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Food Safety Regulation, Product Pricing, and Profitability:

The Case of HACCP

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Food Safety Regulation, Product Pricing, and Profitability:
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Abstract

This paper assesses the impact of mandatory Hazard Analysis of Critical Control Points (HACCP) regulation on output price for small meat processors and packers and evaluates implications for firm-level profitability. The importance of HACCP regulation and pricing is an issue that deserves in-depth analysis because of its implications for the survival of small firms in the meat industry. To investigate this issue a survey was sent to meat processors and packers in the United States to collect data on HACCP expenses, output price before and after HACCP implementation, and inputs prices and quantities. Although output price did not increase significantly to compensate for HACCP expenses, analysis of the translog profit function revealed that small firms were more profitable after HACCP implementation. Other than price increase, these results suggest that HACCP provide incentives like reduced product rework to small firms.

***Key words**: HACCP, product pricing, profitability, translog profit function, U.S. meat processing industry*

Food Safety Regulation, Product Pricing, and Profitability: The Case of HACCP

William Nganje, Michael Mazzocco, and Floyd McKeith

Introduction

A major concern of small processing and packaging firms in the meat industry is whether output price will increase significantly to cover the cost of mandatory Hazard Analysis of Critical Control Points (HACCP) regulations.[1] This is of particular interest to small firms with diverse processes and products that must implement a costly but mandatory HACCP system. On July 4, 1996 a final *Proposed Rule* on HACCP/pathogen reduction in meat processing and packaging systems was released by the Food Safety and Inspection Service, USDA (Federal Register Vol. 60, No. 23). Under the regulation, processors have the primary responsibility for development and implementation of HACCP systems for meat animal slaughter, carcass fabrication, product processing, packaging, and distribution. The responsibility of the agency is to verify that the processor's HACCP system is effective and working as intended. The emphasis of HACCP is on process control rather than on end-product improvement.

Mandatory HACCP in the meat industry raises several questions concerning product pricing and profitability. Antle (1996) suggested the need for economists to evaluate whether mandatory HACCP (a design standard) will yield positive net benefits. Unnevehr (1996) discussed the need for economists to investigate how prices and technical efficiency are evolving throughout the meat industry with mandatory HACCP regulation. Caswell and Mojduszka (1996) identified food safety as a major attribute of food quality and emphasized the importance of a 'market clearing price' to satisfy the demand and supply of food safety. However, the traditional view of a 'market clearing price' may provide wrong signals especially in the case of HACCP because previous studies by Nganje and Mazzocco (1998) and Nganje (1998) quantified efficient benefits of HACCP from reduced product rework that may be indirectly reflected on the price.[2] This paper provides empirical evidence of the impact of HACCP on output price and firm-level profitability.[3] These issues are critical not only for efficient regulatory design and restructuring but also for the survival of small firms in the meat industry.

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[1] HACCP is a continuous comprehensive food safety monitoring system designed to prevent hazards from developing along a production process, thus ensuring a high degree of food safety (Bjerklie 1994 and Karr et al. 1994). HACCP plans are anticipated to minimize contamination problems and provide a food product that is safe when properly handled and prepared for consumption.

[2] A previous study on efficiency of HACCP in the meat industry revealed that firms with HACCP were more efficient than those without HACCP because of labor and carcass savings from not recycling bad products. HACCP prevents recycling or 'product rework' because checks at critical control points along the process enabled errors to be corrected as they occurred and ensured that end-products were safe.

[3] This paper evaluates supply side price analysis, which involves the impact of input prices on the firm's supply function.

HACCP and the Structure of the Meat Industry

With the emphasis of this paper on firm-level analysis, it is important to characterize participants in the meat industry in terms of size and how they will be affected by mandatory HACCP. The majority of the firms in the meat industry are smaller firms (Table 1) with diverse processes and products as opposed to larger firms with lesser processes but diverse products. A typical small firm will slaughter and process cattle, hog, lamb, veal, and other custom-exempt specie like deer, while a typical large firm will only slaughter or process one or two animal species but will produce several different products. Consequently, smaller firms may have to develop more HACCP systems or processes than their larger-firm counterparts and may incur higher HACCP implementation expenses.

