2013

Farm Financial Performance of Kentucky Farms

Tarrah M. Dunaway
tarrah.dunaway1@uky.edu

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Tarrah M. Dunaway, Student

Dr. Ani Katchova, Major Professor

Dr. Mike Reed, Director of Graduate Studies

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Tarrah M. Dunaway and Tarrah Dunaway, Student

Dr. Ani Katchova, Major Professor

Dr. Mike Reed, Director of Graduate Studies

FARM FINANCIAL PERFORMANCE OF KENTUCKY FARMS

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Agriculture
at the University of Kentucky

BY

Tarrah Michelle Dunaway
Lexington, Kentucky
Director: Dr. Ani Katchova
Lexington, Kentucky
2013

ABSTRACT OF THESIS

FARM FINANCIAL PERFORMANCE OF KENTUCKY FARMS

This study examines farm financial performance of Kentucky farms using Kentucky Farm Business Management data from 1998-2010. Logit models are used to estimate the likelihood of farm characteristics affecting whether financial ratios fall into critical zones or not. The results show that large farms in terms of total gross returns and total assets are less likely to experience repayment capacity problems. Total gross returns significantly affect all five financial measures. These findings will help farmers and lenders understand what factors influence farm financial performance. Profitability migration is tested to see if the migration probabilities differ across business cycles. Migration drift is also tested to determine if the Markov property of independence is violated. Results show substantial retention in return on equity (ROE) performance over time, and a tendency for trend-reversal if ROE changes occur. Results are compared to previous literature using ARMS data and Illinois FBFM.

KEYWORDS: Financial performance, Financial stress, Profitability migration,
Business cycle, Path dependence

Tarrah Dunaway

June 28, 2013

FARM FINANCIAL PERFORMANCE OF KENTUCKY FARMS

By

Tarrah Michelle Dunaway

Ani Katchova
Director of Thesis

Mike Reed
Director of Graduate Studies

June 28, 2013

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CHAPTER ONE: FINANCIAL PERFORMANCE OF KENTUCKY FARMS

Summary

This study examines financial performance and factors affecting the likelihood that Kentucky farmers will experience financial stress. Factors hypothesized to affect financial performance are soil rating, tenure, gross farm returns, operating acres, non-farm income, government payments, farm type, assets and recession years. Data from the Kentucky Farm Business Management (KFBM) program and logit models are used to determine if certain factors affect whether farmers fall within the critical zone for five financial ratios. Results indicate that gross returns have significant effects for all the ratios. Results are compared with previous studies using the Agricultural Resource Management Survey (ARMS) data. Overall, it appears that Kentucky farmers are just as profitable and hold more liabilities when compared to farmers across the United States. Findings will help farmers understand what influences financial performance and will be able to make better management decisions.

Introduction

With an uncertain economy, understanding financial performance indicators is essential. Financial performance of an industry or a single company can help predict if the firm is in financial stress and help decide how the management team needs to conduct business. Not only can the indicators tell owners and shareholders useful information but they can let lenders know if they should lend firms money. Financial ratios have been studied intensely across many sectors to identify rate of bankruptcies along with other general information about financial performance.

The agriculture industry is no different, especially farm businesses. Different studies have looked at financial ratios to determine profitability of adapting different technologies, financial stress, and credit risk. However, there are limited studies that focus on determining financial stress from various financial ratios. Katchova (2010) and Ahrendsen and Katchova (2012) both use Agricultural Research Management Survey (ARMS) data to examine the likelihood of farmers falling into critical zones for different financial characteristics (liquidity, solvency, profitability, repayment capacity and financial efficiency).

The main goal of this study is to determine which factors affect financial stress as indicated by financial ratios for farmers. Even though there is much interest in researching the performance of farm businesses, lenders mainly are concerned when one of the financial measurements exceeds a critical value signaling financial stress. Thus, this study focuses on financial performance in term of predicting the likelihood of financial stress.

The information obtained by Kentucky Farm Business Management (KFBM) allows financial ratios to be calculated to determine the percentage of farmers that fall within the critical zone of five financial performance characteristics. Logit models will be used to determine what variables are likely to influence financial performance. Using a binary dependent variable, it allows for the likelihood of a farmer to experience financial stress to be determined. By classifying the financial ratios into critical/acceptable zones it is consistent with past literature and the Farm Financial Standards Council (FFSC) recommended guidelines. Factors thought to influence farm financial performance that will be examined in this study are: soil rating, tenure, gross farm returns, operating acres, non-farm income, government payments, crop farm, assets and recession years. Another goal is to compare KFBM farmers to farmers across the US using available ARMS data provided by previous literature. Results will provide agricultural lenders, managers and farmers information about factors affecting the likelihood of experiencing financial stress, while gaining a better understanding of financial performance in the agricultural industry.

Literature Review

As previously stated, financial ratio studies have been completed on various industries and topics. One example of a study done outside of the agriculture industry is Ohlson (1980) who examined predicting corporate failure by using financial ratios and the logistic model. He pointed out that the results and model are only as good as the creditability of the financial data being collected and used. Certified balance sheets and income statements provided by KFBM will be used to overcome this issue.

Researchers have spent a considerable amount of time analyzing how financial ratios can help predict financial performance for agribusinesses. Parliament, Lerman and Fulton (1990) explored financial performance of cooperative and investor-owned dairies. To analyze the two dairy sectors they used five financial measurements represented by five financial ratios: profitably (ROE), leverage (debt to equity), solvency (coverage ratio), liquidity (quick ratio) and efficiency (asset turnover). Their study found that performance of cooperative dairies was significantly better than investor-owned dairies. Zech and Pederson (2002) examined performance and repayment ability using a risk-rating model by using the net worth growth and term debt coverage ratios.

