Chapter 7

Projecting the Costs of HACCP from the Costs of SPCPs

To our knowledge, there have been four previous cost estimates of PR/HACCP: the FSIS cost-benefit analysis published in the *Federal Register* prior to promulgation of PR/HACCP, Knutsen et al. (1995), and academic reports by Antle (2000) and Boland et al. (2001). These estimates suggested that costs would vary from less than 1 cent per pound (FSIS) to a maximum of about 17 cents per pound for beef, and 5 cents per pound for chicken (Antle, 2000).[1] Boland et al. (2001) provide the only post-HACCP survey evidence of HACCP costs. However, their results are not nationally representative since they include 50 small plants in the Great Plains. The FSIS and Knutsen et al. (1995) cost analyses are *ex-ante* analyses based on estimated costs of the effort required to perform mandated tasks and ignore unexpected downtime and production costs for addressing food safety problems. Antle's (2000) estimate provides an upper bound under which HACCP costs likely fall. His cost function approach accounts for food safety-related costs, such as product condemnations and production downtime, but also includes the costs of producing products with nonfood safety quality attributes.

Ideally, there would be a lower bound cost estimate of PR/HACCP regulation because that lower bound combined with Antle's (2000) upper bound estimate would provide a window within which we would expect the costs of PR/HACCP to fall. In this chapter, making several strong assumptions and using a weighting factor to adjust our cost estimates to those costs that exist under PR/HACCP, we provide that lower bound cost estimate.

We use the cost estimates from chapter 4 to project the cost of PR/HACCP regulation. Although these cost estimates pertain to the cost of SPCPs, the arguments in chapter 3 and empirical linkage between HACCP tasks and SPCPs in chapter 6 suggest that food safety regulation under WMA and WPPA is correlated with food safety regulation under PR/HACCP. Thus, the implications and cost estimates derived in chapter 4 should be related to the costs of regulation under PR/HACCP. It is important to understand the nature of these costs because PR/HACCP is the foundation of Federal food safety process control and future regulations are likely to be derived from the current PR/HACCP rules.

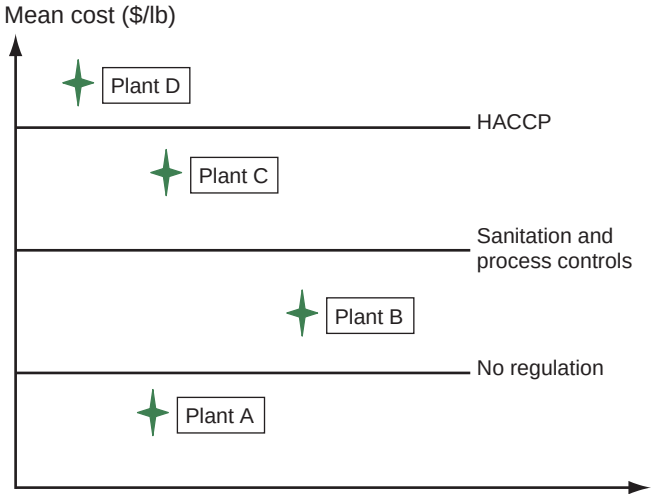
Previously Estimated Costs of SPCPs and the PR/HACCP Rule

Most plants would perform some SPCPs and some HACCP tasks in the absence of FSIS regulation because the markets that they serve demand process controls. The precise number and comprehensiveness of the tasks may or may not exceed the number and detail required by FSIS under the 1996 PR/HACCP rule. We illustrate three industry-average, cost-per-pound levels for quality control effort in figure 7.1: no regulation, mandatory sanitation and process control standards, and PR/HACCP rule. The cost levels are arbitrarily drawn but do illustrate that mean regulated costs are likely to be higher than the no-regulation case because regulation may require some tasks that a plant may not otherwise perform. We assume that plants would continue to perform tasks that they deem essential but are not required under regulation. PR/HACCP costs are greater than SPCP costs because sanitation and process control tasks are components of HACCP plans, which also include monitoring critical control points.

