Factors Impacting Farm Growth

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Abstract

This paper examined the relative importance of farm size, farm type, managerial ability, capital structure, operator age, family size, and off-farm income in explaining farm growth rates. Farm type, managerial ability, and operator age were significantly related to farm growth rates.

Introduction

Farm structure in the United States has been changing for decades. The number of farms has been declining and the average farm size has been increasing. Given the structural change that has been occurring, it is natural to ask whether farms are growing at different rates, and to explore the factors related to the differential rates in farm growth.

Numerous factors can be used to explore firm or farm growth. These factors can be categorized into two broad categories: external factors and internal factors. Firms have more control over internal factors. Examples of external factors include weather, input and output prices, farm policies, national economic growth, and off-farm job opportunities. Internal factors include farm size, farm type, managerial ability, farm organization, capital structure, and technology adoption.

As noted in the next section, several previous studies have examined the relationship between farm growth rates, and internal and external factors. This study adds to the literature in two ways. First, many of the previous studies are quite dated. The relationship between farm growth rates, and internal and external factors using recent data may differ from the relationships examined using older data. Second, most of the previous research has focused on farms that are fairly homogeneous in terms of the enterprises engaged in. This study examines growth rates for a relatively diverse set of farms. Some of the sample farms specialize in crop production while others specialize in livestock. Many of the farms have both crop and livestock enterprises. By examining this diverse set of farms, the relative growth rates of crop and livestock farms can be computed and compared.

The objective of this paper was to examine the relative importance of farm size, farm type, managerial ability, capital structure, operator age, family size, and off-farm income in explaining farm growth rates. Farm growth rates were computed using nominal total farm assets.

Methods

Regressions were used to explore the relationship between the growth rate of total farm assets on individual farms and several independent variables discussed below. Two separate regressions were used. The first regression used the mathematical growth rate of total farm assets as the dependent variable. The second regression used the geometric growth rate of total farm assets as the dependent variable.

Independent variables used in this study included total farm assets, percent of income derived from crop production, managerial ability, capital structure, operator age, family size, and off-farm income. The expected sign for each of these independent variables is discussed below.

Total farm assets was used as a measure of farm size. Shapiro, Bollman, and Ehrensaft (1987), Upton and Haworth (1987), and Weiss (1999) used farm size to explore differences in growth rates among farms. Upton and Haworth (1987) found farm growth rates to be independent of farm size. For the farms studied by Shapiro, Bollman, and Ehrensaft (1987) and Weiss (1999), small farms grew faster than large farms. If small farms are found to grow faster than larger farms in this study, the regression coefficient on total farm assets will be negative. If larger farms are found to grow relatively faster, the regression coefficient will be positive.

Percent of income derived from crop production is used to examine the importance of farm type in explaining farm growth rates. The regression coefficient on this variable will be positive if crop farms grew relatively faster than livestock farms over the study period. If livestock farms have grown relatively faster than crop farms, the regression coefficient on this variable will be negative.

The positive relationship between farm performance and managerial ability is the main impetus for including managerial ability in farm growth studies. Studies that have examined the relationship between farm growth rates and managerial ability include Patrick and Eisgruber (1969), Eginton (1980), Summer and Lieby (1987), Upton and Haworth (1987), and Weiss (1999). Managerial ability was measured using the economic total expense ratio in this study. Farms with higher levels of managerial ability are expected to grow faster so the relationship between farm growth rates and the economic total expense ratio is expected to be negative.

Empirical studies that have examined the relationship between farm growth and capital structure include Patrick and Eisgruber (1969), Weiss (1999), and Escalante and Barry (2002). Farm growth rates have been found to be impacted by capital structure. The debt to asset ratio and the inverted current ratio are used to explore the relationship between farm growth rates and capital structure in this study. A high debt to asset ratio and/or lack of liquidity can potentially constrain growth. Thus, the expected relationship between farm growth and the debt to asset ratio is negative. Similarly, the expected relationship between farm growth and the inverted current is also expected to be negative.

Farm and family characteristics that have been used to examine farm growth include firm and operator age, family size, off-farm employment, educational levels, and

risk attitudes. Information on operator age, family size, and off-farm income was available in this study.

Empirical results reported by Weiss (1999) suggest that farm growth increases until the operator is in his or her mid-thirties and then declines. Because the relationship between farm growth and operator age has been found to be non-linear in previous studies, both operator age and operator age squared are included in the farm growth regressions used in this study. Using the regression coefficients on age and age squared, farm growth rates will be compared for farms operated by farmers of various ages.

A negative relationship between farm growth and family size is expected. Farms with more family members may have higher family living expenses and less money available for farm growth.

Upton and Haworth (1987) and Weiss (1999) found a significant relationship between farm growth and off-farm income. The relationship between farm growth and off-farm income is expected to be positive. Farms with higher levels of off-farm income would have relatively more money available for farm growth.

Data

Whole-farm data for 353 farms in Kansas for the 1983-2002 period were used in this paper. All of the sample farms were members of the Kansas Farm Management Association and had continuous data for the entire 20-year period. Summary information for the dependent and independent variables are presented in table 1. To obtain the information in table 1, 20-year averages of all of the variables were first computed for each farm. These 20-year averages were then used to compute the sample average and standard deviation for each variable presented in table 1.

