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## **AN EFFICIENCY ANALYSIS OF CATTLE BACKGROUNDING OPERATIONS IN KANSAS**

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### **Summary**

As the structure of the beef industry changes, understanding its efficiency, cost, and profitability relationships is important. This study evaluates the relative efficiency of a sample of Kansas farm backgrounding and backgrounding/finishing operations for 1995-1997. No commercial feeders were included. On average, backgrounding operations were 71% technically efficient, 68% allocatively efficient, 83% scale efficient, and 39% overall efficient. The results suggest that Kansas backgrounding operations could reduce their cost by 61%, if all farms were producing at the lowest possible cost. On average, backgrounding/finishing operations were 84% technically efficient, 79% allocatively efficient, 90% scale efficient, and 60% overall efficient, suggesting that those operations could reduce their cost by 40%, if all were producing at the lowest possible cost. Given the average levels of technical, allocative, and overall efficiencies, significant room for improvement exists in technology adoption, input usage, and size adjustment for both backgrounding and backgrounding/finishing operations.

(Key Words: Backgrounding, Finishing, Production Costs, Efficiency, Size.)

### **Introduction**

The livestock sector comprises about 40% of agriculture's contribution to Kansas' gross state product. Within the livestock sector, cattle account for over 80% of the value of all livestock production.

Consequently, fluctuating livestock profitability has a large effect on total income in the state's agricultural sector, and profitability of the cattle industry has a far greater effect on aggregate returns for Kansas agriculture than any other livestock enterprise.

Recently, great importance has been placed on the economic efficiency of agricultural production because of its role in explaining profitability differences. We have seen dramatic structural change in the commercial feedlot sector. The question now is, what is going to happen to farm back-grounding/feeding operations in Kansas? Efficiency measures can be used to generate inferences about the future direction of the industry and determine the factors that may influence the structure of the firms in that industry.

### **Experimental Procedures**

A series of mathematical programs was used to measure technical and cost efficiency for a sample of backgrounding and backgrounding/finishing operations. Specifically, overall efficiency, technical efficiency, allocative efficiency, and scale efficiency were measured. Data were obtained from the Kansas Farm Management Association for 41 backgrounding operations that reported data for 1995, 1996, and 1997. Enterprise data were converted to 1997 dollars and separated into six input categories: labor, utilities and fuel, capital, feed, veterinary, and miscellaneous. Feed costs include all cash and opportunity costs (i.e., feed grown and used on the operation is

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charged a market value.). Capital costs included: interest expense, interest charge, depreciation, machine hire and repair, and vehicle expenses. The interest charge represents an opportunity cost of owned capital. Output was measured in pounds of beef produced. Farms then were divided into three relative sizes based on output. Average revenue, cost, and efficiency characteristics were determined for each group.

## Results and Discussion

Table 1 presents the overall statistical summary for gross revenues, profits, costs and other relevant characteristics for both backgrounding and backgrounding/finishing operations. On average, gross income was \$55.80/cwt, and total costs were \$81.50/cwt for backgrounding operations. Feed was the highest cost component, accounting for 53.1% of the total costs, followed by capital expenses at 24%. The average operation size was 381 head, with an average of 288 lbs of beef produced per head. Average operator age was 51 years.

For backgrounding/finishing operations, gross income and total costs averaged \$59.75/cwt and \$58.55/cwt, respectively. Feed was the most expensive cost component, accounting for 59% of the total cost, followed by capital expenses, which accounted for 22%. The average operation size was 520 head, with an average of 614 lbs of beef produced per head. Average operator age was 53 years.

Table 2 reports the average revenue, cost, and efficiency characteristics of Kansas backgrounding operations, based on size. Efficiency measures are relative and are based on a comparison to the most efficient operator in the sample. The average sizes were 120 head for a small operation, 272 for a medium operation, and 788 for a large operation. Average gross incomes per cwt were \$55.40 for small operations, \$54.74 for medium, and \$57.17 for large. Average total costs were \$95.51/cwt for small operations, \$81.17/cwt for medium, and \$67.83/cwt for large operations.

Technical efficiency measures whether or not a producer is using the most up-to-date technologies. Consequently, a technically inefficient farm cannot produce as much output with the same levels of input as a technically efficient farm. Overall, backgrounding operations were 71% technically efficient. This means that, on average, output could be increased 29% if the latest technology was being implemented. Large operations had the highest average technical efficiency of 79%. Small and medium operations had measures of 68% and 67%, respectively.

Allocative efficiency measures whether a farm is using the cost-minimizing input mix for a given level of output. Overall, the sample was 68% allocatively efficient. This means that costs could be reduced by 32% if the optimal input mix was used. Small operations had the highest level of allocative efficiency with 76%, followed by large at 68%, and medium at 61%.

Scale efficiency measures whether a farm is producing at the most efficient size. Overall scale efficiency was 83%; costs could be reduced 17% if farms were operating at the most efficient size. Medium-sized operations had the highest scale efficiency with 94%, followed by large and small with 84% and 72%, respectively.