Some researchers have specifically looked at young and beginning farmers and how their performance differs from all farmers. Katchova (2010) and Ahrendsen and Katchova (2012) used data from ARMS when examining whether or not farmers fall into critical zones for different financial measurements. However, Katchova (2010) used probit models to examine different groups of farmers (all, beginning and retired farmers) and the likelihood of those farmers falling into critical zones based on a set of factors thought to influence financial ratios. Katchova (2010) found that there are important differences between beginning and retired farmers when it comes to financial characteristics influencing the likelihood of falling into the critical zones. If beginning farmers improve their financial management, it could improve both liquidity and solvency, which might lead to a better overall financial performance. The main concepts of these two studies will be utilized and results will be compared to Ahrendsen and Katchova (2012).

Ohlson (1980) and D'Antoni, Mishra, and Chintawar (2009) both used the logit model along with ARMS data to determine the marginal effects of various factors effecting financial stress for young and beginning farmers. However, D'Antoni, Mishra, and Chintawar (2009) did not look at financial measurements. Their study focused on farms that were in what the Economic Research Service (ERS) considers a “favorable financial position”. They found that farmer’s age, size of operation, ownership, year(s) of operation and farm type were all determinants of financial stress. Farm type, whether or not the farm is considered to be a grain farm, and the logit model will be adapted in this study from the literature above.

Data

Farm-level data is from the Kentucky Farm Business Management (KFBM) Program, an organization that assists farmers in financial recordkeeping, tax preparation, setting and achieving business goals and making management decisions (KFBM website). Farms must have annually certified balance sheets and income statements along with having family living certification in order to be included in this study. The certifications are determined by the specialist that is responsible for that particular region. Since all specialists are certifying farms at their discretion, farms may not be certified using the same guidelines. Along with being certified, farms that had total assets of less than $40,000 were not included in the data set, as recommended by the KFBM coordinator. KFBM collects data on operator and farm levels but for this study operator level data was converted to farm level data for all individual business organizations. This study calculates farm totals (as opposed to averages) of all the operators that work on the same farm. Since KFBM collects financial information about Kentucky’s farmers, financial ratios can be calculated for this study.

Five measures of financial performance are represented by the following ratios: liquidity (current ratio), solvency (debt-to-asset ratio), profitability (return on assets), efficiency (operating expense ratio) and repayment capacity (term debt coverage ratio). Calculations and critical zones for these measurements are shown in Table 1. For example, return-on-assets ratio of less than 1% is considered to be in the critical zone, likewise if operating expense ratio is greater than 80% is considered to be in the critical zone. Term debt coverage needs to be greater than 1.1 in order not to be in the critical zone. For a business to be considered illiquid the current ratio needs to be less than 1. If a farm's debt-to-asset ratio is greater than 55% then they are more likely to experience solvency problems. Each financial measurement has multiple financial ratios that could be used to measure a particular type of performance; only financial ratios with set guidelines about being in critical zones are included as suggested by David Kohl (Kohl and Wilson 1997).

Table 2 displays the mean, median, 25th percentile, 75th percentile, critical zone guidelines and the percent of farms falling into the critical zones. The mean of return-on-assets is 0.051 with the median of 0.041 this indicates that most of the farm businesses within the sample are centered near the median. This is also shown with only 33.52% of the farm businesses falling into the critical zone indicating those farmers are not very profitable. Farm businesses in this sample are considered to be solvent and liquid with only 25.36% and 13.31% of the farms falling into the critical zone for current ratio and debt-to-asset ratio respectively.

Defining Financial Ratios

The Farm Financial Standards Council (FFSC) is a non-profit organization that is responsible for setting financial guidelines for agricultural producers. The FFSC executive committee consists of professionals from various groups that are responsible for promoting uniformity and integrity for agricultural finance reporting and analysis. The 2011 FFSC Financial Guidelines reports 21 financial ratios, "Legal 21", that should be used to measure financial soundness across farm businesses in a standardized way. However, it is noted that not all financial measures can be calculated because the necessary accounting information may not be available (FFSC, 2011).

FFSC provides definitions for the four financial characteristics being used in this study while the definition for solvency comes from Barnard and Boehlji. *Profitability* is how much the business generates net income from land, labor, management and capital. *Liquidity* is the business' ability to meet current and maturing obligations as they come due. *Solvency* measures provide an indication of the firm's ability to repay all financial obligations if all assets are sold and an indication of the ability to continue operations as a viable business after a financial adversity (Barnard and Boehlje). *Efficiency* is how the business uses assets to generate gross revenues. *Repayment Capacity* is the business' ability to repay non-current liabilities.

FFSC financial ratio recommendations are shown in Table 3 alongside ARMS and KFBM ratios. KFBM calculates 16 out of the 21 financial ratios that FFSC recommends, according to previous recommendations by FFSC. There are only 8 ratios that FFSC recommends that both ARMS webtool and KFBM calculates: current ratio, debt-to-asset ratio, rate of return on assets, rate of return on equity, operating profit margin, term debt coverage ratio, asset turnover ratio and operating expense ratio. KFBM also calculates values for both market value and modified cost for many financial ratios, which neither FFSC nor ARMS webtool does. For this study market value calculations were used because modified cost accounting does not take into count land value appreciation. Also, both land appreciation and income are combined when using ratios based on market value. Net worth can increase because of land appreciation and/or income, but there is no clear way to only measure income when discussing net worth.

Definitions of ratios provided by FFSC, ARMS and KFBM of financial characteristics are shown in Table 4. Only ratios that KFBM currently calculates are shown even though FFSC recommends for organizations to calculate more ratios. Overall, there is a significant consistency in the financial ratios between all three organizations but there are a few exceptions. One is that, both FFSC and KFBM define the denominator of rate of return on assets as the average of farm assets, while USDA uses total assets at the end of the year. The same can be said for asset turnover ratio, with the USDA defining the denominator as the total farm assets at the end of year with KFBM and FFSC using an average of farm assets from the previous year and current year. The same can also be said for the rate of return on equity with KFBM and FFCS using the average farm net worth with the USDA using current year net worth. All ratios measuring farm business liquidity are calculated the same across all three organizations. One ratio that is calculated differently in all three groups is the capital debt repayment capacity. KFBM adds taxable non-farm income to net farm income from operations, this is one step the other groups do not include. As stated before the difference between how each financial ratio is calculated is the result of how each organization collects financial data. This could lead to some ratios over or under stating the real value if the values across the three organizations are compared.

