

Factors Impacting Farm Growth
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Introduction

Farm growth is impacted by internal and external factors. Internal factors include farm size, operator age, cost efficiency, technology adoption, crop intensity, land tenure, nonfarm income, and financial structure. External factors include input and output price changes, and changes in crop insurance and government program provisions.

Using KFMA data this paper examines internal factors impacting farm growth. Specifically, the growth rate of total acres is related to farm size, nonfarm income, percent acres owned, operator age, cost efficiency, technology adoption, crop intensity, and financial structure.

Methods

Factors impacting farm growth were compared for farms across farm growth rate quartiles. The first quartile represents farms with the lowest growth rate in total acres. The fourth quartile represents farms with the highest growth rate in total acres. Correlation coefficients were also computed to examine the statistical relationship between each factor and the growth rate in total acres. Correlation coefficients range from -1 to 1. As a correlation coefficient increases in absolute value, the significance of the relationship between the two variables increases. A negative correlation coefficient indicates that there is an inverse relationship between two variables. Definitions for the variables used in this study can be found below.

Farm size was measured using value of farm production and total acres. Cost efficiency was measured using the adjusted total expense ratio and a labor efficiency index. The adjusted total expense ratio was computed by dividing total expenses plus unpaid family and operator labor by value of farm production. Total expenses included cash costs, accrual adjustments to costs, and depreciation. If a farm is covering total expenses and unpaid labor, the adjusted total expense ratio will be less than one. Labor efficiency is computed by dividing total paid and unpaid labor cost by value of farm production. A lower index of labor efficiency would be preferred to a higher index of labor efficiency. Financial structure was measured using the inverted current ratio and the debt to asset ratio. Because current liabilities for some farms were zero, the inverted current ratio was used to examine the statistical relationship between the growth rate in total acres and liquidity. Data were available to compute the average current ratio for each quartile. Technology adoption was examined using the less tillage index which was computed by dividing herbicide and insecticide cost by crop machinery cost. Crop machinery cost included repairs, gas, fuel, oil, machine hire and lease, economic depreciation, and an opportunity charge on machinery and equipment investment. Crop intensity was measured by dividing harvested crop acres by planted crop acres.

The factors impacting farm growth, along with the growth rate in total acres, were also compared across farm size categories. The first category represented farms with less than \$100,000 in value of farm production. The second category represented farms with value of farm production between \$100,000 and \$250,000. The third category represented farms with value of farm production between \$250,000 and \$500,000. The fourth category represented farms with a value of farm production greater than \$500,000.

Farm size categories were developed using the ten-year average of value of farm production for each farm. Correlation coefficients were used to examine relationship between each factor and value of farm production.

Kansas Farm Management Association Data

Data for 719 farms in the Kansas Farm Management Association (KFMA) with continuous data from 1996 to 2005 were used in this study. These 719 farms represent approximately 47% of the farms with whole-farm analysis data in 2005. To be included in this study, a farm had to have usable income, expense, and balance sheet data, and had to utilize over 50% of their labor on crops over the 10-year period. Income and expense were expressed on an accrual basis. Value of farm production included crop income, livestock income, income from government payments and crop insurance proceeds, and miscellaneous income sources such as patronage dividends and custom work income. Livestock income was expressed on a value-added basis. Specifically, accrual livestock purchases were subtracted from accrual livestock sales to arrive at accrual livestock income.

Table 1 presents the summary statistics for the 719 farms. Value of farm production averaged \$225,707. Nonfarm income averaged \$10,719. Average total acres were 1,760 and the average annual growth rate in total acres was 2.87%. Approximately 32% of the total acres were owned and approximately 84% of the labor was devoted to crop production. The average operator age was 54 years. The average adjusted expense ratio was 0.95 so the farms were on average covering total expense as well as unpaid family and operator labor. On average, approximately 20% of value of farm production

was used to cover paid and unpaid labor cost. The average crop intensity index was 0.94. The average current ratio was 2.07 and the average debt to asset ratio was 0.29.

Farm Growth Rate Results

Table 2 contains the summary statistics for the four farm growth quartiles. The correlation coefficient between farm growth and each factor is presented in Table 3. The comparisons below will focus on the comparisons between the first and fourth quartiles, and comparisons for factors with significant correlation coefficients. The first quartile is represented by farms with the lowest growth rate in total acres. The fourth quartile is represented by farms with the highest growth rate in total acres.

Farms in the first quartile had an average annual growth rate in total acres of -3.20%. In contrast, farms in the fourth quartile had an average annual growth rate of 11.27%. Approximately 31% of the farms had a negative growth rate in total acres indicating that these farms actually became smaller over time.