[1] Antle (2000) provides several estimates depending on the level of food safety when HACCP was promulgated. A lower level of food safety at the time of HACCP enactment leads to higher cost estimates. He also assumes a level of improvement due to the regulation. Based on a previous study, he uses a 20-percent level. For his upper bound estimate, he uses a 20-percent level of improvement and a 50-percent level of food safety at the time of HACCP implementation. Cost estimates range from 2.3 to 17 cents per pound for hog, cattle, and poultry slaughter. Lower bound HACCP cost estimates, based on a 90-percent level of safety at HACCP enactment and a 20-percent level of improvement, vary from 0.3 to 1.9 cents per pound for hog, cattle, and poultry slaughter. Antle also reports average costs of about $1.15 per pound for cattle slaughter, $0.79 per pound for hogs (large plants), and $0.60 per pound for poultry (large plants).

Figure 7:1

Hypothetical mean cost per pound expended for food safety process control under PR/HACCP, SPCPs, and no regulation



The stars in figure 7.1 represent individual plant costs of process control effort per pound and are hypothetical points that are used only to illustrate that different plants will choose to expend different levels of process control effort. For example, plant A expends less effort than the mean level of expenditures that would exist without regulation, and plants A and B put forth less effort than the mean level of expenditures put forth by the industry under the WMA and WPPA, while plants C and D expend more effort than the mean expenditure level. Only plant D incurs greater process control expenses than the mean level of expenditures under the PR/HACCP rule. Thus, plants A and B would incur regulatory costs to raise their performance to a level compatible with SPCPs, and plants A, B, and C would incur costs to meet the amount of effort required under PR/HACCP. Plant D never incurs regulatory costs.

In table 4.3, we showed how average costs relative to industry mean costs vary with differences in percent-deficient SPCPs. We did not and could not estimate the costs of complying with sanitation and process control standards because regulation exists for all plants, making an estimate of costs under no regulation impossible. However, we can estimate the potential costs that a plant with above the mean percent-deficient SPCP performance would incur to reach the sample mean level (a benchmark used by FSIS regulators). We can also estimate the potential costs savings that a plant with below the mean percent-deficient SPCP level would realize by performing at the sample mean.

Table 7.1 (columns 5, 6, and 7) contains the estimated costs of performing SPCPs at various performance levels relative to the sample mean, as outlined in chapter 4 and described in table 4.4. The first two columns in the table show the industry and the associated mean percent-deficient SPCPs, column 3 indicates the number of plants in the industry, and column four shows mean plant costs (animal and meat, materials, and labor costs) as published by the Census Bureau. We express SPCP costs as costs relative to the mean percent-deficient SPCPs at various percent-deficient SPCP levels.

Table 7.1 shows that plants with higher-than-average percent-deficient SPCPs have lower costs in all industries except cattle slaughter and cured/cooked pork products. On average, plants with twice the mean percent-deficient SPCPs (column 6, last row) would need roughly $263,000 to improve to the sample mean of percent-deficient SPCPs. Alternatively, plants above the sample mean level of percent-deficient SPCPs could reduce costs by performing only at the sample mean level.[2] For example, a plant at one-half the mean level of percent-deficient SPCPs (column 5, last row) could reduce effort to a level compatible with the industry mean and lower its costs by about $240,000. Note that only about 10 percent of all plants have more than twice the mean percentage of deficiencies and less than 2 percent of plants have more than four times the mean percentage of deficiencies, suggesting that few plants actually reduce process control effort to these levels.

Projecting the Cost of Performing at the Mean HACCP Level

The costs of PR/HACCP can be projected from SPCP costs since the nature of the tasks and enforcement appear to be similar. Employees perform cleaning and process control tasks and record information to comply with SPCP standards and record information and adjust process controls for critical control points under PR/HACCP. Similarities also exist for enforcement. Under both systems, inspectors observe an operation being performed, a particular site, or a record to verify

[2] Chapter 5 showed that plants in the 90th percentile of percent-deficient SPCPs were more likely to exit the industry than other plants, suggesting that plants would benefit little by reducing process control effort above the 90th percentile. So, we assume that the 90th percentile (twice the sample mean of deficiencies) is the level at which no or minimal process controls exist.

compliance with a required task. If a plant improperly performs a task, the inspector marks the task as either a deficient SPCP (pre-HACCP) or a HACCP noncompliance record (post-HACCP) and asks the plant to address the failure. Moreover, under both systems, an excessive number of serious noncompliances could cause FSIS to temporarily shut down the plant by refusing inspector services.