Overall efficiency is a function of technical, allocative, and scale efficiencies and determines the minimum cost of producing a given output level under constant returns to scale technology. At constant returns to scale, there is no cost advantage to becoming larger or smaller. Average overall efficiency was 39%. This means that the same level of output could be produced at 61% less cost if the operation was technically, allocatively, and scale efficient. This would be the optimal point of production, where costs are minimized. Large-sized operations had the highest measure of overall efficiency with 45%, followed by medium and small with 38% and 35%, respectively. This trend is evident by decreasing costs of production in every cost category as size increases (Table 2).

Table 3 reports the average revenue, cost, and efficiency characteristics of Kansas backgrounding/finishing operations. The average sizes were 153 head for a small operation, 445 for a medium operation, and 962 for a large operation. Average gross incomes per cwt for small, medium, and large operations were \$60.12, \$61.30, and \$57.84, respectively. Average costs for small, medium, and large operations were \$67.33, \$53.78, and \$54.39, respectively.

Overall, backgrounding/finishing operations were 84% technically efficient. Large operations had the highest average technical efficiency of 92% followed by small and medium operations at 77% and 83%, respectively. The sample was also 79% allocatively efficient. Again large operations had

the highest level of allocative efficiency with 82%, followed by medium at 80% and small at 76%. Medium-size operations had the highest scale efficiency with 94%, followed by small and large with 93% and 83%, respectively.

Average overall efficiency was 60%. Medium-sized operations had the highest measure of overall efficiency of 63%, followed by large and small with 54% and 62%, respectively.

Given the average levels of technical, allocative, and overall efficiencies, significant room exists for improvement in technology adoption, input usage, and size adjustment. As the structure of the beef industry continues to change, understanding the industry's efficiency, cost, and profitability relationships will become increasingly important.

**Table 1. Overall Average Statistics for Kansas Backgrounding and Backgrounding/Finishing Operations (1995-1997)**

Variables	Unit	Backgrounding	Backgrounding/ Finishing
Gross income/cwt	\$	55.80	59.75
Total cost/cwt	\$	81.50	58.55
Feed cost/cwt	\$	43.28	34.52
Capital cost/cwt	\$	19.86	12.85
Labor cost/cwt	\$	8.22	4.76
Utility cost/cwt		2.22	1.37
Vet cost/cwt	\$	4.59	1.77
Other cost/cwt	\$	3.35	3.21
Age of operator	Years	51	52
Size of operation	Head	381	520

Source: Kansas Farm Management Association.

**Table 2. Average Characteristics of Kansas Backgrounding Operations Based on Size**

Variable	Small	Medium	Large
Revenue Items			
Avg. size (head)	120	272	788
Avg. gross income/cwt	55.49	54.74	57.17
Avg. gain per head (lbs)	259.87	290.02	313.84
Cost Items			
Avg. total cost/ cwt (\$'s)	95.51	81.17	67.83
Avg. labor cost/cwt (\$'s)	11.10	7.80	5.79
Avg. vet cost/cwt (\$'s)	5.57	4.47	3.63
Avg. feed cost/cwt (\$'s)	46.98	45.93	36.93
Avg. utility cost/cwt (\$'s)	2.85	2.06	1.76
Avg. capital cost/cwt (\$'s)	24.86	17.74	17.00
Avg. other cost/cwt (\$'s)	4.15	3.17	2.72
Efficiency Index Measures			
Avg. technical efficiency	.68	.67	.79
Avg. allocative efficiency	.76	.61	.68
Avg. scale efficiency	.72	.94	.84
Avg. overall efficiency	.35	.38	.45

Source: Kansas Farm Management Association.

**Table 3. Average Characteristics of Kansas Backgrounding/Finishing Operations Based on Size**

Variable	Small	Medium	Large
Revenue Items			
Avg. size (head)	153	445	962
Avg. gross income/cwt	60.12	61.30	57.84
Avg. gain per head (lbs)	575.75	623.00	643.06
Cost Items			
Avg. total cost/ cwt (\$'s)	67.33	53.78	54.39
Avg. labor cost/cwt (\$'s)	7.70	4.37	2.25
Avg. vet cost/cwt (\$'s)	1.98	1.64	1.75
Avg. feed cost/cwt (\$'s)	35.82	32.86	34.89
Avg. utility cost/cwt (\$'s)	2.18	1.22	0.70
Avg capital cost/cwt (\$'s)	16.99	11.13	10.45
Avg. other cost/cwt (\$'s)	2.66	2.63	4.35
Efficiency Index Measures			
Avg. technical efficiency	.77	.83	.92
Avg. allocative efficiency	.76	.80	.82
Avg. scale efficiency	.93	.94	.83
Avg. overall efficiency	.54	.63	.62

Source: Kansas Farm Management Association.