the period 1994–2005, based on registration rates between 5 and 20 percent.

⁶ The number of registered human cases of illness avoided due to Salmonella control was estimated to be 30,800 (see footnote 5). Assuming an excess mortality rate of 2 percent for all registered cases, an estimated 616 premature deaths were avoided.

Figure 1: Annual Number of Human Cases of Illness due to Salmonella Registered in Denmark, 1994–2005



Source: Statens Serum Institut (www.ssi.dk).

It is not costless to ensure safer food products. The Salmonella control programs have generated substantial costs for Danish pork, poultry, and egg producers, slaughterhouses, and egg-packaging units. Also, the public sector has incurred monitoring, control, and administration costs. The direct costs during the period 1995–2002 have been estimated at approximately US\$235 million (Andersen and Christensen 2006).

The main benefit arising from increased food safety is improved public health. The most visible direct economic benefits are reductions in health expenditures (for hospitals and doctors) and increased workforce productivity arising from fewer sick days. The benefits of increased food safety also include the utility of better health that comes with avoiding the discomfort of being ill and the risk of dying prematurely. Furthermore, there is a potential utility gain associated with the increased trust in food products in general that may arise from a strict Salmonella control program. Moreover, research and development for Salmonella control may produce improved technologies that can be

used to reduce other food hazards or that prove to be cost saving.

A reasonable policy question is whether the direct costs of US\$235 million have been a good investment of money from society's point of view. In other words, has the improvement in public health elicited economic benefits that match the costs? A number of studies have investigated this question; see, for example, Hansen (2002), Korsgaard et al. (2005), and Andersen and Christensen (2006). Andersen and Christensen (2006) compare direct costs with direct benefits in terms of reduced public health expenditures and increased workforce productivity. The study suggests that for the period 1995–2002, the Salmonella control programs have generated net direct costs to society. This conclusion is based on the assumption that producers, consumers, and other economic agents do not react to the change in policy. To challenge that approach, the authors perform a general equilibrium analysis that allows a longer time horizon, behavioral adjustments, and interactions and feedback mechanisms between agents. Hence, the analysis includes both direct and derived effects

elicited by adjustments in agents' behavior. The general equilibrium analysis shows that the derived effects in terms of changes in production activities and consumption patterns are positive, resulting in a slight increase in real gross domestic product (GDP). In all the studies mentioned, the economic benefits are known to be underestimated because the analyses do not include the benefits of a reduction in the number of long-term complications and premature deaths. Nor do they include the benefits of consumers' increased utility due to reduced discomfort from being ill.

In conclusion, even though the analyses did not include all benefits, the Danish Salmonella control policy was found to have a positive impact on real GDP and thus to be profitable from society's point of view. This result is driven by distributional effects such that Salmonella control is actually beneficial to some industries while posing net costs to other industries. Whether the Salmonella control programs are welfare increasing is a different question, which the general equilibrium analysis does not answer (Golan et al. 2000).

The EU's Food Safety Policy

The EU requires member states to monitor and control Salmonella and other foodborne zoonotic agents (Directive 2003/99 and Regulation 2160/2003). Member states are required to design national control programs to reach common EU goals regarding the prevalence of Salmonella in primary production. No sanctions are specified, however, if a member state does not reach the goals.

The extent of control varies across member states. Finland and Sweden have had Salmonella control programs since the 1960s. In their zero-tolerance approach, all infected poultry flocks must be destroyed or slaughtered immediately after detection, and food found contaminated with Salmonella must be withdrawn from the market (Wahlström 2006). Other countries have not implemented control programs yet. This difference implies that the prevalence of Salmonella in food products varies considerably across countries. A baseline study reveals that 80 percent of Portuguese and Polish egg-laying hen flocks were infected with Salmonella, compared with less than 3 percent in Denmark, Finland, and Sweden (Danish Veterinary and Food Administration 2006).

