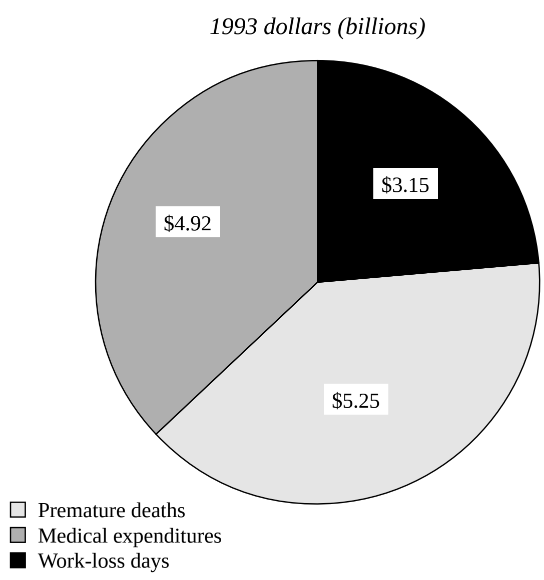
Tracing the Benefits of the HACCP Program

The economic impact of the benefits of reductions in foodborne illness depends on the nature of the benefits. In order to discover how economic activity would differ with less incidence of foodborne illness, we needed to know the economic transactions triggered by foodborne illness. Reductions in productivity costs due to death have a different economic impact than reductions in productivity costs due to illness; and any reduction in productivity has different economic impacts than reduced medical expenses. To trace the impact on the economy from reductions in foodborne illness, we first had to distinguish among the different types of benefits embedded in the HACCP benefit estimates. Extrapolating from information in Buzby et al. (1996), we estimate that the mean, mid-range benefit estimate of $13.32 billion is composed of $5.25 billion due to the reduction in premature deaths; $3.15 billion due to the reduction in work-loss days (productivity costs due to time lost from work because of nonfatal illness); and $4.92 billion due to reductions in the direct medical costs of illness, such as expenditures for physician visits, hospital and nursing home care, drugs, and medical tests and procedures (fig. 4).

The distribution of costs between medical and productivity loss depends on the death and disability rate of the illness. The greater the number of premature deaths and disabilities, the higher the productivity losses and the lower the share of medical expenditure in total cost. As a result, the comparative size of medical or productivity costs fluctuates with technological changes and medical advances, and the mix and level of foodborne illness costs may certainly change in the future. Mushkin (1979) argued that, over time, biomedical research, technological change and new diagnostics will result in proportionally higher medical costs, and she presented statistics indicating that, from 1900 to 1975, medical costs did rise as a proportion of total costs of illness. She found that, in 1900, medical costs of illness were 10 percent of total cost, while in 1975, they were 25 percent of the total.

Figure 4
Costs of foodborne illness



Mushkin hypothesized that medical advances would lead to a reduction in human capital costs as a share of total costs of illness, and there are examples in which medical advances have almost eliminated human capital costs (for example, polio and smallpox). Where illness continues to result in high rates of premature mortality or disability, human capital costs still tend to outweigh medical costs, as is currently the case with most foodborne pathogens (see fig. 4). However, the relative size of the type of cost varies substantially by pathogen. For *Salmonella, Campylobacter jejuni*, and *Listeria monocytogenes*, medical expenditures account for 30-50 percent of total costs of illness, while for *Escherichia coli* O157:H7, medical expenses account for only 12 percent of total costs.

Initial Distribution of the Benefits of Reduced Foodborne Illness

For the HACCP SAM, the costs of foodborne illness estimates, as reported in figure 4, must be disaggregated further. The double-entry accounting system of the SAM framework requires that each flow be identified by sector of payment and sector of receipt. We must know who pays the costs of foodborne illness and who receives the payments. Those sectors or institutions that initially pay the costs of foodborne illness are the initial beneficiaries of reductions in foodborne illness. Those sectors or institutions that receive the payments initially suffer a drop in receipts if foodborne illness is reduced. The SAM simulation analysis traced the impact of these initial benefits as they trickled through the economy.