Model

Even though previous literature mostly uses probit models, this study uses logistic regressions to explain what factors influence financial stress and performance. Probit and logit models are both estimated using the maximum likelihood method and are interpreted the same way. A binary variable is created; 0 is for a farmer not in the critical zones or 1 if the farmer falls in the critical zones for each of the financial performance measurements. The general form for both probit and logit models is

$$p=pr[y=1|x]= F(x'\beta).$$

The functional form of the logistic model is

$$F(x'\beta) = \Lambda(x'\beta) = \frac{e^{x'\beta}}{1+e^{x'\beta}} = \frac{exp(x'\beta)}{1+epx(x'\beta)}$$

with the probability that y=1 or the probability that a farmer will fall into the critical zone for a given ratio. From there marginal effects are calculated by taking the derivative of the functional form:

$$\partial p/\partial x_j = \Lambda(x'\beta)[1-\Lambda(x'\beta)]\beta_j = \frac{e^{x'\beta}}{(1+e^{x'\beta})^2}\beta_j$$

where each index of *j* refers to the j^{th} independent variables, in this case: soil rating, gross farm returns, nonfarm income, government payments, total operating acres, tenure, farm type, recession and assets. This study follows most other literature that uses logit models in that marginal effects at the mean will be reported.

$$\frac{\partial p}{\partial x_j} = F'(\bar{x}'\beta)\beta_j$$

where $\bar{x}'$ is the average of *x* across the sample. The marginal effects at the mean were calculated for each dependent variable to determine the likelihood of a given financial measurement falling into the critical zone. A positive marginal effect means that an increase in a variable is associated with an increase in likelihood of financial distress (more likely to fall into the critical zone) and a negative sign indicates the opposite. Even though average marginal effects would give a better representation of the data, marginal effects at the mean were used because previous literature on this topic reports effects at the mean.

Several factors are hypothesized to affect financial stress, each representing different parts of the business operation. The soil rating variable was selected to determine the likelihood of production influencing performance, while total operating acres and tenure can determine how the numbers of acres affect the likelihood of experiencing financial stress. All three of the variables stated above are hypothesized to have negative marginal effects. Non-farm income was selected as a factor to see if it significantly affects farm financial performance. Government payments (direct payments) used to be heavily relied upon by farmers in order to stay financially sound. However with the government decreasing the amount of government payments over the years because of high prices these payments may or may not be important to some farmers. According to the ERS, 2005 saw the highest total government payments of $24,395.90 (in millions) however in 2011 the total amount was $10,421.4 (in millions). Kentucky farmers received the highest government payments in 2005 possibly because of the tobacco buyout that took place across the US. Kentucky has seen constant fluctuations in the total amount of payments to farmers, with 2002 being the lowest amount, $138,263 (in thousands), within the time period of this study. One would hypothesize that with any additional income the likelihood of experiencing financial stress should be smaller. Gross farm returns and the amount of assets represent how much the farm is making from its production.

Economic recessions affect every business, regardless of the industry. The effects can be widespread or specific to only certain parts of the business. The National Bureau of Economic Research (NBER) reports and determines when the US economy experiences expansions and recessions. According to NBER the economy was in an expansion during 1998 to 2000 and 2002 to 2007 while recessions occurred in years 2001 and 2008 to 2009. By including a recession dummy variable it will determine the likelihood of recessions affecting different financial performance measures which is thought to have a negative effect on the financial stress measurements. Gross farm income, total assets and crop farms are hypothesized to have a mixed effect on the financial stress measurements.

Table 5 shows the descriptive statistics for each independent variable. The results show that a higher percent of farmers are in the critical zone for the term debt coverage ratio, while the smallest percentages of farmers are in the critical zone for the debt to asset ratio. Operating expense and return on asset ratios have similar percentages of farmers falling into the critical zones, 30% and 33.5%, respectively. Farmers are not very much indebted (the average debt to asset ratio being 30.3%) and only 13.3% experience solvency problems. More farmers tend to experience profitability, efficiency, and repayment capacity problems.

Results

Table 6 reports the results of the logit estimates for whether or not farmers fall in the critical zones for each of the financial ratios. Most of the independent variables are found to affect financial performance. A crop farm is more likely to have problems with both liquidity and solvency. This is could be because of multiple reasons. Farm businesses growing crops might carry more liabilities because of machinery and/or rent more acres in order to be more profitable.

Operating acres also affect the financial performance of farmers. As a result of having a larger amount of operating acres, farmers are less likely to be in the critical zone for liquidity, meaning farmers have do not enough current assets to cover their current liabilities. Operating acres is a significant long-term and illiquid asset to any farm business; however just because having a large amount of operating acres does not mean the farm business is solvent. The independent variable tenure does significantly affect solvency. For example for every one unit increase in tenure going from a full tenant to a full owner, a farmer is 9% less likely to be in the critical zone for debt to asset ratio. An explanation for this is that older farmers could have most of their debt paid off.

Larger farms in terms of gross farm returns tend to be more likely have problems with liquidity and solvency, while less likely to be in the critical zones for efficiency, profitability and repayment capacity. For example, for every one percent change in gross farm income a farm business is 3% more likely to be in the critical zone for current ratio while 4% less likely of falling into the critical zone for operating expense. This could be because cooperators are able to manage the farm business well, but not well enough for current assets to cover all current liabilities the business holds. For government payments the magnitude of the effect is realistic in that, with additional government payments farm businesses are less likely to experience financial stress with profitability. For a one percent change in government payments farm businesses in this sample were 2.7% less likely to fall into the critical zone for return on assets. If government payments are high meaning prices are low they are more likely to experience financial stress. The more money that is coming into a business should positively affect anything to do with profitability. With non-farm income, the coefficients on efficiency and repayment capacity financial measures are significant. For example, for a one percent change in non-farm income a farmer is 1.3% less likely of having a term debt coverage ratio less than 1.1.

