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Editorial

Food safety incentives in a changing world food system

Food safety is becoming more important in food markets due to several structural changes in the world food system. These changes include advancements in the science of public health, changes in how consumers obtain and prepare food, and increased international trade in food products. These changes, which are apparent in both industrialized and developing nations, are creating enhanced market incentives for producers to improve food safety and enhanced political incentives for public intervention in food markets. Frequently, partnerships between the public and private sectors are needed to respond to incentives for improved safety. This special feature provides evidence regarding these structural changes and their impact on incentives in the food sectors of several countries. To introduce the specific examples, our overview article discusses how these structural changes create enhanced incentives for food safety.

Food safety and public health

The importance of microbial foodborne hazards was acknowledged worldwide in the 1990s. Advances in public health (faster and more sensitive tests for pathogens as well as better epidemiology) permitted improved surveillance for foodborne illnesses, linked specific foods and companies with pathogens, and linked known human illnesses as complications of acute foodborne infections.

First, the estimates of foodborne illness are improving with greater surveillance and better epidemiology. Estimates of foodborne illness are always uncertain because most illnesses go unreported. In 1995, the US launched a multi-state effort called FoodNet to better understand the actual incidence of several major foodborne pathogens. Advances in molecular biology were introduced to surveillance in the PulseNet program (US and Canada) and SalmNet (Europe), which can distinguish subtypes of pathogens. This has made it possible to link far-flung outbreaks to a single food source and its manufacturer, thereby providing companies with new incentives to control pathogens (Hedberg, 2000).

Second, new pathogens are evolving and posing new threats to the food supply (Tauxe, 1997). *Salmonella* Enteritidis is a new strain of salmonella that appeared in the 1980s. It can infect eggs inside of the layer hen. The emergence of this pathogen has led to a number of *Salmonella* outbreaks from raw and undercooked eggs. Another new pathogen, *E. coli* O157:H7 was identified only in 1982. This mutation of *E. coli* is more virulent, because it has acquired the ability to produce a toxin, the Shiga-toxin. It can cause bloody diarrhea and lead to fatal complications such as kidney failure. This toxin is estimated to cause 92 US deaths annually, mostly children (Mead et al., 1999).

Third, the long-term health consequences of acute foodborne infections are better understood. All foodborne pathogens seem to have some chronic complications, albeit of low probability (CAST, 1994). Examples include linking *Campylobacter* infection with Guillain-Barre syndrome (paralysis), and *Salmonella* infection with arthritis. All three of these advancements in public health lead to greater appreciation of the true costs of foodborne illness.

At the same time that risks from foodborne pathogens are better understood, science has also increased public awareness of new and highly uncertain risks. The outbreak of mad cow disease and its subsequent linkage to new variant CJD in humans has captured media attention. The unknown nature of this risk and the unusual method of transmission make it highly alarming to consumers. Another potential unknown are the risks from genetically modified organisms. While regulatory agencies in the US have certified approved GMOs as posing little or no health threat, many consumers remain unconvinced and some food firms have acted to restrict their sources of supply. Science can provide the basis for understanding and assessing risks, but it cannot always provide answers with the degree of certainty that assures consumers.

Changes in food marketing

There are changes in how consumers obtain and prepare food that influence the risks from food safety. These include the growing purchase of processed or prepared foods that reduces consumer control over preparation, the increased consumption of animal and seafood products, increased international food trade,

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particularly of fresh foods, and the growing awareness of food safety risks among affluent consumers.

The amount of food purchased away from home has increased steadily in the US from 39% in 1980 to 47.5% of the US food dollar in 1999. Much of this food is obtained from institutional food services, such as schools, day care centers, employer cafeterias, or nursing homes, where consumers may exercise little choice over provider or content. Apart from food service and restaurants, consumers also purchase more prepared food in stores to take home to eat (Senauer, Asp, & Kinsey, 1991). These trends are likely evident in other industrialized countries as well. Increased reliance on food services are also apparent in developing countries, where urbanization is rapidly changing food systems and even the poor rely heavily on street vendors for preparation (Garrett & Ruel, 1999). This trend towards greater reliance on prepared foods means that consumers no longer exercise control over food safety in final cooking and preparation. This increases consumer demand for improved food safety from the food production chain.