To accurately project the costs of HACCP based on our SPCP cost estimates, we need comparable estimates of costs under the two regulatory regimes. These costs need not be precise in absolute value but should capture cost components associated with compliance. If cost estimates are comprehensive, then a ratio of the two estimates can be used to illustrate the relative change in regulatory requirements. For example, Ollinger and Cornejo (1999) estimated regulatory stringency based on ratios of the estimated regulatory costs announced in the *Federal Register* by the Environmental Protection Agency (EPA) for one regulatory regime relative to the estimated costs under a former regulatory regime. This ratio provided a gauge of the relative change in costs of the two regimes. The individual cost estimates from the EPA did not reflect actual costs, but since the regulatory cost estimates did capture all aspects of the regulatory change, the ratio of cost estimates across different regulatory regimes did measure relative stringency.

Working under contract for FSIS, the Research Triangle Institute (RTI) assessed the regulatory costs of SPCP performance standards in 1994. It suggested that costs amounted to about $12,500 per plant. Our cost estimates are sharply higher than this estimate because the RTI estimate considered only the supervisory costs of maintaining SPCPs and dealing with the FSIS inspector, while our estimates are based on the actual performance of SPCPs and resulting outcomes. Poorly performing plants may incur production shutdowns, meat condemnations, and other costs due to failure to perform SPCPs but will also avoid the costs of performing and monitoring SPCPs. Highly performing plants will incur the labor and supervisory costs of performing SPCPs and the costs of voluntarily shutting down production when there is a threat to product safety.

Under another contract with FSIS, Anderson et al. (1994) of RTI estimated the costs of HACCP regulation for nine plants. As with the SPCP study, costs included all supervisory costs, the cost of dealing with FSIS inspectors, and recordkeeping tasks (a prime component of HACCP plans) but did not include the costs of corrective actions, carcass condemnations, or plant shutdowns for corrective actions.

The ratio of cost estimates of the two RTI studies should indicate the relative change in stringency of the costs of PR/HACCP relative to the costs of SPCP standards. This ratio shows HACCP costs to be about 90 percent higher than the costs plants incur for SPCPs. Table 7.2 (columns 4, 5, 6, and 7) contains the estimated relative changes in HACCP costs at various levels of percentage of HACCP noncompliance records.

Table 7.2 shows that PR/HACCP sharply increases food safety process control costs relative to SPCPs. Plants that have two times the industry mean percentage of HACCP noncompliance records realize about $500,000 in lower costs—about 2.6 percent of its costs—than they would if they performed at the industry mean level. Alternatively, plants with one-half the mean percentage of HACCP noncompliance records incur about $450,000 more in costs than plants at the sample mean.

Cost Estimates of Complying With the PR/HACCP Rule

It is possible to estimate the costs of HACCP compliance based on our estimate of SPCP costs and the RTI estimates. However, we must make several strong assumptions. First, we assume that plants at two times the mean level of percent-deficient SPCPs (table 7.1) completely ignore sanitation and process control requirements to the point that product quality is noticeably affected and likewise ignore PR/HACCP requirements. This assumption appears to be plausible because plants with about twice the sample mean percent-deficient SPCPs (about the 90-percentile level of performance) increase their chances of failing to survive in their industry (see chapter 5). Second, we assume that RTI cost projections accurately reflect the relative change in regulatory compliance costs across regulatory regimes. Third, we assume that there are no private incentives to increase product quality during the transition from SPCPs to HACCP. This assumption means that all new costs incurred under PR/HACCP would not have taken place otherwise and appears to be conservative because it seems unlikely that consumer demand for greater safety has not changed given increased media coverage of food safety and a number of foodborne illness outbreaks since 1992. Finally, we assume that plants with below the industry-mean level

of percent-deficient SPCPs would reduce their regulatory costs by redeploying resources such that they performed at the industry's mean percentage of HACCP noncompliance records after a regulatory change.