In January 2006 a revision of the EU's legislation on the hygiene of foodstuffs was implemented (Regulation 2073/2005). The regulation sets microbiological limits regarding Salmonella on carcasses, and if the limits are exceeded, the responsible slaughterhouse and primary producer are required to change procedures (the so-called process hygiene criterion). In general, there are no restrictions on marketing infected products. The regulation includes zero tolerance, however, with regard to Salmonella in minced meats and certain other fresh meat products (the so-called food safety criterion). By the end of 2009 and 2010, respectively, all eggs and fresh poultry must also be free of Salmonella. If this criterion is not satisfied, then the product must be withdrawn from the market. The economic consequences of complying with these rules, as well as the implementation plans, are not clear at present.

Policy Issues

Why Intervene?

Why is it necessary to implement Salmonella control programs? Understanding the rationale for intervention is key to understanding how the policy should be implemented.

From an economic viewpoint, food safety is considered a commodity. Thus consumers' demand for food safety and producers' supply of food safety determine the market prices of different food safety levels—provided that the markets satisfy certain efficiency requirements. These requirements include, among other things, that no individual firm exercises market power, that there is a sufficient number of market participants, that there is full information about the products, and that there are no regulatory distortions. In such a setting, the market price equals the marginal value of the good (Russell and Wilkinson 1979).

For some well-defined standard versions of products (such as milk, butter, and some meat products), the price determines the market-clearing quantity. Other commodities, such as food safety, are more complex. Food safety is not traded as an individual good—the consumer cannot buy a bag of food safety. (Exceptions include chicken labeled "Salmonella free" or "Salmonella and Campylobacter free" and pasteurized eggs labeled "Salmonella free.") These food products are almost exclusively

distinguished from other products through their food safety level.) An important reason why food safety attributes, such as the absence of *Salmonella* bacteria, are not traded is that they comprise credence characteristics, meaning that their value cannot be discerned even after consumption (Roberts 2005).

The pricing of food safety is subject to informational problems in terms of general uncertainty (which exists when neither producers, consumers, experts, nor public authorities know the exact value of the attribute) and asymmetric information (which exists when one party, typically the producer, has superior information about the value of the attribute and has the economic incentive to use this information for private profit). From an economic point of view, there is a potential welfare improvement in creating an informationally efficient market. In other words, if consumers are willing to pay more for specific attributes, there may be a social value associated with providing reliable and independent information. Instead of allowing only safe products on the market, it might be economically efficient to give consumers a choice among different levels of risk at different prices (Beales et al. 1981). Thus, providing extra information and ensuring well-informed freedom of choice is a very neutral public intervention strategy that represents a potential welfare gain.

If a market is very small, as is the case with *Salmonella*-free products in Denmark, then non-economic factors like availability, shelf placement, and knowledge of the existence of the food product can dominate the pure price mechanisms such that market values are not reliable indicators of the demand for these products.

In relation to food safety, there is an additional argument for public intervention. The health risk related to food consumption is an unintended side effect of consumption (which is often denoted as a negative externality). Owing to the existence of public health insurance and labor market insurance in Denmark and other countries, food risks also imply negative externalities for public authorities and employers. Human infections due to food-borne diseases may impose direct costs to society arising from doctor and hospital expenses and lost workforce productivity. In addition, food risks are associated with indirect costs related to the personal discomfort of illness and general mistrust in

food, which might have an economic impact by increasing people's willingness to pay for safe food.

Hence, public authorities have a direct economic interest in defining an optimal food safety policy, and such a policy may generate positive indirect effects on consumers' utility. According to economic theory, the policy options for public intervention include (1) providing information to secure an informationally efficient market, (2) internalizing externalities through taxes or subsidies—an efficient way of improving social economic welfare, and (3) in cases of extreme uncertainty about potential severe health impacts, banning certain goods and production procedures.

Social versus Private Perspective

The imperfections in the market for food safety create differences between public and private perceptions of food safety. The aim of public interventions is to unite these perceptions.