Table 1. Percentage Size Distribution of North Central Meat Packing and Processing Plants Compared to Illinois Plants

State	# of Plants	Slaughter Only		Process Only		Both S/P**		Total %
		Large	Small	Large	Small	Large	Small	
Illinois	773	0.6%	1%	31.7%	48.5%	7.5%	10.7%	100
Indiana	259	0.0%	0.7%	10.4%*	51.1%	10.4%	27.4%*	100
Iowa	428	0.7%	1.9%*	8.4%*	34.8%*	8.2%	46%*	100
Michigan	552	1.5%	4.2%*	19%*	35.3%*	13.6%*	26.4%*	100
Minnesota	396	0.3%	1%	16.9%*	34.1%*	14.7%*	33%*	100
Ohio	450	7.7%*	1.3%	29.1%	16.4%*	30.6%*	14.9%	100
Wisconsin	352	0.6%	2.3%*	20.5%*	47.7%	6.5%	22.4%*	100
Total Plants	3,210	0.2%	0.2%	21.3%*	38.3%	12.8%	27.1%*	100

*Indicates a proportion significantly different from Illinois plant size categories at the 95% confidence level.

** S/P represents firms that slaughter and process.

Sources: American Meat Institute and the Michigan Department of Agriculture, State Department of Agriculture (1994); USDA (1994b); and Dunn and Bradstreet (1994).

Antle (1996) noted that "...because compliance with complex HACCP regulations involves a significant start-up cost that is independent of size of operations, the economic survival of smaller firms may be threatened by this form of regulation." Therefore, it becomes paramount to evaluate whether small firms can remain profitable under mandatory HACCP systems. This evaluation becomes more important if we consider HACCP cost and output price changes suggested in the literature. MacDonald et al. (1995) reported that the Food Safety Inspection Service (FSIS) estimates that firms will bear a total cost of $733.5 million, which works out to be 0.24 cents per pound of inspected meat products for the first five years (long-term projections) with mandatory HACCP implementation. The FSIS estimates that small establishments (defined as those with sales of less than $2.5 million) would bear about 45 percent of the new regulatory costs, or $330.6 million. This cost may be relatively high for these

small plants which account for less than 2.0 percent of the industry shipments. Nganje et al. (1995) estimated HACCP cost for small firms that slaughter and process meat to be 29 to 62 percent (range) greater than HACCP costs for large firms.

The emphasis on output price and profitability in this paper is important to resolve possible contradictions about the impact of mandatory HACCP. McDonald et al. (1995) suggested that although firms will incur higher implementation expenses, output prices may not increase significantly to cover these expenses. This implies that HACCP may have adverse effects on firms, especially small ones in the meat industry. Industry officials may use these suggestions to justify the fact that HACCP will cause healthy firms to go out of business. But other studies, Hayenga (1998), reported that as the meat industry becomes more concentrated either via production and marketing contracts or vertical integration, small firms are exiting the industry. Therefore, there may be other factors affecting prices and profitability. There is a need for businesses to investigate empirically the impact of HACCP on output price and firm-level profitability. The authors designed a survey to collect data on input and output prices and quantities and HACCP expenses. The proceeding sections discuss the survey procedure, data collected, analysis, results, and implications.

Survey Procedures

It is important to note that firm-level HACCP data for the meat industry is not publicly available. Consequently, a survey was designed to obtain firm-level data on prices and expenses before and after HACCP implementation. The target population for this study consisted of small meat processing and packaging firms in the United States.[4] A list of firms in the Meat and Poultry Industry was provided to us by the American Association of Meat Processors (AAMP). This list consisted of the name of each firm, the name of the contact person(s), address, and telephone number of 13,572 firms across the United States. Cost considerations precluded surveying all firms. A planned sample size of 990 would provide for a minimum standard error of the sample distribution at the 95 percent confidence level and provide a confidence interval (sample error) of 3 percent for the entire population. But a sample of 1,050 firms was selected using a systematic random sampling technique (for all firm size categories) to accommodate firms that were out of business.