During a recession, farmers are less likely to experience financial stress because of efficiency, which is counter intuitive. An explanation could be when businesses go through an economic recession farmers must manage their business extremely well in order to stay financially sound. Most businesses will experiment with different ways to stay efficient and how to use their money in the best possible way.

The amount of total assets tends to significantly affect all financial measures of performance except profitability. However, if the farmer has high total assets they are more likely to be in the critical zone for operating expense ratio.

When comparing results to Ahrendsen and Katchova (2012) the outcomes are very similar, shown in Table 7. Liquidity is about the same except for the average means of the two groups, with 25.3% of farm businesses in the KFBM data set and 29.6% of farm businesses falling into the critical zone. Fewer farms fall into the critical zones for efficiency, repayment capacity, and profitability meaning that farms in the KFBM data set could be larger commercial farms than the farms in the ARMS data set that Ahrendsen and Katchova (2012) used, nonetheless results are consistent. The farmers in the KFBM data set are more likely to be profitable and their repayment capacity on average is higher. Fewer KFBM farmers fall into the critical zone for the operating expense ratio, while the average mean for Ahrendsen and Katchova (2012) is higher.

When comparing the two data sets, the KFBM farmers have a higher percentage (13.31%) of farmers in the critical zone for debt-to-asset ratio meaning that the groups of Kentucky farmers compared to the farmers in the ARMS data (3.5%) are in the critical zone for solvency and would not be able to pay off all liabilities by selling assets unless they are incolvent. The average mean for solvency is also higher for KFBM farmers (30.33) than ARMS farmers (8.33) used by Ahrendsen and Katchova (2012). Using the ARMS data Ahrendsen and Katchova (2012) found that the average mean for return on assets was -8.21 while this study found the average mean of return on assets was 5.10. This indicates that the average Kentucky farm business is more profitable than the average of farms in the ARMS data set. Further, this coincides with the high percentage of farm businesses in the critical zone for the ARMS data at 75.4%, with a considerably lower percentage of farmers falling into the critical for KFBM 33.52%. Overall it appears Kentucky farmers that are a part of KFBM are more likely to be profitable.

Concluding Remarks

This study examines the financial performance and stress of farmers in the KFBM program from 1998 to 2010. Using the KBFM data, logit models are estimated for both financial and non-financial characteristics that affect whether or not the financial ratios fall into the critical zones. Results show that there are several factors that can influence the likelihood of farm financial performance stress.

The results from the logit models show that larger farms in terms of gross farm returns are less likely to experience liquidity and solvency problems. If a farmer has a large amount of operating acres, he/she is less likely to experience financial stress related to liquidity. Crop farms are also more likely to see financial stress due to liquidly and solvency problems. All of this could mean that Kentucky farmers hold a large amount of liabilities that will not be covered by the assets that they hold. Compared to the ARMS data, Kentucky farmers are more likely to be profitable and hold more liabilities. Overall, the findings indicate that different factors affect each financial measurement differently. It should also be noted that KFBM farms are not representative of Kentucky farms, i.e. they tend to be larger, commercial farms that participate in the program.

These results are helpful for agricultural lenders, and farm analysis specialists to assess the performance of farmers. Understanding the predictors of financial performance could help design Extension programs for farmers that are experiencing financial stress from particular factors. With farming becoming very competitive, it is crucial that farmers are aware of what could affect their overall performance. Financial management trainings might be helpful if farmers have future goals of obtaining higher profitability, managing debt and assets, and efficiency.

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Tables

Table 1. Financial Ratio calculations and critical zone definitions

Financial Ratios	Financial Measures	Calculations	Critical Zones
Return on assets	Profitability	(Net farm income from operations + interest expense - family living withdrawals)/average assets	<1%
Current ratio	Liquidity	Current farm assets/current farm liabilities	<1
Debt-to-asset ratio	Solvency	Total farm debt/total farm assets	>55%
Operating expense ratio	Efficiency	(Operating expenses - depreciation)/gross revenue	>80%
Term debt coverage ratio	Repayment capacity	(Repayment capacity + interest)/(principal + interest)	<1.1

Table 2. KFBM farm business financial ratio means, quartiles, and critical zones

Ratio	Mean	Median	25th percentile	75th percentile	Critical Zone value	Percent farms in critical zone
Return on assets	0.051	0.041	-0.004	0.094	<1%	33.52%
Current ratio	0.906	1.1	0.993	1	<1	25.36%
Debt-to-asset ratio %	0.303	0.276	0.132	0.460	>55%	13.31%
Operating expense ratio %	0.732	0.691	0.573	0.840	>80%	30.03%
Term debt coverage ratio	0.246	1	-1.1	1.1	<1.1	38.91%

Table 3. FFSC financial ratio recommendations and ARMS webtool reports and KFBM

Financial Characteristic	FFSC	ARMS	KFBM
Liquidity	Current ratio	Current ratio	Current ratio (mkt & mod)
	Working capital		Working capital (mkt & mod)
	Working Capital/Gross Revenues ratio		
Solvency	Farm debt-to-asset ratio	Debt-to-asset ratio	Debt-to-assets (mkt & mod)
	Farm equity-to-asset ratio		Equity-to-asset (mkt & mod)
	Farm debt-to-equity ratio		Debt-to-equity (mkt & mod)
Profitability	Rate of return on farm assets	Rate of return on assets	Rate of return on farm assets (mkt & mod)
	Rate of return on farm equity	Rate of return on equity	Rate of return on farm equity (mkt & mod)
	Operating profit margin	Operating profit margin	Operating profit margin (mkt & mod)
	Net farm income		
	Earnings Before Interest Income Taxes		
	Depreciation Amortization		
Repayment Capacity	Capital debt repayment capacity		Capital replacement & term debt repayment capacity (mkt & mod)
	Capital debt repayment margin		Capital replacement & term debt repayment margin (mkt & mod)
	Replacement margin		
	Term-debt coverage ratio	Term debt coverage ratio	Term debt coverage ratio
	Replacement margin coverage ratio		
Financial Efficiency	Asset turnover rate	Asset turnover ratio	Asset turnover ratio (mod & mkt)
	Operating expense ratio	Operating expense ratio	Operating expense ratio
	Depreciation expense ratio		Depr. expense ratio
	Interest expense ratio		Interest expense ratio
	Net farm income from operations ratio		Net farm income from operation ratio

