Economic Analysis of *Salmonella* Impacts on Swine Herds

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Summary and Implications

The economic analysis performed in this study is based on consolidated data from 48 groups of commercial finisher swine classified by three levels of *Salmonella* and on industry data. Each swine grouping had from 900 to 9,000 swine. The groupings were comprised of the same management and genetics, and were provided the same feed rations and diets throughout the study. The study group and comparison group were comprised of swine herds raised in the midwestern United States.

Information was gathered over a 12-month period and contained more than 80,000 data points based on *Salmonella* spp. detection. Epidemiological data, with serology and mix-ELISA, compared three category levels of *Salmonella*: low risk (level 1), moderate risk (level 2), and high risk (level 3).

Economic cost benefit analysis was based on operational and performance outcome data and was used to determine incremental performance efficiencies measured by additional pounds of pork produced per square foot of production space, performance weight gains, and time to market. Modeling was based on selected market hog prices matched with variable costs and overhead costs for producing groupings of finisher swine with identified levels of *Salmonella*. This approach helped to identify economic impacts for swine producers.

Data indicate that swine from groupings with a level 1 *Salmonella* seroprevalence had better production efficiency than those groups having a level 2 or level 3 *Salmonella* status. Those in level 1 produced 5.2 more pounds of pork annually per square foot of finisher space. Groupings of swine with level 1 *Salmonella* seroprevalence annually produced 2.9 more pounds of pork per square foot of finisher space than level 2 groupings.

For market hog pricing and production cost scenarios in this study, there were economic benefits for moving swine herds from level 3 to level 2 or level 1 seroprevalence for *Salmonella*. Data indicate that *Salmonella* may increase the producer's break-even cost due to production inefficiencies attributed mostly to increases in time to market and in excess feed consumption. Moreover, *Salmonella* levels may have an impact on variability in pig marketing weight and needs further study. Management strategies also may report variability in pig marketing weight. For swine production facilities with all in-all out production strategies, variability in pig gain and marketing weight can create problems at close-out time.

An increased weight variability also can account for additional economic loss, because lighter weight hogs and excessively heavy hogs are docked. For example, swine marketed under 220 pounds at close-out are often docked $10 per head; swine marketed under 200 pounds at close-out are docked as much as $20 per head. Excessively heavy hogs also are docked.

Introduction

The economic analysis performed in this study is based on data from 48 groups of commercial finisher swine classified by three levels of *Salmonella* and on data provided by industry. The measurements used for analysis include the *Salmonella* prevalence level classification, operational cost comparisons, and performance weight gains, which were measured in units of additional pounds of pork produced per square foot of finisher space. Three levels of *Salmonella* were identified and categorized based on levels of on-farm prevalence (1). The three categories were identified to represent low risk, moderate risk, and high risk for groupings of finisher swine.

Epidemiological data were collected on swine production sites having similar management practices, including segregated early weaning (SEW), all-in all-out (AIAO) management systems, and monitored single-sourcing and multi-sourcing of swine herds. The study group contained swine herds raised in the midwestern United States. Comparison data used in the analysis were modeled from swine production data provided by industry with swine production located in the midwestern United States. Finisher swine in the study group were comprised of the same genetics and were given the same diet and feed rations throughout the study. The level of risk assigned for groups of swine were based on a modified epidemiological measurement rating developed in Denmark. It represents a measure of pathogen prevalence, a measurement system that is widely used and accepted in Denmark (3).

The economic cost-benefit analysis performed in this study was based on incremental performance efficiencies—gains in additional pounds of pork produced, selected

market prices for swine—and on operational costs for producing finisher swine with identified levels of *Salmonella*. A break-even cost for producing market swine was determined by modeling production data made available to researchers.

Aggregate production cost figures were referenced from *Iowa State University Swine Business Records* for 1994, 1995, 1996, and 1997 and from industry production data. Production costs included variable costs and fixed costs incurred in producing and marketing finisher swine. An economic break-even cost approach was used in the analysis to help determine any economic advantage(s) for groupings of market swine having different category levels of *Salmonella*.