Value of farm production, nonfarm income, total acres, and the debt to asset ratio were significant and positively correlated with farm growth rates. Percent acres owned, operator age, the adjusted total expense ratio, and the labor efficiency index were significant and negatively correlated with farm growth rates. Farms in the fourth quartile, or that were growing at the highest annual rates, were younger, had larger operations, received more income off the farm, owned a lower percent of their acres, had a lower adjusted total expense ratio, used less of their value of farm production to cover labor expense, and had a higher debt to asset ratio compared to farms in the first quartile.

The difference between the average operator age in the first and fourth quartile was 12 years. The farms in the fourth quartile owned 27% of their land. In contrast, the

farms in the first quartile owned 38% of their acres. The results with respect to operator age and percent acres owned were as expected. Unless an heir is going to take over the operation, as a farmer becomes older, he or she will eventually downsize their operation and focus more of their effort on ground that is owned.

The farms in the fourth quartile operated 338 more acres and had an average value of farm production that was approximately \$64,000 higher than that of farms in the first quartile. The adjusted total expense ratios for all four farm growth quartiles were less than one indicating that on average the farms in each quartile were covering operating and unpaid labor cost. However, the relatively higher ratio for the first quartile indicates that this group did not have as much money remaining to cover opportunity charges on capital, which are not included in the computation of the ratio. Labor efficiency was also relatively more problematic for farms in the first quartile.

As expected, the farms that were growing faster had a higher debt to asset ratio. In most instances, it takes both debt and equity capital for a farm to grow at a relatively rapid rate. Liquidity, on the other hand, was not significantly correlated with farm growth rates.

Farm Size Results

Table 4 summarizes the factors impacting the farm growth rate along with the growth rate in total acres by farm size category. The correlation coefficient between value of farm production and each factor is presented in Table 5. Total acres, the growth rate in total acres, the less tillage index, the crop intensity index, and the debt to asset ratio were positively correlated with farm size. Nonfarm income, percent acres owned, operator age, the adjusted total expense ratio, and labor cost as a percent of value of farm

production were negatively correlated with farm size. The relatively large correlation coefficients, in terms of absolute value, for the adjusted total expense ratio and the labor efficiency index illustrate the ability of large farms to control cost. The adjusted total expense ratio for the farms with less than \$100,000 in value of farm production was 1.25. In contrast, the adjusted total expense ratio for farms with more than \$500,000 in value of farm production was 0.87. Farms in the smallest farm size category were covering total expense, but were not covering unpaid family and operator labor. Though not illustrated or examined in this paper, farms in the largest farm size category typically cover total expense, unpaid family and operator labor, and opportunity charges on capital.

Summary and Conclusions

This paper documented farm growth rates for a sample of farms and examined internal factors impacting farm growth. Growth rates were measured using total acres. On average, the sample of KFMA farms grew at annual rate of 2.87%. Farms in the lowest farm growth quartile had a growth rate of -3.20% while farms in the highest farm growth quartile had a growth rate of 11.27%. Farms with less than \$100,000 in value of farm production grew at an annual rate of 1.79%. In contrast, farms with more than \$500,000 in value of farm production grew at an annual rate of 3.82%.

Farm size, nonfarm income, and the debt to asset ratio were significant and positively correlated with farm growth rates. Percent acres owned, operator age, the adjusted total expense ratio, and labor costs as a percent of value of farm production were significant and negatively correlated with farm growth rates.

Table 1. Summary Statistics for 719 KFMA Farms with Continuous Data from 1996-2005.

Item	Average
Value of Farm Production	\$225,707
Total Expenses	\$177,899
Unpaid Operator and Family Labor	\$36,583
Nonfarm Income	\$10,719
Total Acres	1,760
Growth Rate in Total Acres	2.87%
Percent Acres Owned	31.57%
Crop Labor Percentage	83.91%
Age of Operator	53.95
Adjusted Total Expense Ratio	0.9503
Labor Efficiency	0.1973
Less Tillage Index	0.2485
Crop Intensity Index	0.9439
Current Ratio	2.07
Debt to Asset Ratio	0.2871
Percent of Farms from Eastern Kansas	46.04%
Percent of Farms from Central Kansas	39.78%
Percent of Farms from Western Kansas	14.19%

Source: Kansas Farm Management Association 2005 Databank.