The survey questionnaire was developed following a comprehensive review of firm-level HACCP implementation and other expenses and benefits in the literature, including questionnaires that had been used in other cost studies for the meat and poultry industry. The questionnaire was screened by professors and representatives of AAMP and pre-tested three times to adjust the clarity, accuracy, and natural flow of the questions. The final questionnaire had 31 questions and three sections: (1) general business characteristics, (2) total production expenses, and (3) HACCP performance and expenses.

The general business characteristics section collected information about firm size (sales volume and number of employees) and categories (slaughter only, processing only, and both

[4] Small firms are firms with less than $2.5 million annual sales or less than 20 employees.

slaughter and processing), type of product produced and their volume in pounds, and whether sources of live animals and carcasses were tested for *E. coli* and *Salmonella*.

The total production expenses section collected data pertaining to the quantity and price of carcasses or live animals purchased, the hours and dollars per hour of labor used and labor incentives provided, and the units of material and utilities used and their unit prices.

The HACCP performance and expenses section collected data on HACCP expenses (including materials purchased, training of employees, plan development, record keeping and monitoring, and antimicrobial treatment and testing). Data was also collected on the impact of HACCP on product rework, the extension of product shelf life, and variation in input and output quantities and prices after HACCP implementation.

After double mailing, follow-up post cards, and telephone reminders, only 98 total responses were received.[5] Of the 98 respondents, only 68 were valid responses with complete answers to key questions. This response rate maintained the level of confidence at 95 percent, but the sampling error increased to 9.9 percent. Due to cost considerations, it was not possible to make follow up phone calls to all questionnaire non-responses. The 68 completed questionnaires were divided into responses coming from firms with and without HACCP systems. There were 47 firms who had HACCP systems or had begun implementing HACCP. Of the 47 firms, 34 were small meat processing and packaging firms. This paper is based on these 34 small firms with HACCP systems. The majority of the firms performed both slaughtering and processing activities. All 34 firms had cattle, hogs, and lamb as their main species processed or packaged. Of the 34 firms, 27 of them slaughter and process meat, 5 only process, and 2 only slaughter.

Survey of HACCP Cost Estimates

From the survey it was estimated that HACCP expenses contribute about 0.4 percent of total firm expenses (Figure 1) while material, labor, and carcass purchase contributed 13.5 percent, 20.3 percent, and 65.8 percent, respectively. This estimate included operating and depreciated HACCP expenses. For small firms this translates to about 2.5 cents per pound of product on average. Table 2 shows a detailed breakdown of all HACCP cost categories. The range of HACCP expenses varies from 0.04 to 43.51 cents per pound of finished product. The upper limit of this range represents firms that reported major restructuring of buildings and facilities to meet HACCP specifications. Figure 2 shows how HACCP costs decrease significantly as firm size increases. These HACCP expenses are relatively higher than the USDA estimates of 0.24 cents per pound reported by MacDonald et al. (1996), probably because the USDA estimates were for larger or medium size firms. Also, Antle (1996) pointed out that the USDA estimates ignored the cost of designing and operating testing systems to verify that the system is achieving its objectives.

[5] The low response rate was possibly due to the nature of the data requested and the lack of complete awareness of HACCP.