Growth in incomes throughout the world is leading to increased consumption of animal and seafood products and trade of these products is expected to increase (Delgado, Rosegrant, Steinfeld, Ehui, & Courbois, 1999). In China, improved living standards are leading to increasing consumption of meat and seafood with consequent rises in parasitic diseases such as toxoplasmosis, clonorchiasis, cystericosis, and trichinellosis (Roberts & Murrell, 1993). Livestock products are increasingly provided by large scale confinement operations and increased trade means that products are shipped long distances. As many foodborne pathogens reside in the gastrointestinal systems of animals, these pathogens can potentially enter the food supply through cross-contamination during transportation, processing, and retail preparation. Infection of one animal can lead to broader contamination through exposure to other animals in large scale production and processing units.

Another change in diets is the increased consumption of fresh or raw foods. Changing food consumption patterns that feature fresher, rarer ingredients pose new risks (since foods have not been heated to kill pathogens). US consumption of lettuce increased 50% in the 1990s, baby carrots 60% from 1992 to 1999, and cantaloupe 30% from 1995 to 1999. The growing popularity of salad bars and new packaging in supermarkets of washed and ready-to-eat produce are behind the increased consumption of fresh produce (Putnam, 2001). Sushi consumption has increased along with other ethnic foods. The California Restaurateur expects "... Sushi to post strong gains in the coming year" (Boguille, 2001, p. 33). These changes in diet and food preparation introduce new potential risks into the food supply.

Expanded international trade

International food trade is growing with reduced barriers to trade and increased demand for diversity and freshness. In particular, the trade in fresh and minimally processed food products has expanded rapidly during the 1990s (Unnevehr, 2000). The US supply of certain fruits and vegetables is now substantially imported, which was not the case 10 years ago (Hedberg, 2000). As many of these products are consumed fresh, they require greater care to prevent food safety hazards. Handling at all points of the food chain can influence food safety and quality, and this becomes more important as fresh foods are shipped over greater distances.

Increased international trade has the potential to introduce new or different food safety risks into the food supply of importing countries (Kaferstein, Motarjemi, & Bettcher, 1997; Buzby & Roberts, 1997). An example is the parasite *Cyclospora cayetanensis* which appeared in the US and Canada in 1996 and 1997, apparently as a result of its introduction on raspberries from Guatemala (Hedberg, 2000). Standard practices in many industrialized countries may presume a certain level of basic services or sanitation that may not exist in less developed countries. Lack of clean public supplies of water for seafood processing may explain the high rates of detention for microbial contamination among imports from less developed countries into the US (Unnevehr, 2000).

Response to changing incentives

Changes in food marketing lead to exposure to new risks and greater potential consequences of foodborne illness outbreaks. Through increased scientific understanding and greater media coverage, consumers in industrialized countries have become more aware of the potential food safety hazards. This has led to increased demand for actions to improve food safety in both the public and the private sectors. At the same time, growth in food trade has elevated the importance of food safety in international trade disputes. There is considerable debate in many countries regarding the appropriate role of the private and public sectors in protecting consumers from foodborne hazards.

In response to pressures for greater intervention, the public sector food sector activities in many industrialized countries have undergone reorganization. The European Union (EU) has formed a new Food Safety authority to respond in a more unified manner to food safety threats in member nations. Four countries, Canada, Great Britain, Ireland, and Denmark, have consolidated food safety regulation under one authority. All countries expect benefits in terms of more effective public performance in the long run, including improved

efficiency, greater ability to provide farm to table oversight for the whole food system, and enhanced international market access (US GAO, 1999).

Standards for food safety are also increasing in many countries. For example, the 1995 Pathogen Reduction regulation for US meat and poultry imposed new microbial testing and standards for foodborne pathogens such as *Salmonella*. The Food Quality Protection Act passed in 1994 mandated review of US pesticide tolerances to account for the effects of cumulative exposure in children. The hazard analysis critical control point (HACCP) system for prevention of hazards is now mandated for some or all of the food sectors in the EU, the US, Canada, New Zealand, and Australia.

The private sector has developed improved methods of hazard management and control, partly in response to market incentives and partly in response to increased regulation. The HACCP system, originally developed by Pillsbury in the 1960s, is now being widely adopted by the US food industry (Martin & Anderson, 2000). This is partly in anticipation of more widespread mandates of HACCP, following the regulations in seafood, meat, poultry, and fruit juices.

