Tracing the Costs and Benefits of Improvements in Food Safety

The Case of the Hazard Analysis and Critical Control Point Program for Meat and Poultry

Elise H. Golan, Stephen J. Vogel,
Paul D. Frenzen, and Katherine L. Ralston

Introduction

In 1997, the Federal Government introduced a new food safety regulation for meat and poultry slaughter and processing plants. Under the Pathogen Reduction and Hazard Analysis and Critical Control Point rule (commonly known as HACCP), slaughterhouses and processors must adopt new procedures to reduce the incidence of foodborne illness transmitted by raw meat and poultry products (see box, *The HACCP Program*). The costs and benefits of implementing HACCP are distributed throughout the economy. The costs of implementing HACCP are paid initially by the meat and poultry industry, while the benefits of controlling foodborne illness are distributed initially among consumers. However, the ultimate impact of these costs and benefits extends well beyond the initial payers and beneficiaries, with economic ramifications for many different segments of the economy.

To examine the full economic ramifications of HACCP implementation and answer the question as to how economic activity might be different if the HACCP system were implemented and foodborne illness were reduced, we developed a Social Accounting Matrix (SAM) multiplier model. The SAM multiplier model is a linear, general equilibrium model of the economy that traces the impact of exogenous change on every endogenous account in the economy. Our HACCP SAM model is based on the 1993 U.S. SAM derived from a Computable General Equilibrium (CGE) model of the United States developed by the Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA) (Hanson et al., forthcoming).

In addition to building the HACCP SAM model, we needed to accomplish a number of other tasks in order to undertake the SAM analysis—tasks that required facing difficult problems in both the theory and empirical practice of health economics. The first task was to establish the initial benefits of HACCP. A wide variety of benefit estimates are available, and determining the one to use raises some fundamental theoretical questions in health economics, particularly, how to value life and health for economic analysis. The second task that had to be confronted in order to perform the SAM analysis was to establish the initial distribution of HACCP benefits. The initial recipients of HACCP benefits are households whose members would have fallen ill if HACCP had not been implemented. We had to determine the distribution of foodborne illness among different socioeconomic groups to establish the initial distribution of HACCP benefits. Because either private or public health insurers pay a large share of medical expenses, we had to account for the distribution of health insurance coverage among different socioeconomic groups. In addition to identifying the payers of foodborne illness costs, we also had to identify the receivers. Determining the distribution of medical expenses among hospitals, physicians, pharmaceuticals, and education services reveals the empirical difficulties in accurately measuring even one of the most straightforward of the economic measures of the cost of illness: medical expenses.

Using the HACCP SAM model and the information on the distribution of foodborne illness, we ran four basic simulations to illustrate the probable economic consequences of HACCP implementation. First, we traced

The HACCP Program

The Hazard Analysis and Critical Control Point (HACCP) program is administered by the Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture, which is responsible for ensuring the safety of raw meat and poultry products. Prior to the introduction of the HACCP program, the FSIS inspection program for slaughter and processing plants was based on organoleptic (sight, smell, and touch) methods. These methods were adequate for removing noticeably diseased animals from the food supply but were not designed to detect potentially dangerous microbial pathogens that might be present in otherwise healthy animals.

The HACCP program was introduced in response to growing scientific consensus that food safety should be based on the systematic identification and reduction of risks involved in the production of each specific food. The program covers all Federal- and State-inspected meat and poultry slaughter and processing plants in the United States, as well as foreign plants that export meat or poultry products to the United States. The four major components of the HACCP program are: (1) implementation of a written HACCP plan by every slaughter and processing plant; (2) adoption of Sanitation Standard Operating Procedures (SSOPs) by every slaughter and processing plant; (3) *Salmonella* performance standards for slaughter and ground product plants; and (4) generic *E. coli* performance standards for slaughter plants.

The HACCP plan component of the HACCP program requires each slaughter and processing plant to analyze its own production processes and identify "Critical Control Points" (CCPs) where potential hazards affect food safety. Plants must then develop a written HACCP plan and maintain records to ensure that the production process remains within predetermined "critical limits" at each control point, based on parameters such as temperature or chlorine level. The largest plants, 500 or more employees, had to implement HACCP plans by January 1998. Smaller plants had until 1999 or 2000 to implement plans, depending on plant size.

The SSOP component of the HACCP program requires all slaughter and processing plants to prepare a written plan describing the daily procedures used to ensure sanitation during production. Plants must also detect, document, and correct any sanitation deficiencies. All plants were required to have SSOPs in place by January 1997.

The *Salmonella* and generic *E. coli* performance standards included in the HACCP program allow FSIS to monitor whether plants are adequately preventing pathogen contamination of raw meat and poultry products. *Salmonella* was selected for monitoring because it is one of the most common foodborne pathogens and is present in a wide variety of raw food products. Generic *E. coli* was selected because it is naturally found in animal feces and serves as an indicator of fecal contamination during production. FSIS sets maximum acceptable limits for both pathogens, based on baseline surveys of each class of animal and food product. The implementation dates for the *Salmonella* standard are the same as those for the HACCP plan. All slaughter plants were required to begin testing for generic *E. coli* in January 1997.

the economic impact of hypothetical reductions in the human capital costs of foodborne illness (benefits of HACCP). Second, we examined the economic impact of hypothetical reductions in medical expenses arising from foodborne illness (benefits of HACCP) when households paid these costs. Third, we examined the economic impact of hypothetical reductions in medical expenses when either private or public health insurers paid these costs. Fourth, we looked at the economic impact of hypothetical increases in meat and poultry plant operating expenses due to HACCP implementation. For each simulation, we investigated how the hypothetical change might affect the level and distribution of consumption, production, and income in the U.S. economy.

The first section of the paper presents the cost and benefit estimates that are used to initiate the simulations. The second section discusses the SAM framework and presents some details as to how the HACCP SAM was constructed. The third section explains how the SAM multiplier model works and outlines the simulations that we conducted with the HACCP SAM multiplier model. The fifth section begins by determining the incidence of foodborne illness and then traces the benefits of reductions in foodborne illness costs when either households or health insurers pay these costs. The sixth section traces the costs of HACCP implementation. The conclusion compiles all the simulation results to examine the net impact of HACCP implementation on the economy.