Table 1 categorizes the costs and benefits of food safety according to whether they are included in decision making at the industry level, the consumer level, or the social welfare level. Public monitoring and control costs, public research and development expenditures, and public health costs are not included in a consumer- or industry-level analysis but are highly relevant in a social welfare analysis. Increased productivity has both private and social benefits, although the benefits differ. For society, increased productivity in any sector enhances welfare. For industry, on the other hand, increased productivity in its own sector is a positive change whereas increased productivity in a competing sector is considered a negative development. The increased utility of a safer product and increased trust in a regulated product are valuable to industry since these benefits may help increase market shares and even consumers' willingness to pay for the product. For example, the fast-food chain Jack in the Box has embraced food safety innovation and management as a marketing tool (Theno 2006). From a social welfare perspective, a particular food safety policy might create additional positive effects in terms of increased trust in domestic products in general (which might improve exports and reduce imports). Finally, changed market conditions and new technology are included in private as well as social analyses, but the weight and perceptions of these changes are likely to differ. Regulatory

programs can create the economic incentives for innovative ways to control foodborne pathogens.

between commodities because differences in food safety levels or place of origin are often not visible (or are not made visible through compulsory labeling). Table 2 shows documented differences in zoonotic risks between domestic and imported products for pork, poultry, and eggs.

Policy Issues Related to the EU

A particular problem related to Salmonella in Denmark is that Danish and imported meat products differ greatly in terms of Salmonella prevalence. Consumers, however, cannot distinguish

Table 1: Costs and Benefits of Food Safety Included in Decision Making at Consumer, Industry, and Social Welfare Levels

Effect		Consumer level	Industry level	Social welfare level
Costs	Industry costs of producing food safety	No	Yes	Yes
	Direct costs for the public sector (monitoring and control)	No	No	Yes
	Indirect cost of research and development	No	Partly	Yes
Benefits	Reduced hospital expenses ^a	No	No	Yes
	Improved productivity in all sectors	No	Partly	Yes
	Utility of better health ^a	Yes	Partly	Yes
	Utility of increased trust in domestic food products	Yes	Partly	Yes
	New technology as a result of research and development	No	Partly	Yes
Other effects	Changing market conditions for all sectors	No	Partly	Yes

^a Reduced hospital expenses and utility of better health are due to fewer cases of acute and lifelong chronic complications and fewer deaths.

Table 2: Zoonotic Risks in Danish and Imported Pork, Chicken, and Egg Products

Zoonotic risk	Product	Import
Salmonella	Pork	Higher prevalence of Salmonella in imported pork
	Chicken	Higher prevalence of Salmonella in imported chicken products
	Eggs	Higher prevalence of Salmonella in imported eggs
Campylobacter	Pork	No documented differences
	Chicken	Higher prevalence of Campylobacter in imported chicken products
	Eggs	Campylobacter cannot survive in eggs and hence causes no problems in eggs
Resistant bacteria		More resistant bacteria in imported meats

The Danish Salmonella control programs regulate only domestic production of meats and eggs. Hence, the effectiveness of the policy in securing food safety in Denmark depends on the import volume of food products and consumption during travel. The substantial increase in imports in recent years (meat imports rose by two-thirds from 2002 to 2005) causes a new food safety problem in Denmark—one that cannot be solved through the national Salmonella control programs. Further improvements in food safety in Denmark are highly dependent on international food safety policies in general and on European food safety policy in particular.

Because of their zero-tolerance policy, Finland and Sweden have a special agreement with the EU that allows them to ban imports of Salmonella-infected products. At first sight, it is neither legally possible nor economically attractive for Denmark to pursue this line. Legally, the EU has been very reluctant to allow other member countries to implement the same rules as Finland and Sweden. And according to economic theory, such zero tolerance is an extreme solution that is seldom economically efficient because complete elimination of risk is often marginally very expensive. Nevertheless, the economic considerations must be seen in a broader context given that a large part of the Danish Salmonella problem arises from imported products. Furthermore, after findings of very large differences in Salmonella prevalence across countries (Danish Veterinary and Food Administration 2006, Appendix 7), the EU has become more inclined to allow other countries to implement a zero-tolerance rule. For the near future, Danish food safety policy centers on pursuing EU acceptance for introducing an import ban on Salmonella-infected eggs and poultry products backed up by zero tolerance of Salmonella in domestic production. This solution might be economically sound, but it is governed by pressure from the public and the media rather than by direct economic assessment.