Additional economic considerations include discounting values of market hogs as assessed by slaughter processing facilities at time of slaughter. Meat packers assess fees for hogs that are excessively light or excessively heavy. Payments received by the producer for marketing groupings of hogs may be significantly reduced when marketing weight distributions are exceeded.

Methodology

Epidemiological data collected on-farm were gathered over a 12-month period and contained more than 80,000 data points based on *Salmonella* spp. detection (1). Epidemiological data from 48 groups of swine compared three risk category levels of *Salmonella:* level 1, level 2, or level 3. Each group was comprised of 900 to 9,000 finisher swine. Performance gains or losses for producing finisher swine are compared between groups of swine by *Salmonella* level. The primary performance measurement was average pounds of pork produced per square foot of finisher space, a common industry measurement, and by the inventory turn ratio of the production facility. For the analysis, performance was measured by incremental gain in pounds of pork produced per square foot of finisher space per year.

Level 1 groups of swine have *Salmonella* seroprevalence of less than or equal to 10%. Swine from these herds are considered safe for slaughter with no, or little, management interventions required. Swine from level 2 operations have *Salmonella* seroprevalence of greater than 10% but less than or equal to 15%. They require some management interventions. A level 3 *Salmonella* seroprevalence operation has a seroprevalence of greater than 15% and in Denmark is considered a health hazard. Urgent management interventions are required.

Production data were used to project the annual incremental differences in pounds of pork produced among the three different category levels of *Salmonella* seroprevalence. These incremental performance gain differences represent outcome differences in live pork

production per square foot of a finisher space. This allows an analysis of the economic benefit or loss for swine producers based on levels of *Salmonella*.

Production floor space was modeled and was based on three common production capacities of 6,000, 8,000, and 10,500 sq ft. Pig capacity per turn is 750, 1,000, and 1,300, respectively. Finisher swine are loaded into finisher facilities at 8 sq ft per pig. Economic performance projections were made for each building size based on production capacity and inventory turn ratios. Based on production data, a typical facility will have an inventory turn ratio (groupings of market swine) of between 2.4 to 2.7 turns per year per building. Each facility size is evaluated with six selected market prices per hundred (cwt) liveweight: $50, $45, $40, $35, $30, and $25.

In the economic analysis, additional variable costs of producing each additional pound of pork or pig per finisher space are evaluated. The method used to project a net economic gain or loss per finisher facility per year was determined by subtracting the variable cost for producing each additional swine from the revenues for the six selected market prices

Results and Discussion

Data indicate that there exist some production efficiency gains achieved by producers with lower levels of *Salmonella*. The largest performance increase in annual pounds of pork produced, as expected, exists between a level 1 group and a level 3 group; a 5.2-lb increase (1). Increases from a level 1 group vs. a level 2 group showed a moderate increase in performance of 2.9 additional pounds of pork produced per square foot of finisher space. A movement from a level 3 status to a level 2 status has an incremental performance gain of 2.3 additional pounds of pork produced.

The gross market values for additional pork produced per facility are shown in Table 1 for the three facility sizes. For a group of swine with a level 1 status compared with a group with a level 3 *Salmonella* seroprevalence, at a $40 cwt (per hundred pounds live weight), an additional $12,480 (31,200 lb x $.40) would be generated annually for a 6,000 sq ft finisher facility. By reducing the *Salmonella* status from level 3 status to level 2, an additional $5,520 (13,800 lb x $.40) would be generated. For $50 cwt hog prices gross revenues increased by $15,600 annually for the 6,000-sq ft facility, with a production efficiency increase of 5.2 lb. This compared with $7,800 for a $25 cwt hog price. The range in gross revenue increases was from $20,800 to $4,600 for the 8,000-sq ft facility. For the 10,500-sq ft facility, the gross revenue increase ranged from $27,300 to $6,038.

Table 1. Annual additional gain in pounds of pork and value by *Salmonella* level, market value (hog price), and available production floor space measured in square feet.

