Which Costs and Benefits?

In any cost-benefit study, analysts must decide which costs and benefits to include in the analysis. For this study, we used estimates of the benefits of reductions in foodborne illness by ERS (Buzby et al., 1996) and estimates of the costs of HACCP implementation by USDA's Food Safety and Inspection Service (USDA, FSIS, 1996). These estimates were the basis for the official regulatory impact analysis of the HACCP program (USDA, FSIS, 1995 and 1996). Both estimates are examined in detail in Crutchfield et al. (1997). We could have used a number of other benefit and cost estimates. Our analysis provides insights into how the benefits of improved health and the costs of regulatory reform affect the economy. We did not intend and do not provide an all-encompassing assessment of HACCP costs and benefits.

Benefits of the HACCP Program

Estimates of the present value of 20 years of HACCP-program benefits reported in Crutchfield et al. (1997) range from $1.9-$171.8 billion in 1995 dollars (see table 1).[1] These benefits are the expected cost savings due to reduced foodborne illness resulting from the HACCP system. The estimates are conservative because they measure the benefits of reductions in illness caused by only four foodborne pathogens (*Salmonella, Escherichia coli* O157:H7, *Campylobacter jejuni* or *coli*, and *Listeria monocytogenes*), whereas over 40 different foodborne pathogens are known to cause illness (Council for Agricultural Science and Technology, 1994).

The ERS benefit estimates are quite imprecise, with the high-end estimate almost 100 times higher than the low-end estimate. Four primary reasons account for this wide range. First, the incidence of foodborne illness (and death) and the proportion of cases caused by contaminated meat and poultry are uncertain. Table 2 illustrates the wide variation in the estimated number of cases of foodborne illness. Second, the efficacy of the HACCP program in reducing foodborne illness is also uncertain. The highest benefit estimate reported in Crutchfield et al. (1997) incorporates an efficacy rate of 90 percent, while the lowest estimate uses a rate of 20 percent. Third, the benefit estimates vary because two different discount rates are used. Crutchfield's et al. lower estimates use a relatively high discount rate of 7 percent to reflect private valuations, while the higher estimates use a discount rate of 3 percent to reflect a societal viewpoint. The fourth, and most critical source of variation in the benefit estimates, is the use of two different methods to assign economic value to improvements in health and longevity resulting from reductions in foodborne illness. The higher benefit estimates reported in Crutchfield et al. use the willingness-to-pay methodology (derived from Viscusi, 1993), while the lower use a variant of the cost-of-illness methodology (derived from Landefeld and Seskin, 1982).

For this study, we used the mid-range benefit estimates of $4.7-$23.4 billion (see boldfaced type in table 1). These estimates are calculated with a HACCP efficacy rate of 50 percent, a discount rate of 7 percent, and the Landefeld and Seskin cost-of-illness approach.[2] We chose the moderate efficacy rate and the steeper interest rate simply to be conservative. We chose the cost-of-illness approach because it provides a measure of the distortions to the economy arising from illness and premature death (or in this case, a reduction in both). Cost-of-illness estimates measure two types of costs: direct medical expenses and human capital costs. The direct medical costs of illness are expenditures for medical goods and services such as doctor visits, hospitalization, residential care, and medications.[3] Human capital costs of illness are the present value of wages (and nonwage benefits) forgone as a result of an adverse health outcome. The cost-of-illness approach produces an accounting of the dollars that

[1] Benefits begin to accrue 5 years after the HACCP rule is enacted so the present-value calculations actually run over 25 years.

[2] In their cost-of-illness calculations, Landefeld and Seskin (1982) add an individualized element to their human capital calculations by including a risk-aversion factor, computing earnings net of taxes, including nonlabor income, and using an individual, rather than a social discount rate. Buzby et al. (1996) adjusted the Landefeld and Seskin measures of lifetime, after-tax income by averaging across gender, interpolating between age groups, and updating to 1993 dollars.

[3] Some studies include other types of expenses in their cost-of-illness estimates, and indeed, there are many other types of costs that could be included in a study of foodborne illness. Buzby et al. (1996) developed a list of potential foodborne illness costs that includes medical expenses, income or productivity losses, child-care costs, increased health insurance costs, lost leisure time, psychological costs, extra cleaning-time costs, and welfare costs due to unwelcome flavor changes in traditional recipes.

Table 1—HACCP benefits estimated for different scenarios

Scenario	Effectiveness of pathogen reduction	Discount rate	Valuation methods for premature death/disability	Benefits[1] Low	Benefits[1] High
	Percent	*Percent*		*1995 dollars (billions)*	
Preliminary FSIS proposal	90	7	Landefeld & Seskin[2]	8.4	42.1
Low-range benefits estimates	20	7	Landefeld & Seskin	1.9	9.3
Mid-range benefits estimates I	**50**	**7**	**Landefeld & Seskin[3]**	**4.7**	**23.4**
Mid-range benefits estimates II	50	3	VOSL[4] = 5 million	26.2	95.4
High-range benefits estimates	90	3	VOSL = 5 million	47.2	171.8

[1] Present value of 20 years of benefits (beginning 5 years after the HACCP rule is enacted).
[2] Landefeld and Seskin estimates averaged across gender.
[3] These values are used for the HACCP SAM analysis. For the analysis, they are converted to 1993 dollars.
[4] VOSL = Value of statistical life (calculated with willingness-to-pay methodology).