Sources of Data on Foodborne Illness

The Centers for Disease Control and Prevention (CDC) recently estimated that there are 76 million foodborne illnesses in the United States each year, resulting in 325,000 hospitalizations and 5,000 deaths (Mead et al., 1999). The CDC estimate is approximate because many foodborne illnesses are relatively mild and are not reported to public health agencies. Foodborne illnesses that require medical care are not always properly diagnosed. Public health agencies and health care providers consequently underestimate the actual incidence of foodborne illness, and also provide little or no information about the socioeconomic characteristics of persons who became ill.

The National Health Interview Survey (NHIS) provides alternative estimates of the incidence of foodborne illness, based on respondents' reports of health conditions, rather than on administrative records. The NHIS is a nationally representative annual survey of the U.S. civilian noninstitutional population conducted by the U.S. National Center for Health Statistics (NCHS) that inquires about health conditions in approximately 49,000 households (Benson and Marano, 1994.) Respondents are asked to report about the health of each household member for 2 weeks preceding the survey interview in order to minimize recall bias. NHIS also collects detailed information about family structure, income, employment, health insurance, and the impact of illness on work and other daily activities.

We pooled the 1992-1994 NHIS annual samples for this analysis to obtain more stable estimates of the incidence of foodborne illness by household category and income level. The pooled sample includes information on 354,000 persons, representing nearly 14,000 person-years of exposure to the risk of foodborne illness.

Foodborne illnesses were identified based on the standard ICD-9 codes assigned to each reported health condition by NCHS medical coders (Benson and Marano, 1994.) NHIS respondent reports tend to represent symptoms rather than medically diagnosed diseases, unless respondents had visited a physician who diagnosed their condition. Preliminary analysis of the NHIS data suggested that medical coders assigned most symptoms potentially due to foodborne pathogens to one of four general ICD-9 codes: food poisoning, unspecified (005.9); intestinal infections due to other organisms, not elsewhere classified (008.8); infectious colitis, enteritis, and gastroenteritis (009.0); or infectious diarrhea (009.2). Therefore, we defined foodborne illness as all acute conditions classified in one of these general codes, or in any one of 20 other specific codes corresponding to the six pathogens included in the ERS baseline estimates (003.0, 003.1, 003.2, 003.8, 003.9, 005.0, 005.2, 008.0, 008.41, 008.43, 27.0, and 130.0-130.9). Few acute conditions were classified under codes corresponding to other foodborne pathogens, so our definition of foodborne illness captured nearly all acute conditions due to foodborne pathogens.

To determine who initially pays the costs of foodborne illness, that is, who reaps the initial benefits of HACCP, we first determined the incidence and severity of illness in each household category. To measure the distribution of illness, we relied on respondents' reports of foodborne illness and acute health conditions resembling foodborne illness derived from the National Health Interview Survey (NHIS). The NHIS provides more information about the socioeconomic characteristics of persons who become ill than other sources of data on foodborne illness do (see box, *Sources of Data on Foodborne Illness*).[6]

The NHIS indicates approximately 13.5 million annual cases of foodborne illness and other acute conditions potentially caused by foodborne pathogens in the United States during 1992-94. In contrast, the Centers

[6] Perhaps a better source of such information is the FoodNet Population Survey, which identifies persons with diarrhea (a common symptom of foodborne illness).

for Disease Control and Prevention (CDC) recently estimated 76 million annual cases of foodborne illnesses in the United States (Mead et al., 1999). The NHIS estimate is not directly comparable with the CDC estimate because the NHIS counted only those cases severe enough to require at least half a day of restricted activity or a physician visit, whereas the CDC estimate includes all cases regardless of severity. The NHIS also excluded cases resulting in hospitalization or death because the survey did not cover hospitalized or deceased persons. Furthermore, the NHIS excluded cases among persons in nursing homes, prisons, and other institutions because the survey did not cover institutionalized populations. The NHIS estimate consequently includes only a subset of all foodborne illnesses in the United States.

Despite the shortcomings of the NHIS, it was the best available source of information on socioeconomic differences in the incidence of foodborne illness. For this study, we assumed that the distribution of foodborne illness among households revealed by the NHIS is similar to the distribution of foodborne illness due to the four pathogens included in the ERS HACCP benefit estimates (Buzby et al., 1996). In the absence of more comprehensive data with socioeconomic variations in foodborne illness, this assumption is not unreasonable.