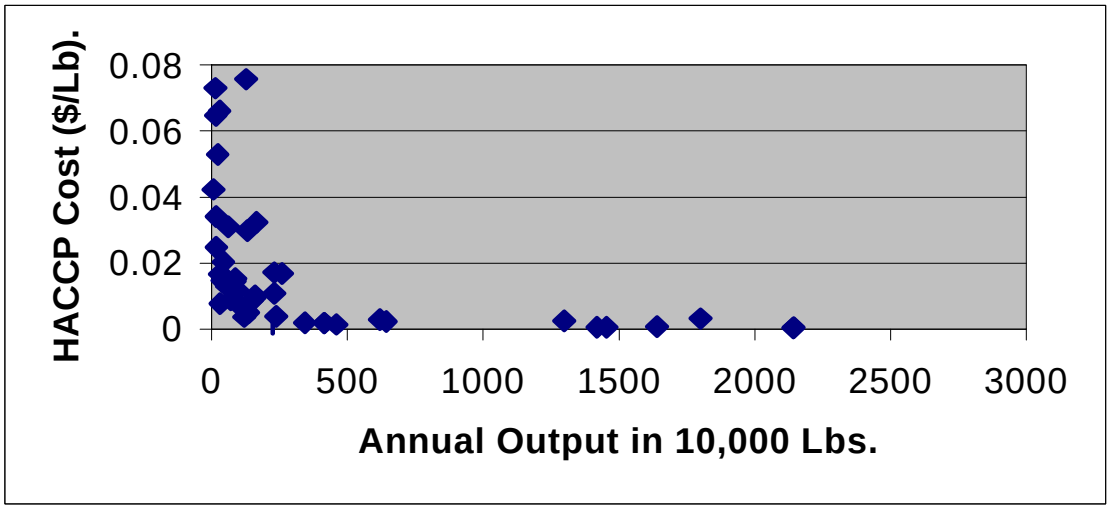

Figure 1. Variation of Reported HACCP Cost and Firm Size

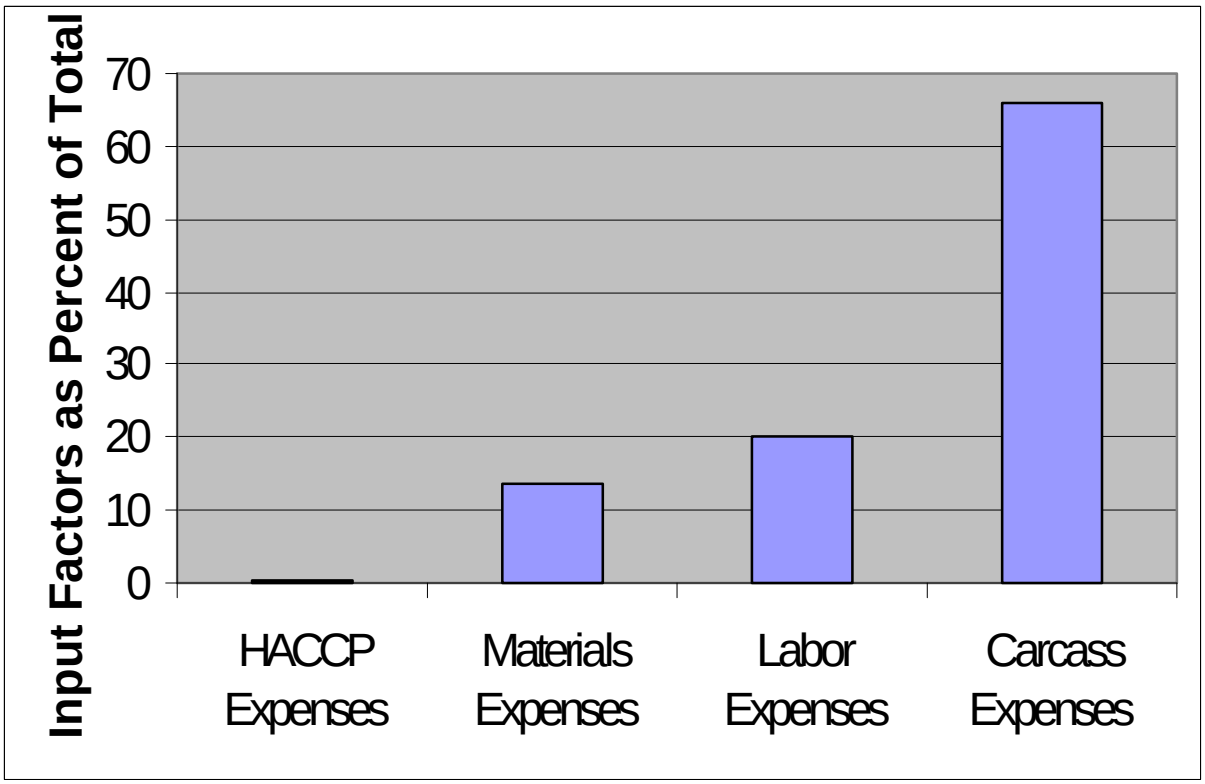

Figure 2. Cost Share of Input Factors (Percent)

Table 2. HCCP Actual and Anticipated Implementation and Operating Expenses

Cost Categories	HACCP Cost Categories	Minimum ($)	Mean ($)	Maximum ($)
Implementation	Plan development	1,000	5,588	35,400
Cost	Training	900	5,074	36,000
	Materials and building remodeling	1,200	43,941	409,995
Sub-Total ($)		3,100	54,603	481,395
Sub-Total ($)/5		620	10,921	96,279
Operating Cost	Record Keeping and USDA verification	1,133	5,753	14,490
	Bacteria testing	1,560	18,510	39,000
Sub-Total ($/yr)		2,693	24,263	53,490
Total HACCP	Expenses/year	3,313	35,184	149,769
Implementation (Amortization)	Cost ($/Lb, five years	0.0001	0.0074	0.08886
Operating Cost	($/Lb)	0.0003	0.0180	0.3462
Total HACCP	Expenses ($/Lb)	0.0004	0.0254	0.4351

Source: Estimated from survey data.

Output Price Variability and HACCP Implementation

Tables 3 and 4 show weighted output price for small firms prior to and after HACCP implementation.[6] There is a 1.06 cents or 0.69 percent increase in output price for small firms after HACCP implementation. This increase did not reveal any significant difference between output prices prior to and after HACCP implementation (using a two sample t-test).[7] Clearly, the increase in output price is less than the average HACCP expense of 2.5 cents per pound reported by these firms. However, Table 6 as compared to Table 5 reveals that as HACCP expenses increase, carcass and labor expenses decrease. These preliminary statistics provide some indications about HACCP incentives (such as reducing labor and carcass expenses) that can reduce cost and increase net profits.