Table 2. Summary Statistics for Growth Rate Categories.^a

Item	Growth Rate Category			
	First	Second	Third	Fourth
Value of Farm Production	\$175,155	\$224,620	\$264,337	\$238,788
Total Expenses	\$140,132	\$174,076	\$207,802	\$189,651
Unpaid Operator and Family Labor	\$33,633	\$38,505	\$38,435	\$35,752
Nonfarm Income	\$9,684	\$10,395	\$10,338	\$12,470
Total Acres	1,459	1,745	2,039	1,797
Growth Rate in Total Acres	-3.20%	0.54%	2.91%	11.27%
Percent Acres Owned	38.23%	30.32%	32.12%	26.73%
Age of Operator	60.40	54.09	52.54	48.73
Adjusted Total Expense Ratio	0.9921	0.9464	0.9315	0.9439
Labor Efficiency	0.2282	0.2054	0.1820	0.1840
Less Tillage Index	0.2521	0.2479	0.2582	0.2358
Crop Intensity Index	0.9053	0.9495	0.9580	0.9542
Current Ratio	2.19	2.60	2.07	1.64
Debt to Asset Ratio	0.2546	0.2428	0.2937	0.3622
Percent of Farms from Eastern Kansas	49.44%	48.33%	45.56%	40.78%
Percent of Farms from Central Kansas	37.22%	41.67%	40.56%	39.66%
Percent of Farms from Western Kansas	13.33%	10.00%	13.89%	19.55%

^a Farm categories represent growth rate quartiles. The first quartile is represented by farms with the lowest growth rate in total acres. The fourth quartile is represented by farms with the highest growth rate.

Table 3. Correlation Coefficients Between Growth Rate in Total Acres and Farm Characteristics.

Item	Correlation Coefficient
Value of Farm Production	0.0687*
Nonfarm Income	0.0555*
Total Acres	0.0419*
Percent Acres Owned	-0.0851*
Age of Operator	-0.3239*
Adjusted Total Expense Ratio	-0.0339*
Labor Efficiency	-0.0488*
Less Tillage Index	0.0167
Crop Intensity Index	0.0196
Inverted Current Ratio	0.0033
Debt to Asset Ratio	0.0976*
Percent of Farms from Eastern Kansas	-0.0253
Percent of Farms from Central Kansas	-0.0313*
Percent of Farms from Western Kansas	0.0801*

Note: An asterisk indicates that the correlation coefficient was statistically significant at the 1% level.

Table 4. Summary Statistics for Farm Size Categories.^a

Item	Farm Size Category			
	First	Second	Third	Fourth
Number of Farms	159	331	186	43
Value of Farm Production	\$68,940	\$170,328	\$344,402	\$718,241
Total Expenses	\$57,551	\$132,974	\$269,893	\$570,801
Unpaid Operator and Family Labor	\$28,770	\$35,191	\$41,073	\$56,759
Nonfarm Income	\$15,806	\$11,000	\$7,420	\$4,018
Total Acres	792	1,603	2,418	3,702
Growth Rate in Total Acres	1.79%	2.98%	3.37%	3.82%
Percent Acres Owned	46.33%	31.13%	28.02%	31.42%
Age of Operator	59.21	52.73	51.58	54.11
Adjusted Total Expense Ratio	1.2521	0.9873	0.9029	0.8737
Labor Efficiency	0.4319	0.2291	0.1576	0.1384
Less Tillage Index	0.1681	0.2295	0.2707	0.2769
Crop Intensity Index	0.9069	0.9056	0.9738	1.0013
Current Ratio	3.01	2.00	2.14	1.81
Debt to Asset Ratio	0.1856	0.2852	0.3013	0.3336
Percent of Farms from Eastern Kansas	52.20%	40.48%	48.39%	55.81%
Percent of Farms from Central Kansas	38.99%	44.11%	34.95%	30.23%
Percent of Farms from Western Kansas	8.81%	15.41%	16.67%	13.95%

^a Farm size categories are defined as follows: first = farms with less than \$100,000 in value of farm production; second = farms with value of farm production between \$100,000 and \$250,000; third = farms with value of farm production between \$250,000 and \$500,000; and fourth = farms with value of farm production above \$500,000.

Table 5. Correlation Coefficients Between Farm Size and Farm Characteristics.

Item	Correlation Coefficient
Nonfarm Income	-0.1988*
Total Acres	0.6839*
Growth Rate in Total Acres	0.0687*
Percent Acres Owned	-0.1389*
Age of Operator	-0.1450*
Adjusted Total Expense Ratio	-0.4707*
Labor Efficiency	-0.5467*
Less Tillage Index	0.2110*
Crop Intensity Index	0.1503*
Inverted Current Ratio	-0.0273
Debt to Asset Ratio	0.0876*
Percent of Farms from Eastern Kansas	0.0566*
Percent of Farms from Central Kansas	-0.0758*
Percent of Farms from Western Kansas	0.0255

Note: An asterisk indicates that the correlation coefficient was statistically significant at the 1% level.