The NHIS indicates that the incidence of foodborne illnesses and other acute conditions potentially due to foodborne pathogens varies by household type (table 5). The average annual number of cases per 1,000 persons during 1992-94 was highest in households with children (70). In contrast, the annual incidence rate was lowest in households with elderly heads of household (15.3). The reason for this low incidence rate is not entirely clear, although one factor may be because institutionalized persons are not included in the NHIS sample. Elderly persons in nursing homes may be in poorer health and therefore at greater risk of foodborne illness than the noninstitutionalized elderly, so the exclusion of the institutionalized elderly from the NHIS results in an underestimate of the incidence of foodborne illness among the elderly.

The NHIS also indicates that the average annual incidence of foodborne illness and other acute conditions potentially due to foodborne pathogens was slightly higher among the poor (60.1) than among the nonpoor (53). However, this difference was not statistically significant.

In contrast to the incidence of illness, there was little difference in the proportion of cases seen by physicians by either household type or income level. One

Table 5—Incidence of foodborne illness and other acute conditions potentially due to foodborne pathogens, 1992-94

Household characteristic	Average annual number of conditions per 1,000 persons		Conditions medically attended	
	Number		*Percent*	
Household type:				
With children	70.0	(3.7)	35.5	(3.6)
Without children	40.2	(3.7)	33.6	(6.2)
Elderly head	15.3	(3.3)	41.5	(16.5)
Income:				
Above poverty	53.0	(2.7)	35.1	(3.5)
Below poverty	60.1	(7.2)	36.4	(8.4)
Health insurance coverage:				
Public coverage	38.1	(4.2)	44.4	(8.7)
Private coverage	60.6	(3.7)	33.7	(4.1)
Uninsured	44.0	(7.7)	27.2	(10.4)
Total	52.9	(2.4)	35.3	(3.1)

Note: Standard errors shown in parentheses. Standard errors for individual years were calculated using the approximation method developed by NCHS (Benson and Marano, 1994). Standard errors for the 3-year pooled estimates assume that the correlation between annual estimates of acute conditions was equal to the mean correlation coefficient for the total population in 1982-84, the only period for which covariances between years have been reported (Bean and Hoffman, 1992). The standard errors are likely to be larger than the true standard errors because neither the NCHS approximation method nor the assumed correlation between annual estimates reflects the oversampling of Hispanics that began in 1992.

Source: 1992-1994 National Health Interview Survey.

explanation for this pattern may be that there is little difference in the degree of severity of illness. Alternatively, the propensity to visit a physician after becoming ill may vary within the population in a way that masks differences in the severity of illness.

The NHIS estimates provide a detailed picture of the distribution of foodborne illness and other acute conditions potentially due to foodborne pathogens severe enough to require physician care. The NHIS does not document which cases resulted in hospitalization or death, however. Since hospitalizations and deaths account for a substantial proportion of total costs of foodborne illness, assumptions about the distribution of hospitalizations and illness within the population may have a major impact on conclusions about the share of costs borne by different groups.

To determine the distribution of hospitalizations and deaths within the population, we assumed that the actual risks of hospitalization and death for persons who became sick enough to visit a physician were the same throughout the population. We also assumed that these risks were equal to the national-level risks implied by the estimates of physician-attended cases, hospitalizations, and deaths reported by the ERS baseline studies (Buzby et al., 1996). Using these assumptions, we allocated the total hospitalizations and deaths reported by Buzby et al. by household category. We distributed the initial benefits arising from reductions in the costs of illness according to this distribution.

The first two columns of table 6 present the distribution of human capital costs of foodborne illness. Because we used the human capital approach to measure the costs of foodborne illness, the costs of both work-loss days and premature death should be restricted to households with members in the labor force. Here we distributed these costs among households headed by a working-age adult to simplify the analysis. We recognize that some persons over age 64 still work, and that a small proportion of labor force participants age 18 to 64 are members of households headed by an elderly person (4 percent in 1992-94). Also, some households may have working-age adults but no labor-force participants. The third column of table 6 shows the distribution of medical expenses.