A plant would incur costs of about $500,000 to improve its performance to the mean of the percentage of HACCP noncompliance records if it performed HACCP tasks at twice the industry mean level of percentage of HACCP noncompliance records (table 7.2). This is about the same amount that a plant with a fourth the mean percent-deficient SPCPs could save by redeploying assets in order to comply with HACCP regulation. This means that all plants with more than the mean percent-deficient SPCPs (about a fourth of all plants) would incur an average cost of regulation of about $500,000. Additionally, plants with from a fourth the mean percent-deficient SPCPs to the mean percent-deficient SPCPs (about a third of all plants) would incur somewhere between zero and $500,000 in costs. Plants with less than a fourth the mean percent-deficient SPCPs would have no cost of compliance under PR/HACCP because they already make expenditures compatible with the requirements under PR/HACCP. The average cost per plant works out to about $208,300—about 1.1 percent of all costs—or, based on Antle's (2000) costs of production, about 1.2 cents per pound for beef, 0.7 cent per pound for pork, and 0.4 cent per pound for poultry. These costs are in line with Antle's (2000) average estimated cost of compliance of 1.39 cents per pound on a weighted-average basis and the Boland et al. (2001) estimate of about 0.9 cent per pound for small meat plants.[3] Estimated costs for processed meat and processed poultry are about 1.6 cents per pound.

For the plant, regulatory costs are a much higher share of nonmeat and poultry costs because meat inputs account for anywhere from 79.7 percent of total costs for cattle slaughter to about 50 percent of total costs for sausage products. Thus, the costs of PR/HACCP relative to all nonmeat and poultry costs varies from about 5.5 percent of all costs for cattle slaughter to about 2.2 percent of all costs for sausages.

Summary

Chapters 4, 5, and 6 show that an increase in percent-deficient SPCPs results in a decline in plant costs, leads to a greater likelihood of plant's exiting the industry, and is positively correlated with a relatively high percentage of HACCP noncompliance records. In this chapter, we used cost function results from chapter 4 to estimate the costs of HACCP. We found that the costs of maintaining a HACCP system is about 1.1 percent of costs, which amounts to costs ranging from about 0.4 cent per pound for poultry to 1.2 cents per pound for beef, or about 0.9 cent per pound on average for meat or poultry. This estimate is much higher than that proposed by FSIS in the *Federal Register* announcement, which placed the cost at about 0.12 cent per pound. However, the estimate is quite close to the weighted-average cost estimated by Antle (2000) of about 1.39 cents per pound and almost identical to the Boland et al. (2001) survey costs of about 0.9 cent per pound.[4]

The 1.1-percent increase in costs is much more substantial to the plant operator than it may appear. Meat and poultry plants have little control over the price of animals and inputs of raw meat and poultry; but these costs constitute anywhere from 50-80 percent of input costs. As a result, the costs of PR/HACCP amount to anywhere from about 2.2 to 5.5 percent of controllable costs.

The increased costs of PR/HACCP relative to the sanitation and process control standards under the WMA and WPPA give plants a stronger incentive to reduce compliance unless buyers increased their food safety demands. In the absence of increased buyer demand for greater food safety, FSIS regulators would have to increase enforcement stringency to maintain the same compliance level.[5]

[3] Antle (2000) reports average meat prices varying from $1.15 per pound for beef to $0.60 per pound for poultry. Recall that the SPCP cost of HACCP compliance is biased downward because there is not a perfect linkage between SPCPs and food safety, whereas Antle's (2000) estimate is biased upward due to quality aspects unrelated to food safety. The weighted-average-cost estimate for Antle (2000) comes from Boland et al. (2001).

[4] Cost estimates of HACCP reported in each publication can be criticized, but their consistency suggest that HACCP costs may approach about 1 cent per pound. The SPCP-based estimate provided here is biased because it measures effort rather than quality; Antle (2000) estimates total product quality and then controls for some observable quality attributes so the accuracy of the quality variable depends on the correlation of the instrument with safety; and Borland et al. (2001) estimate plant labor and materials costs but do not consider downtime.

[5] It appears likely that heightened media coverage of food safety and a number of foodborne illness outbreaks since 1992 have increased demand for food safety over the past 10 years.