The average growth rate in total farm assets was 2.08% using the geometric average and 3.01% using the mathematical average. The geometric average relies heavily on the level of assets in the first and last year of the sample. The mathematical average is not as dependent on these values. Using the mathematical growth rate, approximately 20% of the farms had a negative growth rate in total farm assets. Using the geometric growth rate, approximately 24% of the farms had a negative growth rate indicating that 24% of the farms actually had fewer assets in 2002 than they did in 1983.

On average, total farm assets for the sample farms was $660,590. The sample farms received approximately 64% of their gross farm income from crops. The sample farms were more heavily concentrated in eastern Kansas than in central and western Kansas.

The economic total expense ratio for each farm was computed by dividing total economic cost by value of farm production. Total economic cost was computed by summing cash costs, depreciation, an opportunity charge on unpaid labor, and an opportunity charge on assets. Unpaid labor included operator and family labor. The opportunity charge on assets included opportunity charges for purchased inputs, current crop and livestock inventories, breeding livestock, machinery and equipment, buildings, and land. As indicated by the economic total expense ratio of 1.16 in table 1, the farms on average were not covering all of their economic costs.

Results

Table 2 contains the regression results. The discussion of the results below will focus on the variables that were significant in both regressions.

Total farm assets was not significantly related to the geometric growth rate or the mathematical growth rate in total farm assets. Thus, farm growth rates for the sample of farms were independent of farm size.

The percent of income from crops was significant and positively related to the growth rates of total farm assets. Thus, crop farms grew at relatively faster rate than livestock farms over the study period. Using the mathematical growth rate regression, a one standard deviation increase in the percent of income from crops, holding the other independent variables constant, would result in an increase in the predicted growth rate of 0.7%.

Managerial ability, measured using the economic total expense ratio, was significant and negatively related to the growth rates in total farm assets indicating that farms with a lower economic total expense ratio had significantly higher growth rates. Using the mathematical growth rate regression, a one standard deviation increase in the economic total expense ratio would lower the predicted growth rate by 1.0%.

As expected, the relationship between farm growth rates and operator age was non-linear. Operator age was significant and negatively related to farm growth rates and operator age squared was significant and positively related to farm growth rates. Using the mathematical growth rate regression, the predicted growth rates for farms operated by farmers that were 34 years old and 70 years old were 7.8% and 2.8%, respectively. It is interesting to note that the predicted farm growth rates were positive even for the older operators. Though specific information on farm succession is not available, the results with respect to operator age in this study suggest that the older operators in the sample of

farms studied may be passing their farm over to younger family members to farm rather than retiring and selling their assets.

Summary

The objective of this study was to examine the impact of farm size, farm type, managerial ability, capital structure, operator age, family size, and off-farm income on farm growth rates. Farms with a higher percent of gross farm income derived from crops, with a lower economic total expense ratio, and with a younger operator grew at a relatively faster rate.

Two of the primary results of this study warrant further discussion. First, a positive relationship between farm growth rates and percent of gross farm income derived from crops was found. This implies that the farms specializing in crop production grew at a faster rate than the farms specializing in livestock production. Consolidation in the dairy and swine industries may partially explain this result. Farms that have dropped dairy or swine enterprises have had to increase their crop acres just to maintain their farm size. Farms with dairy and swine enterprises may have also sought off-farm employment to make up for the lost income associated with dropping these enterprises. Procuring off-farm employment may have made it difficult to augment their farm size. Second, farm growth rates were found to be independent of farm size. Much of the previous literature has found the growth rate of smaller farms to be relatively higher than the growth rate of larger farms. The relationship between farm growth rates and farm size certainly merits further study.

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Table 1. Summary Statistics for the Dependent and Independent Variables.

Variable	Average	Standard Deviation
Mathematical Growth Rate in Total Farm Assets	3.01%	4.48%
Geometric Growth Rate in Total Farm Assets	2.08%	3.37%
Total Farm Assets	660,590	466,246
Percent of Gross Income from Crops	0.636	0.261
Economic Total Expense Ratio	1.16	0.22
Debt to Asset Ratio	0.31	0.24
Inverted Current Ratio	0.70	1.17
Age of Operator	52	9
Number of Family Members	3.1	1.1
Off-Farm Income	7,899	10,226
Northeast Region	0.227	
Southeast Region	0.317	
North Central Region	0.136	
South Central Region	0.181	
Northwest Region	0.057	
Southwest Region	0.082	

Table 2. Regression Coefficients for Growth in Total Farm Asset Regressions.

Variable	Mathematical Growth Rate	Geometric Growth Rate
Intercept	0.25199**	0.31065**
Total Farm Assets	5.03E-09	3.05E-09
Percent of Gross Income from Crops	0.01170**	0.02940*
Economic Total Expense Ratio	-0.03510**	-0.04400**
Debt to Asset Ratio	-0.02190	0.00104*
Inverted Current Ratio	-0.00356	-0.00292*
Age of Operator	-0.00659**	-0.00846**
Age of Operator Squared	0.00005**	0.00007**
Number of Family Members	0.00146	0.00319
Off-Farm Income	2.14E-07	-1.58E-07
Northeast Region	0.00027	-0.01010
North Central Region	-0.00173	-0.00685
South Central Region	0.00738	0.00203
Northwest Region	-0.02520**	-0.02760**
Southwest Region	-0.01834**	-0.02628**
Adjusted R-Square	0.246	0.223

Note: A single asterisk indicates significance at the 5% level. Two asterisks indicate significance at the 1% level.