Having determined who initially pays the costs of illness (and reaps the initial benefits of reductions in foodborne illness), the next task was to determine who receives these payments (for example, who supplies the medical goods and services). The task of identifying a sector of receipt quickly reveals a fundamental difference between medical costs and productivity or human capital costs. Medical expenses are real flows, and both a payer and receiver can be identified. However, human capital costs are not flows. They are a pure drop in productivity and although a payer can usually be identified, a receiver cannot.

For medical costs, the sector of receipt was identified by extrapolation from Buzby et al. (1996). We esti-

Table 6—Initial distribution of the benefits of a reduction in foodborne illness, by household type

Household type	Benefits of reduction in premature deaths	Benefits of reduction in work-loss days	Benefits of reduction medical expenditures	Total benefits
	1993 dollars (billions)			
With children	3.99 (76%)	2.39 (76%)	3.54 (72%)	9.92 (74%)
Above poverty	3.26	1.95	2.87	8.08
Below poverty	.73	.44	.67	1.84
Without children	1.26 (24%)	.76 (24%)	1.13 (32%)	3.15 (24%)
Above poverty	1.12	.67	1.01	2.80
Below poverty	.14	.09	.12	.35
Elderly	0	0	.25 (5%)	.25 (2%)
Above poverty	0	0	.22	.22
Below poverty	0	0	.03	.03
Total	5.25 (100%)	3.15 (100%)	4.92 (100%)	13.32 (100%)
Above poverty	4.38	2.62	4.10	11.10
Below poverty	.87	.53	.82	2.22

Note: Percentages may not total to 100 due to rounding.

Table 7—Breakdown of medical expenses

Sector of receipt	1993 dollars (millions)
Medical services	4,000
Chemical	890
General manufacturing	1
Residential services	30
Total	4,921

mated that, of the $4.92 billion in total medical expenses, $4 billion was paid out to the Medical Services sector for medical care, $.89 billion to the Chemicals sector for pharmaceuticals, $1 million to the General Manufacturing sector for medical equipment, and $30 million to the Residential Services sector for rehabilitation and special education (table 7).

The Final Distribution of the Benefits of Reduced Foodborne Illness

The final distribution of benefits depends on households' economic reaction to the initial benefits and households' linkages with the rest of the economy. Direct medical costs and human capital costs have different kinds of impacts on the economy. Medical expenditures have direct and immediate impacts. These expenditures circulate throughout the economy, triggering economic activity and growth in some industries and reductions in others. Unlike direct medical costs, human capital costs do not entail economic flows that can be traced from one industry to another. Instead, these costs mark a pure drop in economic activity. In this section, we used the multiplier model to trace the impact of medical costs and human capital costs. For both types of costs, we attempted to identify the industries and households that ultimately benefit from reduced costs of foodborne illness.

Economic Impact of Reductions in Premature Death

In the first simulation, we used the SAM model to trace the economic ramifications of the benefits of reductions in productivity losses due to premature deaths. In this simulation, the reduction in premature deaths initially resulted in increased household income. In other words, in keeping with the theoretical underpinnings of the human capital approach, the reduction in premature deaths resulting from HACCP translated into an increase in national income. This increase ($5.25 billion) was distributed among households according to the distribution described in the first column of table 6. This initial increase in national income did not represent the ultimate impact, because households responded to the initial increase in income by expanding consumption and savings. This expansion triggered further increases in economic activity extending far beyond the originally affected households.

The SAM multiplier model traced the impact of the initial increase in household income through its positive effects on consumer demand, industrial output, and factor payments. After the SAM model accounted for the general equilibrium impacts, the initial growth in household income due to the reduction in premature deaths resulted in a $14.31 billion increase in industrial output and a $10.08 billion increase in household income (fig. 5).[7] Thus, every dollar of income gained due to reduced premature deaths resulted in an economywide income gain of $1.92. These results demonstrate that premature death imposes substantial costs on society as a whole. In this simulation, the reduction in premature death led to an increase in household income nearly double the size of the initial increase.