Global Aspects of Food Safety

Most traditional trade barriers, in terms of import tariffs and export subsidies, have been removed through multilateral agreements in the World Trade Organization (WTO). At the same time, non-tariff or technical trade barriers are increasingly being used in, for example, food safety issues. Even though the objective of a policy is to improve food safety, it may restrict the international trade of

food products. The WTO agreement on Sanitary and Phytosanitary Measures (the SPS Agreement) sets out the basic rules for trade restrictions based on food safety standards with the aim of avoiding protectionism in the guise of food safety. The agreement allows countries to set their own standards but says that regulations must be based on sound scientific arguments. In addition, food safety requirements must apply to domestic food products as well as imported food.

Food safety requirements may cause particular problems to developing countries for two reasons. First, requirements often call for the use of new inputs or technologies in the production process, and since developing countries have limited access to technical know-how, these requirements may restrict their trading opportunities. Second, food safety requirements involve costs of certification and control, and in developing countries private and public sector entities that certify and control conformity are underdeveloped (Jensen 2002). Hence, by serving as trade barriers, even if unintentionally, food safety requirements in the rich countries may have negative consequences for living standards in developing countries. In other words, higher welfare through improved public health in rich countries may be associated with a loss of welfare in the poor countries owing to limited trading opportunities.

For example, the World Bank has studied the EU's regulation of aflatoxins in food products imported from Africa (Otsuki et al. 2001). "Aflatoxins" is a common name for a range of natural poisons that can infect nuts and dry fruits. In 1960 it was found that aflatoxins in food could increase the risk of liver cancer. The health risk of aflatoxins is internationally recognized but assumed to be very small. When the EU harmonized the standards of member countries, it decided on a very restrictive risk level of aflatoxins (2 parts per million for the variant B₁; Regulation 1881/2006) compared with international standards (9 parts per million). Otsuki et al. (2001) estimated how this restrictive standard (compared with the international standard) affects international trade and health risks. They found that, each year, the EU's restrictive standard costs Africa US\$670 million in lost exports while it reduces the number of premature deaths due to liver cancer in the EU by 1.1 per year. This result must be compared with the WHO's estimate of 33,000 premature deaths due to liver cancer in general per year in a population of about half a billion people, as in the EU.

Stakeholders

Regulation of the agricultural sector in Denmark has typically been based on heavy participation from industry, public authorities, and researchers.⁷ This participation increases the incentives for commitment, but also decreases the possibilities of ambitious goals. The economic impacts on social welfare or cost-effectiveness of policy measures have typically not been part of the discussions. Historically, Danish food safety policy has only been subject to ex post evaluation. In this respect, Danish food safety policy falls behind Danish environmental policy, as well as food safety policy in other countries like the United States, where all regulations that are likely to have an impact of at least US\$100 million must undergo a cost-benefit analysis (Antle 1999). Nonetheless, Salmonella control in the Nordic countries is considered leading-edge by international standards.

Consumers' interest in food safety is indicated by their demand (their willingness to pay for food safety). Food safety is a complex issue for the consumer because it covers a diverse range of risks (including pesticides in cereals, fruits, and vegetables; bacteria in meats and eggs; medicine residues in meat; avian flu; and bovine spongiform encephalopathy [BSE]). In addition, food safety is only one of many product qualities, and consumers face a trade-off between the price of a food product, its food safety attributes, and other quality attributes. Yet consumers can express interest in food safety only if they have access to food safety information on different products—and this is often a problem. The demand for one type of food safety might indeed be affected by information about other food safety issues. For example, the death of two people in Denmark in 2002 due to consumption of Salmonella-infected eggs in an uncooked cake caused a permanent increase in the consumption of pasteurized eggs in Denmark (Smed and Jensen 2005).