Table adapted from Ahrendsen and Katchova (2012)

Table 4. FFSC, ARMS and KFBM webtool report financial ratio definitions

Financial Characteristic	FFSC	ARMS	KFBM Market Value
Liquidity			
Current ratio	Total current farm assets /Total current farm liabilities	Same	Total current assets/ total current liabilities
Working capital	Total current farm assets - Total current farm liabilities	Not reported	Total current assets – total current liabilities
Solvency			
Debt-to-asset	Total farm liabilities /Total farm assets	Total farm debt /Total farm assets	Total liabilities /Total assets
Equity-to-asset ratio	Total farm net worth /Total farm assets	Not reported	Owner equity/ Total assets
Debt-to-equity ratio	Total farm liabilities /Total farm equity	Not reported	Total liabilities/ Owner equity
Profitability			
Rate of return on assets	Net farm income +Farm interest -Value of operator labor & mgt =Return on farm assets /Average farm assets	(Net farm income +Interest expenses -Estimated charges for operator labor and management) /Total assets	(Net farm income from operations – total interest expense – value of family labor)/ average of farm assets
Rate of return on equity	Net farm income -Value of operator labor & mgt = Return on farm equity /Average farm net worth	(Net farm income -Estimated charges for operator labor and management) /Net worth	(Net income from operations – total value unpaid labor) / average farm net worth
Operating profit margin	Return on farm assets /Value of farm production	Net farm income /Value of farm production	(Net farm income from operations + total interest expense – total value unpaid labor)/ value of farm production

Table adapted from Ahrendsen and Katchova (2012)

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Table 4. FFSC, ARMS and KFBM webtool report financial ratio definitions (Continued)

Repayment Capacity			
Capital debt repayment capacity	Net farm income + Depreciation + Net non-farm income - Family living & income taxes + Interest expense on term loans	Net farm income + Depreciation + Net non-farm income + Interest expense on term loans	Net farm income from operations + taxable non-farm income + depreciation – total taxes – total non-farm expense – total personal taxes
Capital debt repayment margin	Capital debt repayment capacity -Scheduled principal & interest on term loans[a]		Net farm income from operations + taxable non-farm income + depreciation – total taxes – total non-farm expense – total personal taxes – total intermediate prin. amount – total long term prin. amount – total of unscheduled prin. on term debt
Term-debt coverage ratio	Capital debt repayment capacity /Scheduled principal and interest on term loans[a]	Capital debt repayment capacity /Scheduled principal and interest on term loans	(Net farm income from operations + taxable non-farm income + depreciation expense + total intermediate loans annual interest paid + total long term annual interest paid – total taxes) – (total non-farm expense – total personal taxes)/ (total intermediate term annual payt. Amt. + total long term annual payt. Amt. + payment on new loan

Table adapted from Ahrendsen and Katchova (2012)

Continued on next page

Table 4. FFSC, ARMS and KFBM webtool report financial ratio definitions (Continued)

Financial Efficiency			
Asset turnover ratio	Value of farm production /Average farm assets	Farm production value /Total farm assets	Value of farm production / average of farm assets
Operating expense ratio	Total farm operating expenses excluding interest & depreciation /Gross farm income	Cash operating expenses /Gross cash farm income	Total operating expenses (not incl. Depr.) / value of farm production
Depreciation expense ratio	Depreciation /Gross farm income		Depreciation/ value of farm production
Interest expense ratio	Farm interest /Gross farm income		Total interest expense/ value of farm production
Net farm income ratio	Net farm income /Gross farm income		Net farm income from operations/ value of farm production

[a] Includes payments on capital leases
Table adapted from Ahrendsen and Katchova (2012)

Table 5. Variable Definitions and descriptive statistics

Variables	Definitions	Mean	Std. Dev.
Soil rating	Soil rating (0-100) Higher the number more productive the land	64.547	8.083
Log Gross farm income	Natural log of gross farm returns in thousand dollars	12.475	1.568
Log Nonfarm Income	Natural log of nonfarm income in thousand dollars	9.318	2.686
Log Government Payments	Natural log total government payments in thousand dollars	9.504	2.964
Total operating acres	Total operating acres in thousands	6.530	0.939
Tenure	Total owned acres divided by total tillable acres	0.417	0.321
Crop farm	1 if crop farm	0.731	0.443
Recession year	1 if recession year	0.093	0.290
Log Total Assets	Natural log of total assets in thousand dollars	14.152	0.724
Return on assets	Proportion of farmers falling in the critical zone for this ratio	0.335	0.472
Current ratio	Proportion of farmers falling in the critical zone for this ratio	0.254	0.435
Debt-to-asset ratio	Proportion of farmers falling in the critical zone for this ratio	0.133	0.340
Operating expense ratio	Proportion of farmers falling in the critical zone for this ratio	0.300	0.459
Term debt coverage ratio	Proportion of farmers falling in the critical zone for this ratio	0.389	0.488

Table 6. Logit model Marginal Effects Predicting Likelihood of Financial Ratios Falling into Critical Zones