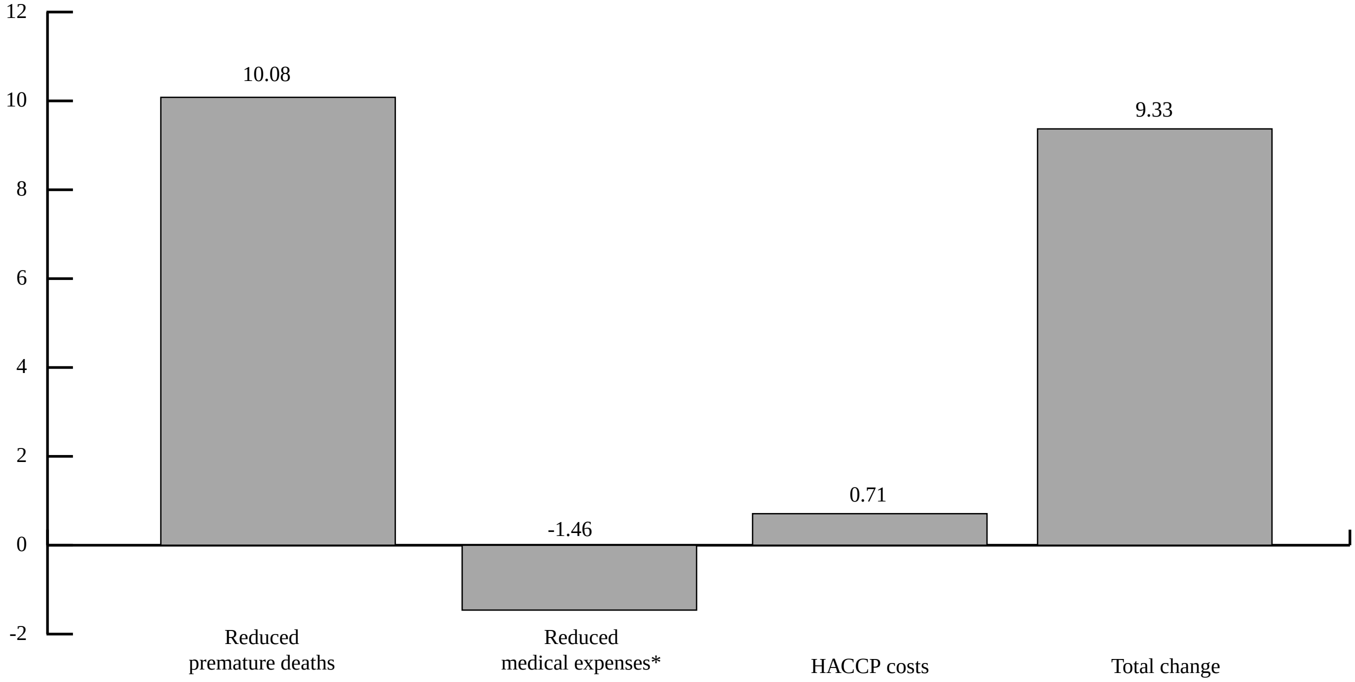
The differences between the initial and final distribution of the benefits of reductions in premature deaths by household category are also noteworthy. Households with children gained a smaller percentage of benefits in the final benefits distribution than in the initial distribution, while childless households and elderly-headed households gained a higher percentage (table 8). In fact, although elderly-headed households were not allocated any initial benefits of reductions in premature deaths, they received 6 percent of the final benefits. These differences arose because, unlike the initial distribution of benefits, the final distribution did not mirror disease incidence, but depended instead on the linkages between households and the economy. A similar pattern appears when households above and below poverty are compared. Poor households realized 17 percent of the initial increase in income due to reductions in premature deaths, but only 9 percent of the final increase, reflecting the fact that lower income households have weaker factor-payment linkages to industrial production than other households. Conversely, upper income households with strong factor-payment linkages were more strongly affected by changes in the returns to labor and capital.

[7] The difference between output and income is accounted for by "leakages," such as taxes and government transfers.

Figure 5

Economic impact of HACCP on household income

1993 dollars (billions)



*For this calculation, we averaged the results of the two simulation experiments involving reductions in medical expenditures.