[8] A detailed profit analysis will provide more insight on how firm-level profits are affected by HACCP implementation. This will validate or contradict the propositions of Caswell and Mojduszka (1996) that firms will only supply safer food if it is profitable or if they are required to do so.

[6] Weighted output price for all red meat produced by these small firms was estimated by summing the product of outputs multiplied by output prices and dividing the sum by total output.

[7] The "two sample t-test" for comparing two means is given by Greene (1993)
$t_{(n1 + n2 - 2)} = (X_1 - X_2)/(S_1/n1 + S_2/n2)^{½}$.

[8] Nganje and Mazzocco (1998) estimated that HACCP improves the efficiency of the meat industry by reducing carcass expenses and labor for product rework.

Table 3. Statistics for Input and Output Price for Small Firms with HACCP Systems

	N	Mean	ST. Dev.	Minimum	Maximum
HACCP Unit Price ($/Lb)	34	0.0254	0.0197	0.0013	0.4443
Carcass Price ($/Lb)	34	0.8553	0.206	0.5100	1.4100
Labor Price ($/Hour)	34	11.6880	2.3551	6.1000	17.030
Material Price ($/Unit)	34	4.1218	3.4417	1.0000	14.940
Output Price ($/Lb)	34	1.5397	0.31068	1.0000	2.1100

Table 4. Statistics for Input and Output Price for Small Firms Prior to HACCP Implementation

	N	Mean	ST. Dev.	Minimum	Maximum
Carcass Price ($/Lb)	34	0.8406	0.1868	0.5100	1.3400
Labor Price ($/Hour)	34	11.7332	2.3240	6.1000	16.140
Material Price ($/Unit)	34	4.2050	3.4503	1.0000	14.940
Output Price ($/Lb)	34	1.5291	0.2977	1.0000	2.010