Projected annual increase in pounds of pork produced[a]	Additional pounds of pork produced per year[b]	Market hog price per hundred weight cwt[c]					
		$50	$45	$40	$35	$30	$25
		6,000-sq ft facility					
5.2	31,200	$15,600	$14,040	$12,480	$10,920	$9,360	$7,800
2.9	17,400	8,700	7,830	6,960	6,090	5,220	4,350
2.3	13,800	6,900	6,210	5,520	4,830	4,140	3,450
		8,000-sq ft facility					
5.2	41,600	$20,800	$18,720	$16,640	$14,560	$12,480	$10,400
2.9	23,200	11,600	10,440	9,280	8,120	6,960	5,800
2.3	18,400	9,200	8,280	7,360	6,440	5,520	4,600
		10,500-sq ft facility					
5.2	54,600	$27,300	$24,570	$21,840	$19,110	$16,380	$13,650
2.9	30,450	15,225	13,703	12,180	10,658	9,135	7,613
2.3	24,150	12,075	10,868	9,660	8,453	7,245	6,038

[a]From Baum (1997) study.

[b]Figures determined by multiplying a typical finisher building space (available production floor space) with dimensions of 6,000 sq ft, 8,000 sq ft, and 10,500 sq ft by the projected annual increase in pounds of pork produced. Example, 6,000-sq ft of production space x 5.2 = 31,200 additional pounds of pork per square feet (ppsf); 8,000-sq ft of production space x 2.9 = 23,200 ppsf.

[c]Swine market value(s) used for calculating additional pounds of pork produced were based on close-out market values of $50 per cwt, $45 per cwt weight, for $40 per cwt weight, for $35 per cwt, for $30 per cwt, and for $25 per cwt, respectively; economic values were calculated by multiplying the annual increase in pounds of pork produced by each of the six selected market prices. Example, 31,200 additional pounds of pork x $50.00 cwt ($.50 per pound) = $15,600.

Table 2. Projected annual economic gain or loss from an 8,000-sq ft finisher facility for swine producers in the top-third production efficiency category.

Swine price $ per cwt	Swine market value price per cwt[a]	Additional cost(s) for producing additional swine for market[b] ($.353/lb)	Projected net economic gain[c] per building production space per year
$	$	$	$
50	20,800	14,685	6,115
	11,600	8,190	3,410
	9,200	6,495	2,705
45	18,720	14,685	4,035
	10,440	8,190	2,250
	8,280	6,495	1,785
40	16,640	14,685	1,955
	9,280	8,190	1,090
	7,360	6,495	865
35	14,560	14,685	(125)
	8,120	8,190	(70)
	6,440	6,495	(55)
30	12,480	14,685	(2,205)
	6,960	8,190	(1,230)
	5,520	6,495	(975)
25	10,400	14,685	(4,285)
	5,800	8,190	(2,390)
	4,600	6,495	(1,895)

[a]See Table 1.

[b]The values represent the added pounds of pork for an 8,000-sq ft (available production space) facility x the cost per pound, or $.353. Figures for the cost per cwt of pork produced were pulled from the *Iowa State University Swine Business/Enterprise Records* (1994, 1995, and 1997) and from consolidated data supplied by industry. The figures used for projecting operational and production costs, $35.30 per cwt, included variable costs per cwt of pork produced. This base cost figure includes costs for feedstuff, for producing additional finisher swine for market—price for feedstuff corn @ $2.31 averaged per bushel, protein, minerals and supplements, mixing costs, veterinary services, and supplies and utilities.

[c]Net economic gain calculated by subtracting additional cost(s) associated with producing additional swine from the swine market value price.

Gross revenues, based on market value prices, do not provide the swine producer with the total economic picture. Additional variable costs are incurred with increased pork production. Data in Table 2 represent swine production data from producers in the top third production efficiency category. The associated increased cost is reflected in values shown under the category of additional cost(s) for producing additional pounds of pork for market.

In Table 2, a grouping of swine with a level 1 status vs. a grouping with a level 3 status projects a net economic gain per 8,000-sq ft building of $6,115 annually, based on a $50 cwt market price ($20,800–$14,685). Again, this is achieved by improving the herd *Salmonella* status from Level 3 to Level 1. The net economic gain achieved by improving from a Level 2 status to a group with a Level 1 status, and a $50 cwt price, is $3,410 ($11,600 - $8,190) annually. Other price and productivity changes are reflected in Table 2.

References

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