[Kansas Agricultural Experiment Station Research Reports](https://newprairiepress.org/kaesrr)

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 658

1996

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## Recommended Citation

Rowland, W W.; Langemeier, Michael R.; Featherstone, Allen M.; and Schurle, Bryan W. (1996) "Explaining differences in efficiency among farrow-to-finish producers," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. https://doi.org/10.4148/2378-5977.6498

# EXPLAINING DIFFERENCES IN EFFICIENCY AMONG FARROW-TO-FINISH PRODUCERS

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## Summary

To remain competitive, hog operations will need to continue to improve production efficiency and manage costs. Kansas Farm Management Association data from 1992 to 1994 were used to measure technical, economic, and overall efficiency for 43 farrow-to-finish operations in Kansas. On average, the farms had .89 technical, .75 economic, and .67 overall efficiencies. Efficiency was related positively to the number of litters produced and pounds of pork produced per litter. Efficiency was related negatively to percentage of labor hired, feed conversion rates, and capital investment per litter. Pounds of pork produced per litter and feed conversion had the largest impacts on efficiency. Results suggest that increasing the pounds of pork produced per litter or decreasing feed conversion would have a sizable impact on technical, economic, and overall efficiency.


(Key Words: Efficiency, Profitability.)

## Introduction

The U.S. swine industry has gone through some massive changes during the last 10 to 15 years. Several forces are driving structural change. The first force relates to technologies or innovations. Innovations or increases in the understanding of the biological process have made specialization more feasible. In addition to increasing production efficiency, specialization often has led to a reduction in production costs. The second force relates to economies of size. Advances in technology and management practices have increased the maximum size of operation that can be managed effectively. Other forces driving structural change include corporate organization, changing consumer preferences, and the benefits associated with vertical integration. Vertical integration may include production or marketing contracts between packers or feed companies and producers or direct ownership of production facilities by packers and feed companies. Vertical integration can be used as a means to lower transaction costs among sectors in the industry.

The objective of this study was to examine the efficiency of a sample of farrow-to-finish producers in Kansas. To remain competitive, hog operations will need to continue to improve production efficiency and manage costs. Survival in this extremely competitive industry hinges on economic efficiency. Identifying the key ingredients of economic efficiency helps producers focus on the management areas that are important to their competitive and strategic position.

## Procedures

Kansas Farm Management Association data for 43 farrow-to-finish producers from 1992 to 1994 were used in this study. The efficiency analysis required data on output, inputs, and costs of production. Output was measured as total pounds of pork produced. Input cost categories included labor, utilities and fuel, veterinarian expenses, feed, capital,

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and miscellaneous. Labor costs included hired labor and a charge for unpaid operator labor. Capital costs included interest, repairs, depreciation, and machinery hired. The opportunity charges associated with owning swine facilities were included in capital costs. Input costs were converted to real 1994 dollars.

Table 1 presents the mean and standard deviations of gross income, cost, profit, and selected farm characteristics. Capital investment per litter was computed using depreciation data. The feed conversion index was computed using feed cost data for each farm and the average grain sorghum price in the district in which the farm was located. On average, the farms lost about $1.75 per cwt. during the 3-year period. Feed costs comprised about 64% of the total cost per cwt. Labor and capital costs accounted for 13 and 14% of total cost per cwt., respectively.

Technical efficiency measures the extent to which a farm uses the best available technologies. Farms not producing as much as other farms would if they had the same inputs are technically inefficient. Economic efficiency measures the extent to which a farm minimizes cost for a given level of output. A farm can be economically inefficient because of technical inefficiency or allocative inefficiency (resulting from a failure to use inputs in a cost-efficient manner). Overall efficiency represents the minimum cost of producing a given level of output using constant returns-to-scale technology. Overall inefficiency can be due to economic inefficiency or not producing at the most efficient size. A series of mathematical programs was used to measure technical, economic, and overall efficiency. Regression coefficients were used along with the means of the variables to compute elasticities. The elasticity measures provided information on the sensitivity of efficiency to specific farm characteristics. Efficiency estimates were used as the dependent variables in the regressions. Independent variables included age of operator, number of litters, percent of income from swine, pounds of pork produced, percent hired labor, feed conversion index, percent of acres devoted to feed grains, capital investment, and the debt to asset ratio.

## Results and Discussion

Table 2 reports distributional information for technical, economic, and overall efficiencies. Technical efficiency ranged from .54 to 1.00. About 40% of the farms were technically efficient. Average technical efficiency for the sample of farrow-to-finish producers was .89, indicating that the output of these farms potentially could be increased by 11%, if each farm was operating in a technically efficient manner.

Economic efficiency ranged from .47 to 1.00 and averaged .75. If all of the farms had been operating on the average cost frontier, the same level of output could have been produced with 25% less cost. Only 12.4% of the farms had an economic efficiency index that was greater than .90. In contrast, over 57% of the farms had a technical efficiency index that was greater than .90. Thus, producing in a cost efficient manner was more difficult for these farms than producing in a technically efficient manner.