Table 8—Final distribution of the impact of a reduction in foodborne illness, by household type

Household type	Benefits of reduction in premature deaths	Benefits of reduction in medical expenses paid by households	Benefits of reduction in medical expenses paid by insurance	Costs of HACCP	Total impact on household income[1]
	1993 dollars (billions)				
With children	5.75 (57%)	-.61 (46%)	-.74 (47%)	-.18 (47%)	4.90 (59%)
Above poverty	4.95	-.60	-.68	-.17	4.14
Below poverty	.80	-.01	-.06	-.01	.76
Without children	3.73 (37%)	-.70 (53%)	-.80 (51%)	-.19 (49%)	2.79 (34%)
Above poverty	3.58	-.69	-.72	-.19	2.68
Below poverty	.15	-.01	-.08	—	.11
Elderly	.60 (6%)	-.02 (1%)	-.03 (2%)	-.02 (4%)	.55 (7%)
Above poverty	.60	-.02	-.03	-.02	.55
Below poverty	—	0	—	—	—
Total	10.08 (100%)	-1.33 (100%)	-1.57 (100%)	-.39[2] (100%)	8.24 (100%)
Above poverty	9.13	-1.31	-1.43	-.38	7.38
Below poverty	.95	-.02	-.14	-.01	.86

Note: Percentages may not total to 100 due to rounding.
— = a quantity greater than zero, but less than $.01 billion.

[1] For the total calculations, the benefits of reduced medical expenses are calculated as the mid-point between columns 2 and 3.
[2] This amount represents the "real" decline in household income.

Economic Impact of Reductions in Work-Loss Days

As is the case with benefits arising from reductions in premature deaths, the impact of the initial distribution of the benefits of reduced work-loss days will likely be diffused and amplified once the general equilibrium effects of these productivity gains are calculated. The economic impact of time lost from work due to illness is more complex and difficult to interpret, however, than the impact of premature deaths. Column 2 of table 6 shows the initial distribution among households of benefits of reduced work-loss days based on incidence rates, but clearly, some, if not all, of the gain in productivity due to fewer work-loss days will be absorbed by industries.

Estimates of the incidence of foodborne illness and acute conditions resembling foodborne illness among workers are reported in table 9. Both the average annual number of cases per 1,000 persons and also the proportion of cases seen by physicians were lower among workers than among the general population, although neither difference was statistically significant. Workers reported losing about 6.6 million work days per year due to foodborne illness during 1992-94, or 56.1 work-loss days per 1,000 workers. The incidence of foodborne illness and work-loss days varied by industrial sector, although the differences between industries were not statistically significant due to the small size of the pooled NHIS sample. Food retail workers tended to have a higher rate of work-loss days than other workers, perhaps because they were at higher risk of foodborne illness (though many other explanations are possible, including stricter policies discouraging workers from reporting to work when ill). The high rate of work-loss days for public administration workers may reflect more generous sick-leave policies in the public sector than in the private.

Table 9—1992-94 National Health Interview Survey estimates of average, annual incidence of work-loss days, by industrial sector

Industrial sector	Work-loss days per 1,000 workers	
	Number	
Agriculture	20.6	(57.1)
Livestock	40.6	(71.4)
Fishing/hunting	0.0	(0.0)
Other primary	59.6	(94.5)
Construction	58.9	(33.8)
Food processing	53.8	(66.2)
Chemicals	71.9	(99.9)
Manufacturing	41.9	(18.0)
Transport/communications/utilities	19.6	(18.0)
Wholesale trade	31.5	(32.1)
Food retail	100.4	(40.4)
Other retail	33.7	(20.8)
Finance/insurance/real estate	66.3	(34.6)
Health services	69.5	(30.1)
Other services	45.9	(14.2)
Public administration	164.0	(61.6)
Total	56.1	(8.1)

Standard errors shown in parentheses, based on NHIS method for calculating approximate standard errors. Workers with industry unknown are excluded. Between-year correlations are assumed to equal zero for workers and .02 for work-loss days.