Table 5. Correlation of Output, Output Price, and Other Input Prices Prior to HACCP Implementation (n = 34)

	Output Price ($/Lb)	Output (Lb)	Carcass Price ($/Lb)	Labor Price ($/Hr)	Material Price ($/Unit)
Output Price ($/Lb)	1				
Output (Lb)	-0.0423	1			
Carcass Price ($/Lb)	0.0729	-0.0311	1		
Labor Price ($/Hr)	0.0619	-0.04815	0.021045	1	
Material Price ($/Unit)	0.0229	0.172591	0.087601	0.4633*	1

* Significant at the 5% level of confidence.

Table 6. Correlation of HACCP Cost Per Pound, Output, Output Price, and Other Input Prices for Small Firms After HACCP Implementation (n = 34)

	Output	HP ($/Lb)	CP ($/Lb)	LP ($/Hour)	MP ($/Unit)	P ($/Lb)
Output (Lb)	1					
HP ($/Lb)	-0.4224*	1				
CP ($/Lb)	0.3745*	-0.0591	1			
LP ($/Hour)	0.1161	0.1216	0.0743	1		
MP ($/Unit)	-0.0817	0.1756	-0.1009	0.345*	1	
P ($/Lb)	0.1559	0.0765	0.6349*	0.1185	0.1363	1

* Significant at the 5% level of confidence.

Profit Function Analysis

The empirical profit function model is presented in Equation 1. The translog profit function can be derived using Taylor expansion series. A profit function model is most appropriate for the analysis in this study because it analyzes profitability, output price, and HACCP technology jointly, and it incorporates the fact that small firms in the meat industry are seeking to maximize profits. Following Antle's (1984) specification, the translog profit function can be written as:

(1)
$$\ln\pi = \alpha_0 + \beta_k \ln P_k + \sum_{i=1}^{4} \alpha_i \ln w_i + 1/2 \sum_{i=1}^{4}\sum_{j=1}^{4} \gamma_{ij} \ln w_i \ln w_j + \sum_{i=1}^{4} \gamma_{ki} \ln P_k \ln w_i + \gamma_{kk} (\ln P_k^{\,2} + \varepsilon_i$$

Where

$\ln\pi$ = log of net profit

lnP = log of weighted output price

lnw = vector of input prices (labor rate per hour, carcass price per pound, unit material expenses, and unit HACCP expenses per pound)

α_0 , α_i , β_k , γ_{ij} , γ_{ki}, and γ_{kk} = coefficients to be estimated.

For Equation 1 to be a valid profit function, it must be homogenous of degree one in output and input prices. This means

$$\beta_k + \sum_{i=1}^{4} \alpha_i = 1, \qquad \gamma_{kk} + \sum_{i=1}^{4} \gamma_{ki} = 0, \qquad \gamma_{ki} + \sum_{j=1}^{4} \gamma_{ij} = 0 \quad \forall i$$

Since net profits were negative for some observations, only the profit share equations [obtained from the partial derivatives of the net profit function with respect to input prices (labor, carcass, material, and HACCP)] were used to estimate this model. The share equations prior to and after HACCP implementation are presented in Equations 2 and 3. The system of three profit share equations (labor, carcass, and material) prior to HACCP implementation is:

$$(2) \qquad \begin{aligned} ps_1 &= \alpha_1 + \gamma_{11}\ln w_1 + \gamma_{12}\ln w_2 + \gamma_{13}\ln w_3 + \gamma_{k1}\ln p \\ ps_2 &= \alpha_2 + \gamma_{22}\ln w_2 + \gamma_{12}\ln w_1 + \gamma_{23}\ln w_3 + \gamma_{k2}\ln p \\ ps_3 &= \alpha_3 + \gamma_{33}\ln w_3 + \gamma_{23}\ln w_2 + \gamma_{13}\ln w_1 + \gamma_{k3}\ln p \end{aligned}$$