	ROA	Current Ratio	Debt to Asset Ratio	Operating Expense	Term Debt Coverage
Soil Rating	-0.001	-0.002	-0.001	-0.002	0.000
	(0.010)	(0.008)	(0.011)	(0.008)	(0.008)
Log Gross Farm Returns	-0.281**	0.030**	0.031*	-0.042**	-0.093**
	(0.158)	(0.083)	(0.154)	(0.067)	(0.113)
Log Nonfarm Income	-0.006	-0.008	-0.002	0.035**	0.001**
	(0.028)	(0.026)	(0.030)	(0.034)	(0.024)
Log Government Payments	0.027**	0.002	-0.005	0.031	-0.013
	(0.032)	(0.027)	(0.041)	(0.045)	(0.026)
Log Total Operating Acres	-0.006	-0.038*	-0.013	-0.023	0.000
	(0.118)	(0.111)	(0.142)	(0.114)	(0.105)
Tenure	-0.090*	-0.004	-0.094**	-0.037	-0.028
	(0.297)	(0.272)	(0.374)	(0.267)	(0.255)
Crop farm	-0.047	0.065*	0.065**	0.056	0.041
	(0.189)	(0.188)	(0.260)	(0.188)	(0.169)
Recession	-0.176	-0.038	-0.003	-0.144**	-0.033
	(0.263)	(0.237)	(0.295)	(0.248)	(0.207)
Log Total Assets	0.037	-0.130**	-0.117**	0.047*	-0.058*
	(0.166)	(0.140)	(0.187)	(0.134)	(0.136)

** denotes significance level at 0.05
* denote significance level at 0.10
Numbers in parentheses are the standard errors.

Table 7. Comparison of means and percent in critical zones

Financial Measures	Ratio	Percent in critical zones KFBM	Percent in critical zones Katchova & Ahrendsen	Mean Values KFBM	Mean Values Katchova & Ahrendsen
Profitability	Return on assets %	33.52	75.4	5.10	-8.21
Liquidity	Current ratio	25.36	29.6	90.6	61.42
Solvency	Debt-to-asset ratio %	13.31	3.5	30.33	8.33
Efficiency	Operating expense ratio %	30.03	65.2	73.20	509.73
Repayment Capacity	Term debt coverage ratio	38.91	54.8	24.6	68.05

CHAPTER TWO: Profitability Migration Analysis of Kentucky Farmers

Summary

This study focuses on profitability migration of farm businesses in Kentucky. Migration probabilities across business cycles are tested to see if they differ between expansion and recession years. Based on year-to-year transitions probabilities the results show that the highest return on equity (ROE) class is less likely to retain its performance in a recession, while the lowest ROE is less likely to retain its performance in an expansion. Migration trends for year-to-year are tested to see if there is a drift or persistence in ROE performance based on previous year performance. Results indicate that the Markov independence property is violated when examining return on equity by resulting in trend-reversal of ROE performance. These results will be useful in making policies directed at helping farmers to be more profitable in different economic environments and also for benchmarking analysis.

Introduction

Migration analysis has been studied intensely with respect to credit migration in order to provide lenders a way to examine the creditworthiness of farm businesses. Migration analysis is simply a probability-based measurement concept that relays transitional probabilities of upgrading or downgrading to the next class. Past credit risk migration transition probability models as described in Phillips and Katchova (2004) and Barry, Escalante and Ellinger (2002), examine various types of measurements over time such as credit scores and profitability. For this study migration transition probabilities are calculated based on the return on equity in the current year and the probability of migrating to another class of return on equity in the following year.

One key concept of migration analysis is the Markov property of independence related to the probability of a bond or loan moving to any class during a period is independent of what has occurred in the previous period (Phillips and Katchova). The Markov property hypothesizes that the previous periods do not predict the migration direction for future periods. If there is a violation of the property (trend reversal) than the migration direction is independent of past performance. Even though the Markov property was previously applied to examine loans and bonds, in this study the concept will be used to analyze if return on equity migration is independent from the previous year migration.

This study explores migration transition probabilities of profitability measured by return on equity using farm-level data provided by Kentucky Farm Business Management (KFBM) Association from 1998 through 2010. Five groups were made, each capturing 20 percent of the total data, based on ROE. Adapted from Phillips and Katchova (2004), business cycles and profit drifts will be the focus here. One measurement approach will be used that measures year-to-year transition probabilities. Migration probabilities and migration drift have been studied in terms of credit ratings for bonds and loans performance and farm business performance, while the contribution of this study is to apply this methodology to farm profitability. This study will also help expand on the understanding of changes in performance since much more is known about financial performance than changes in performance.

This topic is very important to Kentucky farmers and agricultural leaders because it will allow them to know if there is any persistence in profitability of Kentucky farm businesses and see how profitability is affected in different economic conditions. The KFBM mission is to help farm businesses improve their financial performance through detailed recording keeping system while helping the farmers accomplish their goals. Using the information from the records financial ratios for all farm businesses can be calculated and tracked over time. It is important to state, that knowing how profitability changes over time can allow farmers to make the correct management decisions. Monitoring ROE trends are helpful when tracking progress of farm businesses (Kohl and Wilson).

Literature Review

Profitability has been studied across agriculture for various reasons. Gloy, Hyde and LaDue (2001) looked at farm management and performance of dairy farms in New York. To measure farm performance return on assets and compound return on assets was used. The authors found that farm size, changes in farm size, and production factors are positively related to farm profitability. Another finding was that, in general, farms were either consistently low or high in regards to ROE. Blank et al. used return on equity (ROE) to measure profitability when examining household wealth and the factors that influence performance using ARMS data. Barry, Escalante and Ellinger (2002), also measured profitability as return on equity when determining migration transition probabilities. Hagerman, Leathman and Park choose return on equity to measure performance in their study for Texas farm cooperatives. When examining financial performance of dairy farming system in New Zealand, Nocla Shadbolt, found that there was little difference between return on assets and return on equity results. However, ROA and ROE are different in calculations and interpretation.

The main difference between ROA and ROE is interest rates. If ROA is higher than interest rates then ROE will higher than ROA. Also, if the cost of debt is relatively low, then farmers have an incentive to borrow (leverage up) and increase their ROE above ROA. Another way to state this is that ROE will be high if the cost of debt is low. Return on equity is amplified because of debt/leverage both for the good and bad financial scenarios

Migration has mainly been used to determine credit risk or credit score migration to provide lenders a more accurate way to measure creditworthiness for agricultural businesses. Farm credit migration has been examined by various researchers (Fetherstone, Langemeier, and Haverkamp (2006), Barry, Escalante and Ellinger (2002), and Phillips and Katchova (2004)), each using farm-level data but all looking at different factors that influence migration. Featherstone, Langemeier, and Haverkamp (2006), used data from Kansas Farm Management Association Data Bank to analyze credit score migration of farms that had a minimum of

Standard & Poor's B classification. They found that most farms had stronger tendencies to retain the same credit quality as opposed to migrating. Also they found that large farms are normally in the middle range of the Standard & Poor's scale.

