

Background

USDA's Food Safety and Inspection Service has enforced the Nation's food safety laws for meat products that move across State lines since 1890 and for poultry since 1957. FSIS began monitoring meat and poultry sanitation and process control activities more closely with enactment of the Wholesome Meat Act of 1967 and the Wholesome Poultry Products Act of 1968. With outbreaks of foodborne illnesses during the 1980s and 1990s, FSIS' emphasis shifted toward the control of harmful pathogens, which cannot be seen by consumers, and away from traditional inspection of animal carcasses for visible signs of diseases.¹ To reflect this new emphasis, FSIS promulgated the PR/HACCP rule on July 25, 1996.

The PR/HACCP rule mandates that each meat and poultry slaughter and processing plant establish and implement standard sanitation operating procedures (SSOPs). These activities are cleaning practices that a plant performs to ensure that it is operating in a clean and sanitary manner. The rule also requires plants to have and adhere to a HACCP plan. Under a HACCP program, plants monitor points in their processing system that have the potential of leading to a food safety hazard and take corrective actions when they suspect that a critical level at one of these points has been breached.

HACCP plans are based on seven criteria:

- (1) assess all hazards,
- (2) find all points where food safety is at risk (critical control points),
- (3) set critical limits for each critical control point (CCP),
- (4) develop procedures to monitor each CCP,
- (5) determine corrective actions,
- (6) implement a record-keeping system, and
- (7) establish verification procedures (Unnevehr and Jensen, 1996).

The PR/HACCP rule mandated that all slaughter plants conduct generic *E. coli* testing to ensure the adequacy of their controls. In addition, plants that slaughter animals or produce raw ground products have to adhere to *Salmonella* performance standards. FSIS phased in the PR/HACCP rule over a 3-year span starting in January 1998. The largest plants (those with more than 500 employees) had to comply by the end of January 1998, small plants (10 to 499 employees) had until January 1999, and very small plants (fewer than 10 employees or annual sales less than \$2.5 million) had to conform by the end of January 2000. All plants had to have sanitation standard operating procedures (SSOPs) in place by January 1997, regardless of size. (See Ollinger and Mueller (2003) for a more detailed discussion of PR/HACCP and regulations that preceded it.)

¹Medical experts indicate that foodborne illness outbreaks have always been present. Advances in epidemiology, however, made it possible to identify the sources of illnesses that previously could not be identified. Some of these sources, such as *Salmonella*, have been common for many years while others, such as *E. coli* O157:H7, are a new danger.

Private Markets and Government Regulation Play Roles in Ensuring the Use of Food Safety Process Controls

The quality and characteristics of many food products that we buy can be directly observed. For example, the ripeness of a banana can be determined by its color, and its type can be ascertained from its physical dimensions. For meat products, consumers can use government grading practices, e.g., lean ground meat, and visual observations to compare meat cuts by meat texture, fat content, and type. However, consumers have no accurate way to measure food safety and, thus, may unknowingly purchase and eat products that are contaminated. In some cases, particularly for the elderly and the very young, consumption of contaminated foods may cause serious illnesses and even death.

If an illness outbreak does occur and health authorities are able to link the illness to a particular food, then the sales of all producers of that type of food may be adversely affected. Consumers have many food choices, and, generally, believe each product is safe for consumption. If consumers learn that someone became sick after consuming a particular type of product, then consumers will select a different food product. If the adulterated product has a brand, then consumers will avoid products produced under that brand. However, if the product is unbranded or its source is unknown, then consumers will avoid the purchase of all products of that type, regardless of source, because all products would have the same appearance, and, thus, be potentially harmful.

A loss of consumer confidence in a company's products can be financially devastating. Hudson Foods, for example, exited the hamburger patty business after it was held responsible for the production of hamburgers tainted with *E. coli* O157: H7. For this reason, many companies have sought third-party accreditation of the safety of their meat products. For example, Wiser (1986) asserts that the red meat industry sought food safety legislation between 1890 and 1910 in order to assure export markets of the quality of American meat exports. In recent years, it has been major meat and poultry buyers, such as McDonald's, Burger King, Kroger, and other large fast food restaurants and grocery chains, rather than sellers, that have taken the lead in assuring food safety. These companies recognize that, if they fail to deliver food safety, consumers will stop buying their products. Thus, they enter into long-term contracts with suppliers in which they demand that their supplier adopt the most advanced food safety technologies and practices in exchange for a guaranteed market for their products (Ollinger, 1996). In an informal survey of nine large food retail firms, Kaufman (1994) found that six of the surveyed firms mandated their own safety standards and seven required adherence to either good manufacturing practices (GMPs) or HACCP programs. Food safety quality-control programs required by McDonald's, Jack-in-the-Box, and other fast food chains illustrate that industry's strong commitment to food safety (Ollinger, 1996).

