Cost Efficiency Estimates for a Sample of Crop and Beef Farms

Michael Langemeier
346 Waters Hall
Department of Agricultural Economics
Kansas State University
Manhattan, Kansas 66506
mlange@agecon.ksu.edu

Rodney Jones
304C Waters Hall
Department of Agricultural Economics
Kansas State University
Manhattan, Kansas 66506
jonesrd@agecon.ksu.edu

Paper presented at the 2005 SAEA Meeting, Little Rock, Arkansas, February 6-9, 2005

Cost Efficiency Estimates for a Sample of Crop and Beef Farms

Abstract

This paper examines the impact of specialization on the cost efficiency of a sample of crop and beef farms in Kansas. The economic total expense ratio was used to measure cost efficiency. The relationship between the economic total expense ratio and specialization was not significant.

Introduction

The percent of income from livestock and the percent of farms with livestock income in Kansas have declined over the last 30 years. Though this decline has occurred for beef, swine, and dairy, the percentage decline is not near as large for beef as it is for swine and dairy. Research that examines the relative efficiency of crop and crop/beef farms would help explore the relative importance of beef production to farm performance.

The objective of this paper was to examine the cost efficiency of jointly producing crops and beef cows. The paper also explores the relationship between cost efficiency and farm size.

Methods

Economies of scope exist when the total cost of producing two enterprises together is less than the total cost of producing the enterprises separately (Baumol, Panzar, and Willig, 1982). This study explores economies of scope associated with producing crop and beef enterprises together. There are three potential sources of economies of scope for crop and beef enterprises. First, a farm may be able to more efficiently utilize labor in winter months if they produce both crop and livestock enterprises. Second, a farm may be able to more effectively utilize machinery and equipment if they produce both crop and livestock enterprises. Third, beef enterprises can often utilize wheat pasture or crop aftermath with little or no loss in crop revenue. The use of these items would lower the total cost of producing both enterprises.

In this study, cost efficiency is examined using the economic total expense ratio. Under perfect competition, the economic total expense ratio would be equivalent to

overall efficiency computed using Data Envelope Analysis (DEA). The economic total expense ratio was computed by dividing economic cost by gross farm income.

The relationship between cost efficiency and specialization is explored using Ordinary Least Squares regression. Specifically, the following relationships are explored:

(1) ETEXPR = f(GFI, HI)

(2) ETEXPR = f(GFI, LIVE)

where ETEXPR is the economic total expense ratio, GFI is gross farm income, HI is the Herfindahl index (Greer, 1984), and LIVE is the percent of gross farm income derived from livestock production. The first equation focuses on the relationship between cost efficiency and whole-farm specialization. The second equation focuses on the relationship between cost efficiency and livestock production specialization.

Due to the importance of economies of size, the relationship between the economic total expense ratio and gross farm income is expected to be negative. The relationship between the economic total expense ratio and the Herfindahl index will be negative if specialization improves cost efficiency. Similarly, if specializing in livestock production improves cost efficiency, the relationship between the economic total expense ratio and the percent of income derived from livestock production will also be negative. Economies of scope would be evident if the relationship between the economic total expense ratio and the Herfindahl index is positive.

Data

Table 1 contains summary information for 720 Kansas Farms. All of the sample farms were members of the Kansas Farm Management Association and had continuous

whole-farm data for the 1999-2003 period. Farms participating in the KFMA program are typed using labor standards. To be included in this study farms had to be typed as dryland crop farms, as irrigated crop farms, as beef cow farms, or as farms with both crops and beef cows.

The economic total expense ratio for each farm was computed using total economic cost and gross farm income information. Economic cost was computed by summing labor costs, purchased input costs, and capital costs. Labor costs included unpaid operator and family labor, and hired labor. Average family living expenses were multiplied by the number of operators on the farm to obtain an opportunity charge for unpaid operator and family labor. Purchased input costs included purchased feed, seed, fertilizer, organization fees, veterinarian expenses, marketing expenses, herbicide and insecticide, and crop insurance. Capital costs included depreciation, repairs, fuel and utilities, machine hire, taxes, general insurance, and an opportunity charge on assets. The opportunity charge on assets included opportunity charges for purchased inputs, current crop and livestock inventories, breeding livestock, machinery and equipment, buildings, and land.

