Research Report

Risk Assessment for Food Safety: Application and Evaluation of HACCP in Hog Slaughter and Processing

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New federal regulations focus control at the processing plant level. The project described in this article is designed to evaluate the microbial reductions and costs associated with the use of a Hazard Analysis and Critical Control Point (HACCP) system in large pork slaughter and processing plants. The objectives are to measure the efficiency of HACCP systems in achieving lower microbial counts in pork processing, to measure the marginal costs associated with different levels of pathogen reduction in pork processing and to determine implications for mandated HACCP adoption on industry costs. The study considers specific control points or technologies that are used to reduce, control, or monitor levels of microorganisms during the production process in large pork slaughter and processing plants in the upper Midwest.

Methods

HACCP is one approach to improving food safety that helps firms decide where to intervene during processing for control of pathogens. Because control of existing processing may be inadequate to reduce microbial contamination to desired levels, firms may consider additional interventions. We examine four pathogen reduction technologies in pork processing: carcass rinses, sanitizing sprays, steam vacuums, and a hot water pasteurizer.

Cost Data. We estimated the cost of individual technologies based on data from input supply firms and local (representative) costs of electricity, water, and labor. We then drew estimates of pathogen reduction from selected meat science studies. These results were extended by collecting in-plant data. Several large processing plants were contacted about providing data on costs incurred in implementing HACCP regulations and additional antimicrobial controls. A questionnaire on costs was developed. Two firms, with information representing four large processing plants, provided information on the costs of HACCP implementation and operation. In addition, firms allowed collection of in-plant microbial samples.

Microbial Data. Initial information on effectiveness on control technologies was obtained from published studies. Additional data were collected in-plant from participating firms by sampling for *Salmonella*, *E.coli*, and Total Plate Count (TPC). The sampling took place over the period June 1997 through February 1999, with samples obtained from one pre-rinse site and two post evisceration sites: pre-rinse and post-rinse. The plants used acetic acid rinses, and the pre-rinse samples were obtained after the last carcass processing before the rinses.

In total, there were 886 observations for *Salmonella*, 824 observations for *E. coli,* and 830 observations for TPC. Samples were collected using Federal Safety Inspection Service procedures. The samples were collected using sponges from three carcass locations (shoulder, mid-line, and ham) from a 100 cm^2 area at each location. All samples were collected during the morning shift and sent to the Iowa State University Veterinary College labs for testing.

Methods. First, a simple optimization model was used to find the least-cost combinations to achieve multiple pathogen reduction targets based on available data from published studies of the various technologies and data available on costs of using the technologies. Analysis of the plant samples was next. Statistical analysis was used to determine which variables had a statistically significant effect on the in-plant microbial levels, or prevalence, holding the effects of other variables constant

Results and Discussions

Analysis of the plant samples showed that observed conditions varied considerably. In part, this can be attributed to differences in processing technologies used. Some antimicrobial treatments reduced microbial contamination of carcasses. However, there were differences across plants in the effectiveness of controls. Other variables, such as day of the week, had a significant impact on the product contamination levels.

There is strong support for the fact that the cost function for reduced microbial levels is upward sloping in pork processing. Some interventions or combinations of interventions are more cost-effective than others.

Based on survey results of the firms and data gathered from manufacturer sources, costs of individual technologies to reduce pathogens are in the range of $0.03 to $0.20 per carcass for hogs. Total costs associated with on-going, recurring costs of HACCP (training, administrative, CCP

and plant costs of testing, and process modification) were estimated to be $0.1394 per carcass.

Firms have invested significant resources in implementing HACCP and introducing new antimicrobial controls, such as rinses. The effectiveness of these technologies and controls needs careful plant level study of the microbial levels throughout the production process. The cost effectiveness of specific technologies is likely to depend on product control throughout the process. ◆

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Dairy policies around the world: What would we gain from getting rid of them?

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Despite the general globalization of agricultural markets, trade and production of dairy products are still highly distorted in most countries. This article discusses the impact of these distortions and the likely gains that would result from reforming existing policies.

Import restrictions are present in many countries, and export subsidies are often used. Dairy imports are distorted by tariff-rate quotas (TRQ), which are a two-tier import tax or tariff system. Imports up to a certain level (the so-called minimum access commitment) are allowed in a country at a relatively low import tax rate. Additional imports (above the quota) are taxed at a higher tariff rate.

Many TRQs are unfilled, and tariffs remain very high, often prohibiting over-quota imports. The multitude of TRQ schedules and nomenclatures is confusing and restrictive. The lack of transparency in the administration of the TRQs may explain why some quotas are unfilled, despite the fact that these quotas are usually very low. Major gains could be realized by defining fewer and more aggregate TRQ categories, and by increasing the transparency and efficiency of TRQ administration.

Domestic dairy policies remain complex and arcane in many countries, often relying on a combination of price discrimination schemes via price pooling and production quotas. The price discrimination schemes rely on the low price responsiveness of fluid milk consumption, charging a higher price for fluid milk, and allowing markets to determine the price of milk used for manufacturing dairy products.

Dairy producers receive a "pooled" price based on the pooled values of deliveries in all milk markets. Because of trade barriers, the price of manufactured dairy products is artificially high. And this higher price stimulates the milk market. Both domestic and trade policies, then, contribute to higher milk prices.

Dairy products are priced artificially high because of trade barriers preventing price arbitrage through trade. In some countries, production quotas limit the expansion of milk production induced by market distortions. These milk production quotas contribute to higher milk prices by restricting supply. Finally, in the European Union (EU) and other countries, dairy prices are also supported by government purchase of butter and milk powder, which has the same qualitative effects as trade barriers.

What is happening in the EU as a result of policy reforms? Based on recent Center for Rural and Agricultural Development (CARD) policy analysis, it appears that reforms of the Common Agricultural Policy (CAP) in the EU under the Berlin Accord's "Agenda 2000" would have small effects on dairy markets because dairy is essentially spared until 2005. The current EU system of domestic producer price support and quota remains little affected.

Export subsidies and large inventories help absorb EU excess supplies of dairy products. No real fundamental and definite reform is planned after 2005 either. By contrast, if enlargement of the EU to include Central and Eastern European Countries (CEECs) occurs in 2003, there would be major repercussions in EU dairy markets, but relatively small effects on world dairy markets.

The EU enlargement is likely to induce lower internal dairy prices in the EU and a major price hike in CEECs. Consumers in those countries would be major losers upon EU accession, whereas major gains would accrue to dairy producers in the CEECs who receive EU prices. Internal EU trade would expand considerably.

World dairy markets would see little effect from CAP reforms and from EU enlargement. However, the cost of the CAP would balloon following enlargement and would probably induce further reforms to contain cost. The reforms currently planned for after 2005 in the Berlin