Barry, Escalante, and Ellinger (2002) utilized a four measurement approach (year-to-year, two-year moving average, three-year moving average and three-year average to fourth year) along with looking at three different classes: credit score, profitability and repayment capacity. For their study, the highest retention rates came from the three-year moving average for ROE, credit score and repayment capacity. They measured profitability by return on equity.

Looking at business cycles as a factor of credit score migration was studied by Phillips and Katchova (2004). The results found that higher risk classes were more likely to stay in or worsen their current financial position and less likely to improve in recessions. Another component was migration trends, which they found that path dependence does exist. Both Barry, Escalante, and Ellinger, and Phillips and Katchova grouped the farm data into five classes and used Illinois Farm Business Farm Management Association data.

By combining previous studies about credit risk migration and measures of profitability this work focuses on profitability migration for business, in addition to drift classes. As in credit risk migration models, groups are formed based on pre-determined criteria. Gloy, Hyde and LaDue had ten groups based on profitability. The highest ten percent was in the first group, then the next highest ten percent in the second group and so on. This is very similar to this study of profit migration except using five groups, each made to include 20 percent of the data.

Data Source

The study will utilize Kentucky Farm Business Management (KFBM) data from 1998 to 2010. Only individual business types will be used along with only the farm businesses first operator even though there may be multiple operators on one farm. Profitability will be measured in terms of return on equity. Return on equity (ROE) is how well the owner can generate net income which is calculated by the following equation:

$$ROE = \frac{Net\ farm\ income}{(Net\ worth_{B} +\ Net\ worth_{E})/2}$$

Net farm income is calculated by subtracting total operating expenses from gross farm returns. Net worth is just another way to say owners' equity. With subscript B meaning the net worth of the farmer at the beginning of the year, and subscript E meaning the net worth at the end of the year. The higher the ratio the higher the ROE is for the farm business.

Each farm participating in the KFBM program is given a unique farm identification number, this allows for financial data to be used while keeping personal information confidential. Farms are matched over time using the farm id to make sure that the financial records are continuously certified for the amount of years required by each migration test. The business cycle migration requires two years of continuous data while migration drift requires three years of continuous financial data to calculate the matrices. This is because not all farms are surveyed in all years. One reason could be is that the farm was certified one year but not the next which would eliminate that farm from the study. Any observation that was considered to be an outlier was replaced with value of three standard deviations away from the mean, which was done in previous credit risk migration studies such as Featherstone, Roessler and Barry (2006) and Featherstone, Langemeier and Haverkamp (2006).

Migration Model and Measurement

In this study, each farm is placed in groups based on the value of return on equity. The five groups capture 20 percent of the data in each group. With lowest ROE class being the lowest return on equity, with highest ROE class meaning that those farms have the highest return on equity, the higher the value the better. Table 8 shows the ranges for each of the ROE classes. The groups are equal in size (number of observations) which has determined the specific cut off values for the five groups.

Profitability migration considers changes to a farm business' profitability over time using the ROE classes stated above. The transition probabilities represent the probability for a farm to migrate to another ROE class or to retain the same ROE class during a specific time frame.

Unconditional transitional probabilities are calculated as follows:

$$P_{ij} = \frac{n_{ij}}{n_i}.$$

With n_i representing farmers in a given ROE class *i* for the current year and with n_{ij} representing the number of farm businesses that have migrated from ROE class *i* to ROE class *j*, which returns P_{ij} or the estimate of one year transition probability (Lando and Skodeberg, and Phillips and Katchova). The unconditional matrices do not take into consideration any economic conditions.

Conditional matrices are calculated using the same equation as the unconditional matrices except taking into consideration business cycles and migration trends. Transition probabilities will be calculated separately for years when the U.S economy experienced an expansion or recession. The hypothesis for testing the effect of recessions and expansions is:

H_0: $P_{ij} = P^c_{ij}$ (*expansion*)$=P^c_{ij}$ (*recession*)

H_a: $P_{ij} \neq P^c_{ij}$ (*expansion*) or $P_{ij} \neq P^c_{ij}$ (*recession*)

Three conditional matrices will be calculated for the migration trends, upgrade, downgrade and no trend. Hypothesis testing for violation of the Markov property of independence is:

H_0: P_{ij}(upgrade)$= P^c_{ij}$ (upgrade |upgrade)$=P^c_{ij}$ (upgrade|downgrade)

$= P^c_{ij}$ (upgrade|no trend)

H_a:At least one $P^c_{ij} \neq P_{ij}$

Unconditional and conditional matrices will be compared to see how farm businesses perform under different economic circumstances.

Along with calculating ROE migration probabilities for the business cycle, this study also tests for violation of the Markov property of independence (migration trends) for return on equity. Path dependence hypothesizes that previous periods affect the migration direction for future periods. Using the same ROE classes as for the migration business cycle probabilities, migration trends are studied. Uptrend, no trend and downtrend probabilities are examined. With uptrend representing the initial ROE class i, moves to ROE class $i+1$, with the opposite movement representing the downward trend if the initial ROE class i, moves to ROE class $i - 1$ all for one year probabilities. If the ROE experiences no class changes from one year to the next then that farm business is placed in the no trend matrices for the conditional matrices. If trend reversal is present, another form of path dependence, then farmers will more likely experience upgrades followed by downgrades rather than experiencing upgrades followed by upgrades (Phillips and Katchova). However, if momentum is present then an upgrade (downgrade) in ROE class would be followed by another upgrade (downgrade).