Also, public policies regarding different food safety issues are interlinked. For example, in 2006 public control in Denmark discovered meat whose expiration dates had long passed in some supermarkets.

⁷ The experiences with and opportunities for co-regulation involving public and private sectors in the United Kingdom are investigated in Fearné and Martínez (2005).

This finding drew intensive media coverage. Immediately after the "old-meat" case, there was political pressure on the minister of family and consumer affairs to control Salmonella in imported meats and eggs. Even though these policy issues are usually treated separately, the timing suggests that pressure on the minister in the "old-meat" case led to increased pressure on the "Salmonella-import" issue. A related issue is that people are not consumers all the time. Sociological studies distinguish between consumers and citizens, meaning that citizens express only part of their preferences in their market behavior. Market behavior will not necessarily capture general opinions, political beliefs, and voting behavior.

Producers and processors can affect the level of food safety through their choice of production system (via decisions they make about outdoor access for animals, hygiene, fodder, and pesticide use in vegetables, fruits, and other crops). Typically, enhanced food safety increases production costs. So it is not in producers' or processors' interest to increase food safety unless they can obtain a subsidy or a price premium or secure market shares—or unless they are forced to do it by public regulation. Therefore control is necessary. Retailers might care about food safety to the extent that (1) they want to avoid outbreaks and recalls that give them bad publicity, (2) they have to comply with public regulation, and (3) they can meet the criteria of domestic and foreign consumers that demand safer food.

Denmark exports 90 percent of its pork production, two-thirds of its beef production, and around half of its poultry and egg production. Therefore, the perception of food safety in export markets is important to Danish producers. If food safety is not considered important or it is impossible to distinguish Danish food products from products from other countries, then Danish producers have little interest in financing a reduction in Salmonella prevalence. If, on the other hand, food safety is important to retailers and consumers abroad—or if it is a prerequisite for selling in these markets—then domestic producers have a strong incentive to control Salmonella.

The retailers' objective is to maximize profits. They care about food safety to the extent that consumers do. With respect to Salmonella, experience shows that this objective implies that some retailers

have not been keen on labeling meat with place of origin even though this information is important from a food safety angle.

From an economic point of view, politicians have an interest in food safety insofar as it affects social welfare. Because food safety is subject to informationally imperfect markets and creates externalities with public health costs, authorities have a direct interest in regulating markets for food safety by formulating a food safety policy. The interests of public authorities should in principle represent consumers and producers, but politicians might also have their own agenda—which might be re-election.

The European Commission has an interest in optimizing the overall level of food safety in the European Union, and since member countries have different preferences and production systems, their interests are not necessarily identical to Danish interests. Food safety is just one of many issues in which the European Commission must formulate a common policy. Hence, each country must accept that compromises are being made between their wishes and other countries' wishes and that food safety is being balanced against other issues.

Different countries around the world may have different and contradicting objectives. Whereas provision of sufficient volumes of food (food security) may be the main objective in poor countries, this is not an issue in the rich countries. At the same time, in a globalized world, developing countries have an at least implicit interest in the food safety policies of rich countries because these policies may affect their trading opportunities.

Policy Options

What are the policy options for Danish politicians if they wish to reduce the prevalence of foodborne bacteria in Denmark? The Danish Veterinary and Food Administration has analyzed Denmark's possibilities for implementing a strategy to reduce the prevalence of foodborne bacteria in the Danish markets for meats and eggs (Danish Veterinary and Food Administration 2006). The report was prepared by a working group initiated by the Danish minister of family and consumer affairs. As a result of the working group's recommendations, Denmark has applied for special status in the EU (like Finland

and Sweden) allowing it to adopt a zero-tolerance policy toward Salmonella in poultry and eggs. Owing to a higher prevalence of Salmonella in domestically produced pork and beef, Denmark decided to aim to reduce the Salmonella level in these types of meat before applying for special EU status with respect to pork and beef. The working group also concluded the following:

- It is not possible to reject imported meat that is infected with bacteria (except with the multiresistant Salmonella MRDT104) by referring to either the EU environmental guarantee or the SPS Agreement.
- It is possible to reject specific consignments of meat that have been tested and are judged to be dangerous to human health using case-by-case control by referring to the EU legislation that food must not be sold if it is dangerous. The National Food Institute performs a risk assessment based on the test results. If the relative risk is too big, the consignment of meat must be withdrawn from the market and can be sent back. Similar control of Danish meat must be performed.