Source: U.S. Department of Agriculture, Economic Research Service, compiled in Crutchfield et al. (1997).

Table 2—Estimates of foodborne illness are imprecise

Pathogen	Annual cases	Annual deaths	Share foodborne	Share foodborne from meat and poultry	Annual cases from meat and poultry	Annual deaths from meat and poultry
			Percent	*Percent*		
Samonella	800,000-4,000,000	1,000-2,000	87-96	50-75	459,770-2,880,000	435-1,440
E. coli O157:H7	10,000-20,000	220-541	80	75	6,000-12,000	132-325
Campylobacter jejuni or *coli*	2,000,000-10,000,000	200-730	55-70	75	825,000-5,250,000	83-383
Listeria monocytogenes	1,118-1,903	270-510	85-95	50	464-884	115-242

Source: Buzby et al., 1996.

consumers and producers spend differently as a result of illness or premature death.

The human capital component of the cost-of-illness approach is based on the assertion that the cost to society of adverse health outcomes is the impact that such outcomes have on national income. Early proponents of the human capital approach argued that investments in health ultimately augment human capital and lead to increases in both the number and quality of people in the workforce, thereby increasing national income and social welfare (Mushkin, 1962). Robinson (1986) traced the philosophical underpinnings of the human capital approach to the economic doctrine dominant from the early 19th to the mid-20th century, which held that the best government policy is one that most effectively increases the "wealth of nations," as measured by national income. The human capital approach to valuing life is consistent with this notion. A life is valued in terms of its contribution to national income. The human capital approach is based on the tenet that social welfare is diminished by illness, disability, and premature death to the extent that these outcomes diminish national income.

Many economists have criticized the cost-of-illness method, primarily because it does not incorporate valuations for pain and suffering and other nonmarket commodities. Many prefer the willingness-to-pay approach, arguing that it provides a more accurate appraisal of the changes in welfare resulting from changes in health and longevity than the cost-of-illness method (for a review of valuation methodologies for health cost-benefit analysis, see Tolley et al., 1994, and Kuchler and Golan, 1999). However, willingness-to-pay amounts do not measure market distortions. Although the willingness-to-pay methodology may indicate how much a society would pay to avoid adverse health outcomes and premature death, it does not measure the economic impact of such outcomes. For example, the willingness-to-pay estimates used in the upper range of HACCP benefit estimates in

Crutchfield et al. (1997) were derived by observing the wage premium paid to workers for risky jobs. These wage premiums, and the attitudes toward risk and health that generated these premiums, do not shed light on the effect of illness or premature death on the level or distribution of economic activity.

The cost-of-illness approach tallies the primary economic flows associated with an adverse health outcome. It accounts for the drop in productivity resulting from illness, accident, or premature death, as well as the shift in consumer spending from general consumption and investment to medical goods and services. The cost-of-illness approach provides an accounting of the dollars spent on medical expenses and the earnings lost due to illness, accident, or premature death. Combined with a general equilibrium analysis, such as a SAM multiplier model, the cost-of-illness approach provides the first step in deciphering the full economic impact of illness and premature death. This information helps policymakers gauge the extent and distribution of the costs of foodborne illness caused by contaminated meat and poultry and the benefits of the HACCP program.

For the HACCP SAM analysis, we used the mean of the mid-range Crutchfield et al. 20-year present-value estimates converted to 1993 dollars (to conform to the 1993 SAM): $13.32 billion (table 3).

Table 3—Benefit and cost estimates used in the HACCP SAM simulations

Benefits[1]	Costs[2]
1993 dollars (billions)	
$13.3	$1.1

[1] Benefits are mean mid-range benefit estimates reported in Crutchfield et al. (1997) converted to 1993 dollars. These benefits are the present value of 20 years of benefits (beginning 5 years after the HACCP rule is enacted).

[2] Costs are mean cost estimates reported in Crutchfield et al. (1997 converted to 1993 dollars. These costs are the present value of 20 years of HACCP costs; they include both initial and yearly costs.

Costs of Implementing the HACCP Program

The HACCP program includes four essential elements: (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 slaughterhouses (see box, *The HACCP Program*). Throughout this report, references to HACCP and HACCP costs refer to all four components.

The cost estimates prepared for the Food Safety and Inspection Service (FSIS) cost-benefit analysis of HACCP include the additional costs for both FSIS and the meat and poultry industry to implement HACCP. The cost estimates depend on numerous assumptions, including assumptions about industry structure, wages, modification costs, costs of training, supply and demand conditions, and the timing of implementation. The 20-year present-value FSIS estimates of the costs of HACCP are $1.1-$1.3 billion (Crutchfield et al., 1997). Other studies have used different assumptions and have produced different estimates (for example, Knutson et al., 1995, Jensen et al., 1998). For this study we use the official FSIS estimates, though our methodology could be applied to any of the other cost estimates. The types of costs included in the estimates could cause the level and distribution of economic effects to differ substantially.

For the actual HACCP SAM analysis, we used the mean value of the FSIS HACCP 20-year present-value cost estimates converted to 1993 dollars (to conform to the 1993 SAM): $1.1 billion (table 3).