Overall efficiency ranged from .34 to 1.00 and averaged .67. If all of the farms had been operating at the minimum cost, the same level of output could have been produced with 33% less cost. Only one farm had overall efficiency. The minimum average cost occurred at an output of 149,355 lb or about 78 litters using the average pounds of pork produced per litter. The minimum average cost was $28.05 per cwt.

Elasticities are reported in Table 3. An asterisk indicates that the variable was significant at the 5% level in the corresponding regression. The coefficients on age of operator were not significant in any of the regressions. The percent of crop acres devoted to feed grain production variable was significant in the economic efficiency regression but not in the other two regressions. The debt to asset ratio was significant in the overall efficiency regression but not in the other two regressions. The regression coefficient on

the percent of income from swine variable was significant and negative in the technical and economic efficiency regressions. For this sample of farms, advantages were associated with engaging in multiple enterprises.

The number of litters produced, pounds of pork produced per litter, percent of labor hired, feed conversion, and capital investment were significant in all three efficiency regressions. Efficiency was related positively to the number of litters and pounds of pork produced. An increase in either of these two variables would increase efficiency. Efficiency was related negatively to the percent of labor hired, feed conversion, and capital investment. A decrease in any of these variables would increase efficiency.

Pounds of pork produced per litter and feed conversion had the largest impacts on efficiency. Each 1 percent increase in pounds of pork produced per litter would result in a .8004% increase in overall efficiency. Each 1% decrease in the feed conversion would result in an increase in overall efficiency of .6357%. Given the wide range of feed conversion and pounds of pork produced per litter exhibited by the farms in the sample, opportunities are available for many of the farms to increase technical, economic, and overall efficiencies.

**Table 1. Summary Statistics for a Sample of Kansas Farrow-to-Finish Producers**

| Variable | Mean | Standard Deviation |
|---|---|---|
| Income, cost, and profit ($/cwt.) | | |
| Gross income | 41.16 | 5.83 |
| Labor costs | 5.61 | 2.42 |
| Utilities and fuel | 1.69 | .88 |
| Veterinarian expenses | .87 | .65 |
| Feed costs | 27.47 | 5.71 |
| Capital costs | 5.88 | 2.71 |
| Miscellaneous costs | 1.41 | 1.10 |
| Profit | -1.77 | 8.71 |
| Other variables | | |
| Percentage of income from swine production | 55.60 | 21.38 |
| Percentage of acres devoted to feed grain production | 27.77 | 16.77 |
| Ratio of hired labor costs to total labor costs (%) | 18.20 | 25.99 |
| Debt to asset ratio (%) | 32.96 | 26.77 |
| Age of operator | 48.63 | 11.98 |
| Number of litters | 257.53 | 298.04 |
| Pounds of pork produced per litter | 1910.32 | 358.71 |
| Capital investment per litter ($) | 347.67 | 342.31 |
| Feed conversion index | 1.00 | .23 |

Source: Kansas Farm Management Associations.

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**Table 2. Efficiency Measures for a Sample of Kansas Farrow-to-Finish Producers**

| Variable | Technical Efficiency | Economic Efficiency | Overall Efficiency |
|---|---|---|---|
| Summary statistics | | | |
| Mean | .89 | .75 | .67 |
| Standard deviation | .12 | .13 | .11 |
| Minimum | .54 | .47 | .34 |
| Maximum | 1.00 | 1.00 | 1.00 |
| Distribution of measures (% of farms) | | | |
| Less than .40 | 0 | 0 | .78 |
| .40 to .50 | .60 | 1.55 | 5.43 |
| .50 to .60 | 2.33 | 9.30 | 17.05 |
| .60 to .70 | 3.88 | 26.35 | 33.33 |
| .70 to .80 | 19.38 | 25.58 | 30.23 |
| .80 to .90 | 17.05 | 24.81 | 9.30 |
| .90 to 1.00 | 17.05 | 6.98 | 3.10 |
| 1.00 | 40.31 | 5.43 | .78 |

**Table 3. Farm Characteristic Elasticities**

| Variable | Technical Efficiency | Economic Efficiency | Overall Efficiency |
|---|---|---|---|
| Age of operator | -.0235 | .0022 | -.0415 |
| Number of litters | .0892* | .0938* | .0349* |
| Percent of income from swine | -.0854* | -.1011* | -.0301 |
| Pounds of pork produced | .5323* | .7989* | .8004* |
| Percent hired labor | -.0599* | -.0459* | -.0306* |
| Feed conversion index | -.2710* | -.5632* | -.6357* |
| Percent feed grains | -.0301 | -.0353* | .0137 |
| Capital investment | -.0645* | -.0935* | -.0942* |
| Debt to asset ratio | -.0184 | -.0195 | -.0396* |

Note: An asterisk indicates that the regression coefficient used to compute the elasticity was significant ($P < .05$).