Based on these conclusions, Denmark initiated case-by-case control of bacteria starting in November 2006. The Danish minister of family and consumer affairs warned that using the European legislation this way is new and that the procedures will be complicated. The idea is that the increased risk of having meat rejected in Denmark will induce Danish importers and foreign producers to reduce the prevalence of foodborne bacteria in their products. Under this system, meat infected at a level considered dangerous is restricted from the market. If not already sold at retail, the meat is submitted to heat treatment or sent back to the country of origin. The control has a risk-based sampling scheme, and the plan is to test 1,500 batches of imported meat and 900 batches of Danish-produced meat a year. Danish importers claim that the control discriminates against foreign meat by testing it more frequently than Danish-produced meat, and a local organization of importers is considering making a complaint to the European Commission. After one month under this system, Denmark had rejected one consignment of fresh meat. All 12 samples taken from 268-kilogram consignment of French chicken contained

Campylobacter at a level estimated to be 15 times above the average risk level at the same time the previous year.

This strategy is not the only option for Danish politicians to reduce the Salmonella risk for Danish consumers. Other options include:

- working for common international rules regarding foodborne bacteria in food products, such as through EU legislation or WTO negotiations;
- reducing Salmonella in Danish meats and eggs by eliminating Salmonella during primary production or processing;
- pursuing decontamination strategies instead of prevention strategies using a new EU directive that allows decontamination when scientific evidence for effectiveness and cost savings can be documented (this directive is not in use yet);
- adopting market interventions like subsidizing production of safe food, taxing unsafe food, or implementing labeling standards;
- informing and educating consumers about food safety and hygiene requirements when preparing fresh meat products and eggs; and
- pursuing increased use of co-regulation through coordination of public and private efforts.

Assignment

Your assignment is to identify opportunities and obstacles for improving Danish food safety policy using Salmonella control as a case. Discuss the advantages and disadvantages of the options mentioned in this case study for each stakeholder group. The assignment should include a discussion of the consequences of increased food safety in rich countries for the trading opportunities of developing countries. For example, is there necessarily a trade-off between the best possible food safety in Denmark and the welfare of people in developing countries that wish to export food products to Denmark?

Additional Readings

- Andersen, L., and T. Christensen. 2006. Danish salmonella control: Benefits, costs, and distributional impacts. Paper presented at the pre-conference workshop, "New Food Safety Incentives and Regulatory, Technological, and Organizational Innovations," of the annual meeting of the American Agricultural Economics Association, Long Beach, CA, July 22.
- Garcia, M., and A. Fearne. 2006. Is co-regulation more efficient and effective in supplying safer food? Insights from the UK. Paper presented at the preconference workshop, "New Food Safety Incentives and Regulatory, Technological, and Organizational Innovations," of the annual meeting of the American Agricultural Economics Association, Long Beach, CA, July 22.
- Otsuki, T., J. S. Wilson, and M. Sewadeh. 2001. Saving two in a billion: Quantifying the trade effects of European food safety standards on African exports. *Food Policy* 26 (5): 495–514.
- Wegener, H.C., T. Hald, D. Wong, M. Madsen, H. Korsgaard, F. Bager, P. Gerner-Smidt, and K. Moelbak. 2003. Salmonella control programs in Denmark. *Emerging Infectious Diseases* 9 (7): 774–780.