The economywide impact of productivity gains from reductions in time lost from work depends on the ultimate allocation of these benefits between industry and households. This allocation in turn depends on a number of industry-specific characteristics, notably sick-leave benefits. Modeling the relationship between industry and labor was beyond the scope of this report, and we did not simulate the impact of reduced work-loss days with our SAM model. However, whether these productivity gains are passed on to households through labor income, capital income, or lower prices, they will likely result in an increase in economic activity similar to the one modeled with reductions in premature deaths.

Economic Impact of Reductions in Direct Medical Expenses When These Expenses Are Paid By Households

We next used the SAM multiplier model to trace the economywide impact of reductions in medical expenditures due to foodborne illness when these expenses were paid directly by households. In the first step of this simulation, households reduced their demand for medical goods and services by $4.92 billion. To mirror this decrease in demand, we reduced output of $4 billion from the Medical Services sector for medical care, $.89 billion from the Chemicals sector for pharmaceuticals, and $30 million from the Educational Services sector for rehabilitation and special education. These savings were then redistributed back to households according to the original distribution of medical expense reductions reported in column 3 of table 6. In this expenditure-switching simulation, we allocated the additional consumption of other goods according to household consumption coefficients for each good. Households were assumed to spend or save these savings from reductions in medical expenses in the same way they spent other income.

After the SAM model accounted for the general equilibrium effects of the decrease in medical expenditures, there were net *decreases* of $1.6 billion in industry output and $1.33 billion in household income. Thus, every dollar of medical expenses saved as a result of HACCP led to an economywide income *loss* of $.27. The consumption of medical goods and services due to illness apparently triggered growth in the economy that outweighed the economic decrease due to reduced household spending on nonmedical goods and services. In other words, the medical expenditures precipitated by foodborne illness led to an increase in economic activity. Redirecting these expenditures to other goods and services resulted in a decrease in economic activity. The explanation for this result is that, in general, medical goods and services use a very high proportion of domestically produced inputs and have relatively stronger links to the domestic industrial structure.

Although economic activity may decrease with a reduction in foodborne illness, this decrease in income does not necessarily mean that households are worse off. Most people would undoubtedly prefer to avoid foodborne illness rather than to get sick and take the cure in order to generate economic activity. This result highlights the need to refine the methodology to account for changes in well-being not captured by income measures alone. The seemingly perverse positive effect of defensive expenditures (such as medical expenditures and pollution cleanup costs) on national accounts has been well documented by environmental economists (Lutz, 1992).

As shown by comparing tables 6 and 8, the ultimate decrease in household income triggered by the decrease in medical expenditures was distributed differently than the initial distribution of the reduction in medical expenses. Higher income households, which have stronger factor-payment links to the economy, bore a larger share of the decrease in economic activity than lower income households, which have weaker links to the economy. In fact, households with incomes below the poverty level bore only 1.5 percent of the decrease in household income triggered by increased medical expenditures, although their members comprised 16 percent of the population.

Economic Impact of Reductions In Direct Medical Expenses When These Expenses Are Paid By Health Insurance

In the above simulation, medical expenses were paid directly by households. However, in the United States, most households have health insurance provided by either private insurers or government insurance programs like Medicare and Medicaid. The economic ramifications of out-of-pocket versus third-party payments is quite different. To examine the economic impact of reducing medical expenses when they are covered by private or public medical insurance, we used additional information from the NHIS to classify households into one of three health insurance categories, based on the coverage of individual household members:[8]

(1) Households with public coverage: one or more household members had Medicaid, Medicare, or other public health coverage, regardless of whether any members had private coverage.

(2) Households with private coverage: at least one household member was covered by a private health plan, and all other members were uninsured.

(3) Households without coverage: no household member had either public or private coverage.

This classification distinguishes households whose health care costs were wholly or partially subsidized by public programs from households protected by private insurers and households lacking any kind of coverage. Public coverage took precedence in the classification in order to identify all households receiving public funds.

Medicare was considered public coverage because most Medicare beneficiaries elect optional Part B coverage, which is subsidized by the Federal Government. This approach differs from the classification developed by Paulin and Weber (1995), which treats Medicare as

[8]The focus on health insurance reduced the size of the NHIS sample available for analysis by approximately one-sixth, because the survey questions about health insurance coverage were not administered during the first half of 1993.