The Herfindahl index was computed to examine the extent to which the 720 farms were diversified or specialized. Using average crop and livestock income information for each farm, the Herfindahl index summed the squares of the percentage of income from crops and beef production. The Herfindahl index for a specific farm depended on the percentage of income derived from each source. For example, a farm with 50% of its income from crops and 50% of its income from beef production would have a Herfindahl

index of 0.50. As specialization into crops or beef production increases, the Herfindahl index approaches 1.00.

The average gross farm income for the sample of farms was $205,400. Approximately one-half of total economic cost was comprised of capital costs. The average economic total expense ratio was 1.2984 indicating that on average the farms were not covering all of their economic costs. Approximately 80% of gross farm income was derived from crop production. The average Herfindahl index was 0.7940. On average, the farms had 56 beef cows. Approximately 60% of the farms had beef cows.

Results

The regression results are reported in table 2. The top half of the table presents the results for equation (1). The bottom half of the table presents the results for equation (2). The coefficients on gross farm income in both equations are negative and significant. This result reveals the importance of economies of size and is consistent with other studies (Hallam, 1993; Purdy, Langemeier, and Featherstone, 1997).

The Herfindahl index and the percent of gross farm income derived from livestock production variables are not significantly different from zero. Thus, the economic total expense ratio is not significantly different for farms that are diversified and farms that are specialized. The results with respect to the Herfindahl index and percent of gross income derived from livestock production are consistent with Purdy, Langemeier, and Featherstone (1997). The results of this study have implications regarding economies of scope. On average, economies of scope involving the joint production of crops and beef cows are not large enough to significantly impact cost efficiency for the sample farms.

Summary

The objective of this paper was to examine the cost efficiency of jointly producing crops and beef cows. Jointly producing these products may improve the utilization of labor and machinery, and could potentially make use of underutilized resources such as wheat pasture and crop aftermath.

Cost efficiency was measured using the economic total expense ratio. Relationships between the economic total expense ratio, and whole-farm and livestock production specialization were explored. A positive relationship between the total expense ratio and whole-farm specialization would indicate the presence of economies of scope. The relationship between the economic total expense ratio and whole-farm specialization was not significant. Thus, on average, there was not a significant advantage associated with producing both crops and beef cows together.

Further research could explore the measurement of economies of scope for individual farms. These scope economies could then be related to farm size and other farm characteristics.

References

Baumol, W.J., J.C. Panzar, and R.D. Willig. *Contestable Markets and the Theory of Industry Structure*. New York: Harcourt, Brace, and Javanovich, 1982.

Greer, D.F. *Industrial Organization and Public Policy*, Second Edition. New York: Macmillan Publishing, 1984.

Hallam, A. "Economies of Size: Theory, Measurement, and Related Issues." In *Size, Structure, and the Changing Face of American Agriculture*, edited by A. Hallam. Boulder: Westview Press, 1993.

Purdy, B.M., M.R. Langemeier, and A.M. Featherstone. "Financial Performance, Risk, and Specialization." *Journal of Agricultural and Applied Economics*. 29(July 1997):149-161.

Table 1. Financial and Production Characteristics of a Sample of 720 Kansas Farms.

Variable	Average	Std. Dev.
Gross Farm Income (GFI)	205,400	157,504
Labor Cost	42,979	20,456
Purchased Input Cost	67,193	56,885
Capital Cost	124,724	83,942
Economic Total Expense Ratio	1.2984	0.5005
Percent of GFI from Crop Production	0.7990	0.2402
Percent of GFI from Livestock Production	0.2010	0.2402
Herfindahl Index	0.7940	0.1927
Number of Beef Cows	56.22	77.70

Table 2. Relationship Between Efficiency, Gross Farm Income, and Specialization.

Variable	Parameter Estimate	t-value	Significance Level
Efficiency and Herfindahl Index			
Intercept	1.5778	21.34	< 0.0001
Gross Farm Income	-1.28E-06	-11.72	< 0.0001
Herfindahl Index	-0.0207	-0.23	0.8166
R-Square	0.1631		
Efficiency and Livestock Production			
Intercept	1.5363	46.31	< 0.0001
Gross Farm Income	-1.26E-06	-11.50	< 0.0001
Percent of GFI from Livestock Production	0.1040	1.45	0.1482
R-Square	0.1655		