References

- Andersen, L., and T. Christensen. 2004. Food safety in a social welfare economic perspective: An analysis of the Danish salmonella control programmes (in Danish). Report 171. Copenhagen Institute of Food and Resource Economics.
- . 2006. Danish salmonella control: Benefits, costs, and distributional impacts. Paper presented at the preconference workshop, "New Food Safety Incentives and Regulatory, Technological, and Organizational Innovations," of the annual meeting of the American Agricultural Economics Association, Long Beach, CA, July 22.
- Antle, J. M. 1999. Benefits and costs of food safety regulation. *Food Policy* 24 (6): 605–623.

- Beales, H., R. Craswell, and S. Salop. 1981. The efficient regulation of consumer information. *Journal of Law and Economics* 24 (3): 491–544.
- Danish Veterinary and Food Administration. 2006. Special status and new initiatives for Salmonella and Campylobacter control in Danish and imported meats and eggs (in Danish). Report 18. Copenhagen.
- Fearne, A., and M. G. Martinez. 2005. Opportunities for the co-regulation of food safety: Insights from the United Kingdom. *Choices* 20 (2): 109–116.
- Golan, E., S. J. Vogel, P. D. Frenzen and K. L. Ralston. 2000. *Tracing the costs and benefits of improvements in food safety*. Agricultural Economic Report No. AER791. Washington, DC: Economic Research Service, U.S. Department of Agriculture.
<http://www.ers.usda.gov/publications/aer791/>.
- Hansen, J. 2002. Salmonella control in a social welfare economic perspective (in Danish). *Economy of Danish agriculture* (Autumn). Copenhagen: Institute of Food and Resource Economics.
- Helms, M., P. Vastrup, P. Gerner–Smidt, and K. Moelbak. 2003. Short and long term mortality associated with foodborne bacterial gastrointestinal infections: Registry based study. *British Medical Journal* 326 (7385): 357–360.
- Jensen, M. F. 2002. Reviewing the SPS Agreement: A developing country perspective. Working Paper 01/2002. Copenhagen: Institute of Food and Resource Economics.
- Korsgaard, H., H. C. Wegener, and M. Helms. 2005. Societal costs of zoonotic Salmonella and other foodborne pathogens in Denmark (in Danish). *Medical Weekly* 167 (7): 760–763.
- Ministry of Food, Agriculture, and Fisheries. 1998. *Annual report on zoonoses in Denmark 1997*. Copenhagen.
- . 2006. *Annual report on zoonoses in Denmark 2005*. Copenhagen.
- Otsuki, T., J. S. Wilson, and M. Sewadeh. 2001. Saving two in a billion: Quantifying the trade effects of European food safety standards on African exports. *Food Policy* 26 (5): 495–514.
- Roberts, T. 2005. Economic incentives, public policies, and private strategies to control foodborne pathogens. *Choices* 20 (2): 95–96.
- Russell, R. R., and M. Wilkinson. 1979. *Microeconomics: A synthesis of modern and neo-classical theory*. New York: John Wiley and Sons.
- Ryan, C., M. K. Nickels, N. T. Hargrett-Bean, M. E. Potter, T. Endo, L. Mayer, C. W. Langkop, C. Gibson, R. C. McDonald, R. T. Kenney, et al. 1987. Massive outbreak of antimicrobial-resistant salmonellosis traced to pasteurized milk. *Journal of the American Medical Association* 258 (22): 3269–3274.
- Smed, S., and J. D. Jensen. 2005. Food safety information and food demand. *British Food Journal* 107 (3): 173–186.
- Theno, D. 2006. Continuous food safety innovation as a management strategy. Presentation at the annual meeting of the American Agricultural Economics Association, Long Beach, CA, July 22. Slides posted on <http://www.fsn-aaea.org/>.
- Wahlström, H. 2006. *Salmonella workshop: Control in poultry from feed to farm*. Proceedings of a workshop in Uppsala, Sweden, March 13–17.
http://www.medvetnet.org/pdf/Workshops/salmonella_workshop_proceedings.pdf.
- Wegener, H. C., T. Hald, D. Wong, M. Madsen, H. Korsgaard, F. Bager, P. Gerner–Smidt, and K. Moelbak. 2003. Salmonella control programmes in Denmark. *Emerging Infectious Diseases* 9 (7): 774–780.