Table 10—Households, by health insurance type

Health insurance type	Households with children	Households without children	Elderly	All households
	Percent			
Public insurance	23	11	96	30
Private insurance	65	74	3	60
Uninsured	12	16	1	10
Total	100	100	100	100

Note: Health insurance type excludes households that could not be classified because of incomplete data.

private coverage. Military health coverage was treated as private coverage because military dependents and retirees included in the NHIS sample received coverage as an employment benefit. Single-purpose hospitalization plans covering only hospital charges were also counted as private coverage, following Bloom et al. (1997).

The majority of nonelderly households fell into the private insurance category (see table 10). Sixty-five percent of households with children and 74 percent of households without children had private coverage. In contrast, elderly households depended almost exclusively on public health insurance coverage, reflecting the role of Medicare in providing health care for the elderly.

Note that the three health insurance categories we used capture only some differences in sources of payment for health care. Many households with public coverage also had private coverage, notably so-called medigap policies for costs not covered by Medicare. Some households with private coverage paid less out-of-pocket for health care than others because they had more comprehensive policies, or because their employers paid a larger share of the premium. Finally, some uninsured households may have had better access than others to health care providers who reduce their fees for low-income patients and then shift the unreimbursed cost to public payers (through government subsidies or charitable deductions) or private payers (through higher charges). As a result, our conclusions about the effects of health insurance provide only a very general indication of the way that health insurance may affect economic activity.

We used the information from the NHIS on the distribution of illness by household insurance category (table 5) to distribute the $4.92 billion dollars in medical-expenditure savings. Households with private coverage accrued a much larger share of total savings ($3.19 billion) than households with public coverage ($1.39 billion) and households without coverage ($.34 billion). Thus, the availability of health insurance changes the linkages examined in the earlier simulation. Most important, the fact that nearly one-third of medical expenses were incurred by households with public or no coverage linked these savings to taxpayers.

We used the SAM multiplier model to trace the impact of reductions in direct medical costs when third-party payers (private insurers or the government) paid the bills. The initial drop in medical expenses for publicly insured and uninsured households was deducted from medical sectors and distributed back to households as "tax cuts." Specifically, the $1.73 billion reduction in the medical expenses of publicly insured and uninsured households was distributed back to households above poverty. These households increased their consumption and saving accordingly. The initial impact of the reduction in medical costs for privately insured households was represented by a $3.19 billion decrease in costs for the insurance sector. We modeled the decrease in costs for the insurance sector by diverting insurance sector expenditures from the purchase of medical goods and services to the purchase of other goods and services, as indicated by the expenditure coefficients in the SAM.

The final impact of the decrease in medical expenses paid by third parties was a decrease in economic activity. The decrease in output was similar, though slightly larger, when medical expenses were paid by third-party payers, $1.85 billion, than when they were paid out of household income, $1.6 billion. Similarly, the decrease in total household income was $1.57 billion when medical expenses were paid by third-party payers, and $1.33 billion when expenses were paid out of household income. Every dollar of medical expenses paid by third-party payers resulted in an economywide income loss of $.32, as opposed to a loss of $.27 when households paid expenses out of pocket.

The final distribution of the decrease in household income resulting from third-party payments of medical expenses differed from the initial distribution of foodborne illness for two reasons (table 8). First, medical expenses were paid by insurance companies and taxpayers rather than by households, thus diffusing *initial* cost reductions throughout the economy. Second, the decrease in economic activity resulting from lower medical expenditures was shared among household factor payments, thus diffusing the *final* decrease in income throughout the economy. When medical expenses were paid by third-party payers, the link between the initial distribution of illness and the distribution of the economic impacts was broken because both the initial and final impacts of foodborne illness were diffused throughout the economy. As a result of the greater diffusion, the final distribution of economic impacts differed from the distribution that prevailed when expenses were paid out of household income.

The final impact of a reduction in medical expenses on the economy probably falls between the two cases analyzed here because households and third-party payers share medical expenses. Regardless of the exact mix between household payments and insurance and government payments, the SAM multiplier simulations indicate that the ultimate impact of a reduction in medical expenses is a decrease in economic activity.