The higher cost estimate provided here for PR/HACCP than estimated by FSIS does not suggest that PR/HACCP is not cost effective. Depending on the anticipated effectiveness of the regulation and methodology used, the ERS estimate of the benefits of PR/HACCP ranged from $1.9 billion - $171.8 billion annually. Even the lowest benefits estimate, which assumes 20-percent effectiveness and the most conservative benefits methodology, generates about twice as much in health cost savings as industry incurs in cost increases.

We did not address the issue of whether HACCP regulation favors large plants over small plants in this chapter. However, recall that we did examine this question in chapter 4 dealing with the costs of SPCPs. In that chapter, we found that large plants did not have lower costs of performing SPCPs than small plants. Since the two regulations are related, it appears likely that, in the long run, PR/HACCP does not favor large plants. In the short run, a different assessment may be reached because HACCP costs include many more fixed costs than the SPCP-based system. Large plants can more readily spread these fixed costs over their larger production volumes.

Table 7.1—Estimated costs of various percent-deficient SPCPs relative to the mean level of percent-deficient SPCPs[1]

Industry	Percent deficiency[2]	Plants	Plant costs[3]	Costs of SPCP tasks relative to the costs of a plant at the mean level of percent-deficient SPCPs			Average cost of performing SPCP tasks relative to industry mean level
				½*Mean	2*Mean	3*Mean	
	Percent	*Number*	*$ million*	*$1,000*			
Cattle slaughter	3.70	230	32.3	89	-101	-261	-66.5
Hog slaughter	9.16	307	32.3	-957	1,041	1,810	597.4
Poultry slaughter	8.33	155	32.5	-424	548	1,083	327.5
Cured/ cooked pork	5.53	117	12.5	257	-273	-460	-155.2
Sausage	4.25	257	12.5	-79	82	137	46.5
Processed meat from animals	2.17	288	12.5	-27	28	47	15.9
Processed meat from raw meat	2.00	546	12.5	-205	227	400	90.8
Processed poultry	3.95	129	12.5	-254	247	390	137.8
Average—all industries	5.00		19.3	-237	263	510	156.2

[1] Negative numbers mean that costs are below the costs for plants at the industry mean level of percent-deficient SPCPs.
[2] Percent-deficiency is the industry average plant-level number of unperformed or poorly performed SPCPs divided by the total number of SPCPs.
[3] Mean plant cost is mean values published by Census of Manufacturers for all meat slaughter, meat processing, and poultry slaughter and processing plants. It is defined as value added plus meat and material input costs.

Table 7.2—Projected HACCP costs based on estimated costs of various percent-deficient SPCP levels relative to the industry mean levels of percent-deficient SPCPs[1]

Industry	Average total plant costs[2]	HACCP non-compliance records[3]	Costs of HACCP tasks relative to the costs of a plant at the mean level of percent HACCP noncompliance records [4]			Average cost of performing HACCP tasks relative to industry mean level
			½*Mean	2*Mean	3*Mean	
	$ million	*Percent*	*$1,000*			
Cattle slaughter	32.3	2.38	170	-193	-496	-126
Hog slaughter	32.3	1.90	-1,827	1,977	3,439	1,135
Poultry slaughter	32.5	5.45	-810	1,047	2,058	622
Cured/cooked pork	12.5	1.23	491	-521	-874	-294
Sausage	12.5	1.39	-151	157	260	88
Processed meat from animals	12.5	1.40	-52	53	89	30
Processed meat from raw meat	12.5	1.40	-392	434	760	172
Processed poultry	12.5	5.45	-485	472	741	262
Average—all industries	19.3	2.13	-450	500	969	297

[1] Negative numbers mean that costs are below the costs for plants at the industry mean level of percentage of HACCP noncompliance records tasks.
[2] Mean plant cost is mean values published by Census of Manufacturers for all meat and poultry slaughter and processing plants. It is defined as value added plus meat and material input costs.
[3] Percentage of HACCP noncompliance records is the average of the number of HACCP in noncompliance divided by the number of scheduled and performed tasks.
[4] Research Triangle Institute estimated the costs of compliance with HACCP tasks is about 1.90 times higher than the costs of complying with SPCP tasks. We multiplied this level of change in stringency times the estimated costs of SPCPs (table 7.1) to determine cost levels.