The profit share is the negative of the expenditure of the ith input divided by net profit (Antle 1984) or $ps_I = -(W_i X_i)/\pi$. It can be deduced that profit shares do not sum up to one (because π is net and not gross profit) and, hence, all share equations can be used in the system of equations. The system of four profit share equations (labor, carcass, material, and HACCP) after HACCP implementation is:

$$(3) \qquad \begin{aligned} ps_1 &= \alpha_1 + \gamma_{11}\ln w_1 + \gamma_{12}\ln w_2 + \gamma_{13}\ln w_3 + \gamma_{14}\ln w_4 + \gamma_{k1}\ln p \\ ps_2 &= \alpha_2 + \gamma_{22}\ln w_2 + \gamma_{12}\ln w_1 + \gamma_{23}\ln w_3 + \gamma_{24}\ln w_4 + \gamma_{k2}\ln p \\ ps_3 &= \alpha_3 + \gamma_{33}\ln w_3 + \gamma_{23}\ln w_2 + \gamma_{13}\ln w_1 + \gamma_{34}\ln w_4 + \gamma_{k3}\ln p \\ ps_4 &= \alpha_4 + \gamma_{44}\ln w_4 + \gamma_{24}\ln w_2 + \gamma_{14}\ln w_1 + \gamma_{34}\ln w_3 + \gamma_{k4}\ln p \end{aligned}$$

Homogeneity and symmetry restrictions were imposed using Shazam software to estimate valid coefficients of the share equations and net profits. Net profits can be estimated directly from each share equation (net profits are equal to the negative of expenditure share divided by the sum of the right-hand side for each share equation).

Data and Definition of Variables

A primary data set from the survey of the meat industry described earlier is used for the analysis in this paper. Firms were advised to use tax and sales information to answer the survey questions. Data on the input and output prices and quantities for the 34 small firms prior to and after HACCP implementation was used in the analysis. Total output for each product category (fresh cuts, smoked cuts, smoked and fresh sausages, and by-products) was reported in pounds.

The unit of measurement for output price was dollars per pound. Weighted output price was used for the analysis. Weighted output price was computed by summing the product of the price and the quantity for each product category and dividing this sum by the total output from all product categories. The weighted output price multiplied by total output yielded the same gross revenue as compared to multiplying each product category by its price before summing the revenue from each category.

The carcass price used for the analysis was the dollar per pound of fabricated carcass, not live weight. The price of labor used was the hourly wage rate plus benefits (fringes). The unit material price was computed by summing the product of total units and the price per unit and then dividing by the total number of units of all materials purchased. Depreciated items and their values were included.

The unit HACCP expense was computed by dividing total output by the sum of all HACCP expenses (labor and training expenses, testing fees, and operating). HACCP equipment was depreciated based on the life of the equipment. Training cost was also depreciated based on the labor turnover in the industry.

Results of the Profit Function Analysis

The results of the estimated coefficients of the profit shares and net profit are presented in Table 7. Prior to HACCP implementation, estimated net profits from the three share equations are $259,838.7; $303,098; and $230,535.9. These numbers are the averages for all 34 firms. The differences are due to differences in the estimation error between share equations. After HACCP implementation, estimated net profits from the four share equations are $413,537.2; $330,355.2; $327,825.3; and $358,704. Estimated net profits after HACCP implementation were significantly greater than net profits before HACCP for all share equations.

The HACCP share equation (Share #1) reveals that as HACCP expenses increase net profits increase significantly (given $ps_I = -(W_i X_i)/\pi$). The estimated coefficient for HACCP expenses is –0.0539. Although, preliminary descriptive analysis reveals that output price does not increase significantly to compensate for HACCP expenses; firms are more profitable with HACCP systems because HACCP technology enables firms to reduce product rework and increase efficiency of labor and carcass use. With critical control points along the process, firms can avoid recycling bad products at the end of the production line. HACCP enables firms to correct mistakes as they occur and reduce spoilage of carcass and over use of labor from bad end-product recycling.