Restaurants, grocery stores, and other buyers and plants are made better off by entering into contractual relationships stipulating higher quality. Buyers benefit because there is a reduced threat of risking a reputation loss stemming

from an outbreak of foodborne illness. For example, Jack-in-the-Box lost millions of dollars due to selling hamburgers tainted with *E. coli* O157:H7. Meat suppliers benefit from increased sales and a more certain market for their products (Golan et al., 2004).

Export markets provide a lucrative outlet for meat suppliers. Recent actions taken by food authorities in Russia, South Korea, and other countries to limit access to their markets have cost U.S. exporters millions of dollars in lost sales and have forced U.S. suppliers to change operating procedures to meet export market demands. Thus, export markets, like buyer requirements, may encourage firms to make investments in food safety process controls.²

Major meat and poultry buyers can evaluate food safety because they know the conditions under which the products were produced and can conduct their own pathogen tests. However, low-volume buyers and consumers do not have such capabilities. Moreover, even if consumers contract foodborne illnesses from contaminated food products, they may not know the quality of the food that caused it because there often is no direct linkage between a sickness and the meat or poultry producer. Several factors account for this:

- (1) A buyer may be unable to identify an illness as being due to foodborne pathogens.
- (2) Even if a buyer knows that sickness is due to a foodborne pathogen, it may be difficult to determine the specific food that caused it, partly because the evidence has already been consumed.
- (3) Although the food may be identified, the place of purchase/consumption may be unknown.
- (4) If the place of purchase/consumption is known, the producer of the specific food may be unknown because the store may have bought meat or poultry products from many suppliers, obscuring the producer's identity.

Low-volume buyers and consumers can sometimes identify producers, however. If there is only one supplier of a generic product, then the source can be identified. Market mechanisms too can help identify producers. Branded products typically earn a price premium because of perceived higher quality. Producers use brands to encourage repeat purchases, but brands also enable consumers and food safety experts to identify the source of the pathogen-tainted product that caused the foodborne illness. The expense of a lost reputation for producing contaminated products can be devastating. As reported by Alison Young of the *Detroit Free Press* (6-21-2001), Sara Lee incurred \$76 million in direct costs and lost over \$200 million in sales after one of its plants was implicated in the production of frankfurters containing *Listeria monocytogenes*. This foodborne pathogen killed at least 15 people, caused 6 miscarriages, and seriously sickened 80 people.

²Some argue that the primary purpose of food safety import standards is to restrict imports rather than enhance food safety. Regardless of the motivation, the standards must be met, and the effect is to improve food safety quality.

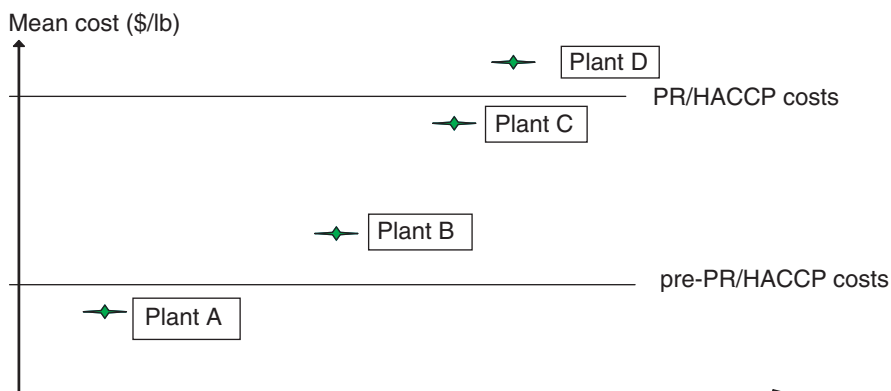
Private Economic Incentives Encourage the Use of Food Safety Process Controls