Food processors and retailers are increasingly looking for assurances of food safety from their suppliers, creating incentives for improved safety throughout the food chain. In the UK, the passage of "due diligence" laws has forced food retailers to ask their suppliers for certification of hazard management (Henson & Northen, 1998). Hobbs, Fearne, and Spriggs, in this special feature, discuss how vertical alliances have increased in the beef industries of the UK and Australia, in order to better address food safety issues. Fast food services in the US increasingly specify food safety standards in their contracts with suppliers (Brown et al., 2000; Burgdorfer, 2001).

Private sector responses to increased demands for food safety have been facilitated by the growing use of third party certification (Caswell, Bredahl, & Hooker, 1998). Because food safety hazards can be expensive to test for, certification of production processes is sometimes needed to verify food safety. ISO 9000 methods for certification have been applied in the UK meat sector (Zaibet & Bredahl, 1997) and in the US pork industry (Unnevehr, Miller, & Gomez, 1999). Suppliers of produce to major US supermarket chains must increasingly certify food safety practices, and this is true for international as well as domestic producers (Calvin & Cook, 2001).

Partnerships between the public and private sectors are playing an important role in addressing market incentives. The public sector can provide training, production guidelines (instead of mandatory standards), or voluntary certification services. These partnerships are evolving in both industrialized and developing countries. For example, the meat industry worked with USDA to provide model HACCP plans for small meat processors, in order to facilitate the mandatory use of HACCP. In Bangladesh, the government undertook training and investments to help seafood processors meet export market standards (Cato & Dos Santos, 2000). Some industry groups have requested public assistance to certify production practices, such as the USDA/AMS Quality Through Verification Program for fresh produce.

These public actions are often motivated by the structural changes created by food safety regulations and market incentives. That is, small food processors or farmers may have limited means for improving food safety management. Economies of scale are apparent in the adoption of HACCP, for example, because large firms are better able to undertake initial investments in planning and training (MacDonald & Crutchfield, 1996). Transactions costs of certifying many small suppliers can be high, and this can lead to pressures for farm level consolidation. Food safety has been cited as one reason for trends towards vertical integration and larger scale of farm and food production.

Overview of this special feature

The papers in this special feature demonstrate the importance of the trends discussed above in creating incentives for food safety improvement in the global food industry. The feature begins with the paper by Hobbs, Fearne, and Spriggs comparing experiences in the UK, Canada, and Australia. All three countries had new regulations and private sector initiatives to respond to food safety issues. As major exporters, Canada and Australia followed risk management strategies to prevent trade-threatening food safety incidents. In the UK, the private sector, primarily retailers, had incentives to restore consumer confidence following high provide food safety scares.

Further evidence that trade is motivating public and private actions to address food safety is found in the next three papers. Gomez, Cabal, and Torres find that the Colombian poultry industry must improve food safety to remain competitive with imports from other countries following trade liberalization. This is motivating a partnership between the public and private sector to address needed improvements in management and standards. Salay and Mercandante report that the Brazilian feed corn buyers are voluntarily testing for mycotoxins, despite substantial costs for tests. And the Brazilian government is initiating a new role by setting national standards for aflatoxin in corn. Feher reports on the experience of Hungary's adoption of new standards to meet the requirements for joining the EU. As a major exporter, Hungary must adapt to EU standards in order to remain competitive. Dialogue with the private

sector has been important in preparing the food industry for this change.

Farm level responses to food safety incentives and their structural implications are addressed in the last two papers. Hayes, Jensen, and Fabiosa use Sweden's experience with banning antibiotic use in pork production to draw lessons for a possible ban in the US. They find that such a ban would tend to reward producers who are already managing productivity and quality well. Wang et al. have similar findings for control of toxoplasmosis in pork. Confinement production would have a slight cost advantage if control of this infection became mandatory. Thus, in the case of the pork industry, higher food safety standards would tend to favor more productive producers.

Taken together, these papers emphasize that increased international trade, higher standards in industrialized countries, and the growing private sector responses will all be important influences on the global food industry at all stages of production. These trends challenge economists and other food control professionals to provide better answers to the following questions. How well is industry responding to new incentives for food safety improvement? When will public intervention improve food market performance? How can food safety barriers to trade be mitigated so gains from food trade can be better realized? These questions provide us with a challenging research agenda.

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