These results validate earlier findings on HACCP increasing the efficiency of small firms in the meat industry by Nganje and Mazzocco (1998). Other than price increase, these results suggest that HACCP provides other incentives like reduced product rework to small firms. These results validate the fact that HACCP can improve the overall profitability of small firms in the meat industry.

Table 7. Estimated Coefficients of Profit Share Equations and Net Profits

Equations	Variables (logs)	Estimated Coef. after HACCP	Estimated Coef. before HACCP
Share #1	**HACCP Expense**	-0.0539**	-
	Carcass Price	0.0674***	0.2079***
	Labor Price	-0.0309	-0.1483
	Material Expense	0.0205	- 0.4246
	Output Price	0.50839*	0.4916**
	Constant	-0.445	-3.2892
Net Profit		**$413,537.2**	**$259,838.7**
Share #2	**Carcass Price**	0.0674***	-1.0304***
	HACCP Expense	-2.2467***	-
	Labor Price	2.2344	-0.1483
	Material Expense	-0.0551	-0.2069
	Output Price	25.86**	0.3811**
	Constant	**-28.440***	1.4870***
Net Profit		**$330,355.2**	**$303,098**
Share #3	**Labor Price**	-0.034	-0.2069
	Carcass Price	2.2344	-0.3925*
	HACCP Expense	-2.4240***	-
	Material Expense	0.2237***	0.3649***
	Output Price	4.3578	0.4065***
	Constant	-11.6607	0.527
Net Profit		**$327,825.3**	**$230,535.9**
Share #4	**Material Expense**	0.02054***	
	Labor Price	-0.0551	
	Carcass Price	0.22374***	
	HACCP Expense	-0.18912	
	Output Price	1.683***	
	Constant	-2.455	
Net Profit		**$358,704**	
System R^2		0.4931	0.4154

*, **, and *** imply significance at the 1%, 5%, and 10% level of confidence, respectively. - implies that the variable is omitted. Share #1 gave the closest net profit estimate and was used for the stochastic simulation.

Conclusions

This paper uses primary data to evaluate how output price and firm-level profitability varies with mandatory HACCP regulations for small firms in the meat industry. Results indicate that although HACCP expenses are higher for small firms and output price may not increase significantly with HACCP implementation, small firms are more profitable with HACCP systems. This result seems to confirm the propositions advanced by Mazzocco (1996) that HACCP can serve as an effective quality management tool in providing cost cutting incentives of other inputs. The hypothesis that output price may not increase significantly to compensate for HACCP expenses and, hence, small firms will incur substantial pressure under HACCP was not validated because of other efficiency gains from reduced end-product recycling which reduces labor and carcass inefficiencies.

Implications of the Findings

Regulatory Requirements

Even though increased safety is consumer driven, Executive Orders or Acts exist that protect businesses against costly, regulatory procedures. Executive Order 12291 compels agencies to use cost-benefit analysis as a component of decision making. The Regulatory Flexibility Act (P.L. 96-354) requires regulatory relief for small businesses where feasible. The FDA finds that regulating food safety with HACCP programs constitutes a major rule under both the Executive Order and the Regulatory Flexibility Act. Consequently, the majority of small firms in the industry may respond adversely in the case of any negative ruling that threatens their existence in the business. This paper provides empirical support for mandatory HACCP regulations in the meat industry. The fact that small firms are more profitable with mandatory HACCP systems indicates they even if prices may not increase significantly, it is advantageous for small firms to implement HACCP.

Effectiveness of HACCP

Small firm managers anticipate that they may switch some processes and products to custom-exempt products not regulated by HACCP. This will not only limit the effectiveness of mandatory HACCP regulations but also will reduce safer products to consumers. However, this may be prevented if firms acknowledge that they can be more profitable with HACCP. HACCP will increase the safety of meat products significantly if all firms comply. This paper presents the argument that firms do not need to switch to custom-exempt regulations to realize positive profits with HACCP.

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