Markets impose food safety requirements up to the point at which it is no longer profitable to do so, suggesting that plants would perform some food safety process control tasks in the absence of any regulation. However, the strength of the incentive varies by the type of market. Hence, the precise number and comprehensiveness of the tasks necessary to maintain food safety may or may not exceed the number and detail required by FSIS under the 1996 PR/HACCP rule. We illustrate cost-per-pound levels of quality control effort in figure 1 for both a case prior to the PR/HACCP rule and another under the PR/HACCP rule. The cost levels are arbitrarily drawn but do illustrate that mean PR/HACCP costs are equal to or higher than the mean pre-PR/HACCP rule costs. This is true because regulation does not prevent plants from undertaking quality-control actions that they deem necessary and usually requires some tasks that plants would not otherwise perform.³ We assume that plants would continue to perform tasks that they consider essential but are not required under regulation.

The stars in figure 1 represent individual plant costs of process control effort per pound of meat or poultry and are hypothetical points that are used only to illustrate that different plants will choose to expend different levels of process control effort and, thus, have differing expenditure levels. For example, plant A expends less effort than the mean level that existed before PR/HACCP, and plants A, B, and C put forth less effort than the mean level of expenditures under PR/HACCP. Only plant D incurs greater process control expenses than the PR/HACCP rule level. Thus, plants A, B, and C would incur positive but different costs in order to comply with PR/HACCP while plant D incurs no regulatory costs. In terms of hypothetical market arrangements, we hypothesize that plant A would represent a plant that sells generic products that are commingled with products from elsewhere by buyers, giving it no identity with the buyer and the weakest incentive to invest in food safety. Plants B, C, and D, on the other hand, represent plants serving export markets, facing buyer requirements, or selling branded products or facing some other market arrangement that encourages the use of more sophisticated food safety techniques. Evidence supporting these hypotheses is provided in later sections.

³Presumably, plants do not perform some tasks required under regulation because they perceive the private benefits to be less than the costs. There is also an administrative cost to plants in that they must report quality control efforts to the government. In the absence of regulation, there would be no reporting cost.

Figure 1
Hypothetical mean cost per pound expended for food safety process control under PR/HACCP and pre-PR/HACCP



Industry Characteristics

The U.S. meat and poultry slaughter and processing industries had \$110 billion in sales in 1997 and ranged from slaughter plants selling only animal carcasses to processors manufacturing ready-to-eat products for home consumption. There are five main types of plants: cattle, hog, and poultry slaughter plants, producers of cooked or otherwise further processed products with no slaughter operations, and grinders and other processors with no slaughter operations.

Census of Manufacturing data show that there were 1,393 plants owned by 1,308 companies slaughtering animals other than poultry in 1997. A little more than one-fourth of the 1,393 plants had fewer than 20 employees. The large number of plants belies much higher four-firm concentration ratios in cattle slaughter and large plant dominance in both cattle and hog slaughter. MacDonald et al. (2000) show that four-firm concentration ratios in cattle and hog slaughter were 71 and 43 percent, and that plants with more than 400 employees accounted for more than 70 percent of the value of shipments in cattle and more than 85 percent of value of shipments in hog slaughter.

The poultry products industry generated about 60 percent of the sales volume of the cattle, hog, and other nonpoultry animal slaughter industry. But, with only 474 plants owned by 259 companies, poultry plants were, on average, larger and more likely to be part of a multi-plant firm than were plants in the red meat industries. Reflecting this larger plant size, Ollinger et al. (2001) show that more than 80 percent of chicken and turkey slaughter output came from plants with more than 400 employees. Despite the greater degree of multi-plant ownership, four-firm concentration ratios were below 50 percent in 1992 (Ollinger et al., 2001).

Raw-meat processing plants grind, marinate, and debone products while not-raw meat processing plants cook, smoke, ferment, or otherwise process meat or poultry. According to the 1997 Census of Manufacturers, there were 1,297 raw meat further processors and cooked, smoked, fermented, or otherwise further processed product processors. Industry concentration was not particularly high. Four-firm concentration ratios in two main categories—pork products, not sausage, and sausage products—were 31 and 38 percents in 1992 (Ollinger et al., 1997). Moreover, the 1,297 plants were owned by 1,150 companies and about one-half the plants had fewer than 20 employees in 1997.