Productivity of KFMA Members between 1993 and 2011[1]

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Introduction

Productivity measures the ability of producers to convert inputs into outputs. Productivity growth occurs when more output can be produced with the same level of inputs, the same output can be produced using less inputs, or a combination of the two. In general, productivity growth is linked to competitiveness, economic growth and improved welfare. In particular, in a context of rapid global population growth and economic expansion, coupled with increased environmental concerns and an increasingly more limited ability to incorporate more acres into agricultural production; agricultural productivity growth is one of the most important factors that will determine food availability and the global ability to fight hunger among other issues. Productivity is closely linked to farm profitability, which at the regional level has significant economic development implications. Productivity and efficiency are closely related because improvements in efficiency result, necessarily, in improvements in productivity. However, productivity may also improve “inefficiently'' due to technical progress.

The study conducted by Quintana-Ashwell and Featherstone measures productivity growth among KFMA members between the years 1993 and 2011 and analyzes to what extent the changes in productivity are due to improvements in (operation) efficiency or due to technical progress.

Data and Methods

The study employs anonymous KFMA data from 1993 to 2011 on crop and livestock production and use of labor input, crop and livestock input, fuel, and other inputs to construct a “production frontier” which indicates the maximum level of output observable at every level of input use. Operations that lie on the frontier are said to be “efficient” while operations “below’’ the frontier are

[1] Highlights prepared from research paper: Quintana-Ashwell, Nicolas E., and Allen M. Featherstone. "Beyond benchmarks: DEA study of Kansas Farm Productivity." 2015 Annual Meeting, January 31-February 3, 2015, Atlanta, Georgia. No. 196857. Southern Agricultural Economics Association, 2014.

said to be "inefficient." The degree of inefficiency is measured, in their approach, by the horizontal distance (input orientation) of each operation to the frontier. Figure 1 offers a simple representation of the method when farms use only one input and one output. Farms A, B, C, D, and E are efficient when variable returns to scale technology (VRS) is allowed, but only farm C is efficient when constant returns to scale (CRS) technology is allowed. Points P, N, and B are for reference only. Farm M is inefficient in

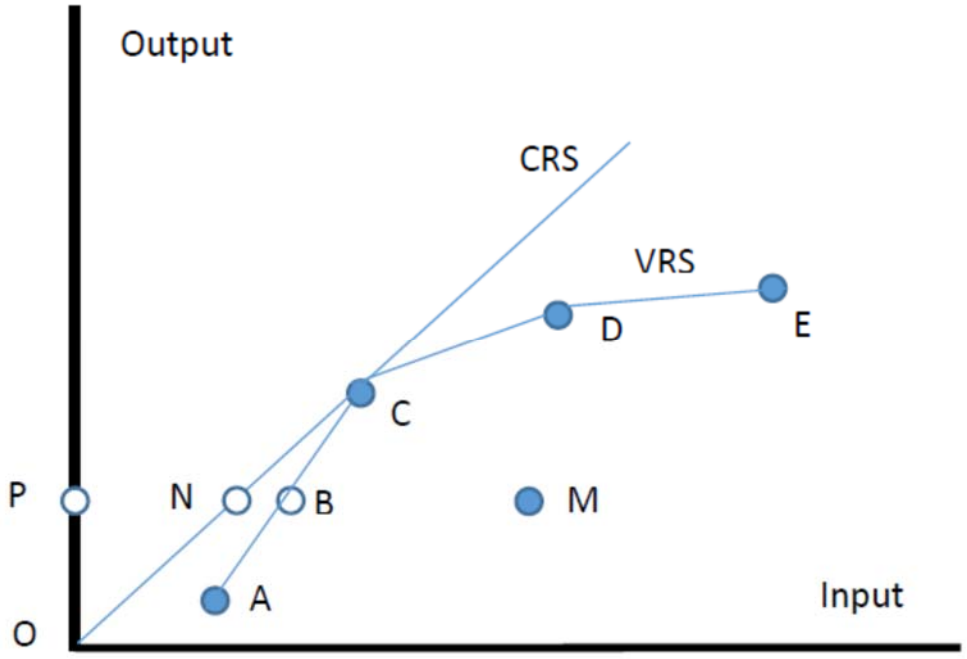

Figure 1. Input Oriented Data Envelopment Analysis for efficiency studies.

any case and the degree of inefficiency is the –relative- distance from M to B in VRS and from M to N in CRS; conversely their efficiency score λ is the inverse of the relative distance: $\lambda_{CRS} = \frac{\overline{PN}}{\overline{PM}}$ and $\lambda_{VRS}\frac{\overline{PB}}{\overline{PM}}$.

The efficiency scores obtained comparing output, input use, and technology in different periods allow to calculate "Malmquist productivity indices", MPI, which can be decomposed into the efficiency change and technical change. A productivity index greater than one indicates productivity improvement while an index of less than one indicates productivity retrocession. Table 1 presents summary statistics of select data and results.

The average productivity improvement from year to year was 7 percent with a greater variation over the years than between farmers. The growth in productivity was driven by technical progress (4

percent), efficiency improvements (2.7 percent), and scale efficiency improvements, i.e. right sizing, (1 percent). The advances in technology were biased towards producing greater output (3.5 percent improvement) rather than reducing input use (0.04 percent deterioration).

Table 1. Descriptive Statistics of Data and Productivity. Note:* rounded to nearest thousand.

	AVERAGE	STANDARD DEVIATION	SD BETWEEN FARMERS	SD ACROSS TIME
CROP INCOME*	$232	256	199	156
LIVESTOCK INC.*	$66	123	106	64
LABOR COST*	$51	32	26	17
CROP COST*	$77	90	67	59
FUEL COST*	$20	20	15	13
LIVESTOCK COST*	$25	65	52	40
OTHER COSTS*	164	129	105	75
MALMQUIST PRODUCTIVITY INDEX	1.07	0.424	0.071	0.418
TECH. PROGRESS	1.04	0.264	0.033	0.262
INPUT BIAS	0.996	0.287	0.071	0.278
OUTPUT BIAS	1.034	0.294	0.064	0.287
PURE EFFICIENCY CHANGE	1.027	0.234	0.024	0.232
SCALE EFFICIENCY CHANGE	1.01	0.168	0.025	0.166

An econometric analysis that took into consideration farmer-specific effects and year-specific effects indicates that productivity is negatively affected by output prices and positively affected by input prices. This indicates that farmers may be over-exerting or slightly wasting their resources when they try to take advantage of strong positive market signals, while they tend to make better uses of their inputs when significant input price increases are observed. A significant negative effect on

previous year productivity improvement was found, indicating that when an operation achieves a significant productivity gain on a given year, it is likely that it will "ride on it" the next year as opposed to continue and deepen the productivity-gaining process. For details and an accessible descriptions of the technical aspects of the study, see http://ageconsearch.umn.edu/bitstream/196857/2/QuintanaFeatherstoneDEAProd.pdf.