Business Cycle Definition

In recent research Eldon, Carlos and Camilo used NBER definitions of business cycles when seeking evidence of convergence of total factor productivity across the states. They noted that the speed of convergence is faster during recessions and slower during periods in expansions. Groth, uses an "operating cycle" instead of a traditional business cycle, citing that businesses operate differently depending on the type of business. Such as an operating cycle consists of a business turning its assets into cash, cash into raw materials, then turning the raw materials into a product, this process is called work-in-process. The last two stages of the operating cycle are turning the product into finished goods and to start collecting money, known as accounts receivable. Bredahl and Marks also uses Groth definition of operating cycle instead of a traditional business cycle. The operating cycle definition stated above is not a good business cycle definition to use for this study. It would be very difficult for a farm business to track each of the above operating cycle factors because of unknown and natural factors that affect the agriculture industry, such as weather.

To better explain profitability in different economic situations, the traditional business cycle is used. The National Bureau of Economic Research (NBER) reports when the US economy experiences expansions and recessions. According to NBER the economy was in an expansion during 1998 to 2000 and 2002 to 2007 while recessions occurred in years 2001 and 2008 to 2009. NBER's last announcement was in late 2010 reporting that the recession cycle ended, so for this study it assumes that the US economy is in an expansion for 2010. This same procedure was done by Bangia et al. and Phillips and Katchova.

Results

Transition probability matrices reflect migration of one ROE class in the current year to the same or another ROE class in the next year. Tables 9 and Table 11 shows the unconditional transition probabilities for the year-to-year business cycle and drift migration analysis, respectively. Retention rates can be found on the diagonal of the matrix, representing the probability of remaining within the same ROE class in the next period. Kentucky farmers participating in the KFBM program have a high probability of staying in their respected profitability class resulting in high retention rates, compared to migrating to another ROE class.

If ROE performance was randomly fluctuating from one year to the next, we expect transition probabilities to be close to 1/5 for migration to any of the five ROE classes for the next period. Since we observe higher transition probabilities across the diagonal in comparison to off the diagonal, there is a tendency for ROE performance to remain the same over time. These results indicate strong tendency in ROE performance to be stable over time possibly due to managerial and production skills of the producer.

The results from the unconditional matrices are displayed in Table 9. Results indicate that there is a greater tendency to move up one class away from the current ROE class (improve their performance) than move down one ROE class for Low ROE class and Middle ROE class. The results indicate the opposite for the high ROE classes, with having a higher probability for migrating down one ROE class in the next period.

The Highest ROE class has the highest retention rate of 47.8% while farmers in the Middle ROE class have the lowest retention rate of 32.6%. Middle ROE performance class has the lowest retention rates because they may have not the right management skills or/and access to capital that could is needed to migrate up to the next ROE class however this might not be true for all farmers and is only speculated. Since Highest ROE Class cannot migrate up to another class, those farmers are concerned with migrating downwards, however the probability of moving down one ROE class to the high ROE class in the next period is 25.3%. For top ROE performers, it can be assumed that farm managers have the management skills to continuously be top performers.

When comparing the return on equity retention rates to the Phillips and Katchova credit score retention rates, some retention rates are lower while others are higher. This could be because ROE might fluctuate more over time than credit risk class which combines several financial ratios into one measure of credit score. Return on equity classes only consider one financial measure, profitability.

Business Cycle Results

The results for the business cycle matrices are shown in Table 10. The business cycle matrices are the same transition matrices discussed before, but split into expansion and recession business cycle conditional matrices. The numbers in parentheses show the differences between the unconditional and business cycle conditional matrices, but none of the differences were statistically significantly different from zero.

During expansion periods, farms in the highest, low, and lowest ROE class are more likely to stay in the same class, while farms in the middle ROE class are less likely to stay in the same class than the unconditional matrix. For example, the likelihood of a farm business staying in the highest ROE class in conditional matrix of an expansion period is 50% which is 2.2% higher than the probability from the unconditional matrix. These findings mean that during expansion, the top farms have the opportunity to keep their top performance and even worst performers are more likely to make improvements on their performance. The opposite trend is true during recession time, with the lowest ROE class performers being more likely to stay in the same ROE class, while farm businesses in the remaining ROE classes are less likely to stay same in the ROE class. The performers in the highest ROE class have retention rates that are 8.5% lower during a recession than the unconditional matrix. While the lowest ROE class retention rate during a recession is 11% higher than the unconditional matrix. During a recession, top performers are less likely to retain their top performance, while worse performers tend to be more likely to stay in their ROE classes. This shows that the main objective for farmers is to do well in expansion years while doing OK in recession years. A reason for this outcome might be because top ROE performers may be able to leverage more in expansions versus recessions. Another point to make is that recessions can have a lingering effect on farm which can be tested in subsequent studies.

Migration Drift Results

Table 11 shows the new unconditional matrix for the migration drift. The drift unconditional matrix consists of farms with three consecutive years of data as opposed to the previously discussed unconditional matrix including farms with two consecutive years of data. Retention rates from the year-to-year looks very similar to the unconditional transition probabilities for the business cycle in Table 2. Lowest, Low and Middle ROE classes all have a greater tendency to improve to the next ROE class rather than moving down.

Results from the migration drift are displayed in Table 12. The upward trend matrix is for farms that have experiences an upgrade (improvement in ROE class) in the previous period, the no trend is no change in ROE class in the previous period, and the downward trend is for downgrading (worsening in ROE) class in the previous period. The transition probability matrices were re-estimated for these three groups of farms.

For the upward trend, the highest retention rate (36.1%) is for the highest ROE class. Opposite results are found for the no trend matrix, the low ROE class has the highest retention rate, i.e. they stay low. The lowest ROE class has the highest retention rate for the downward trend conditional matrix. All conditional matrices compared to the unconditional matrix that shows the low ROE class has the highest retention rate and the middle ROE class has the lowest rate. The probability of upgrading from middle ROE class to high ROE class following an upgrade is 0.9% less than the unconditional matrix. While the probability of downgrading from middle ROE class to low ROE class is 4.8% higher in the upward trend matrix than the unconditional matrix. Upgrading from the high ROE class to highest ROE class following an upgrade is 9.8% less than the full sample matrix. Similar results are found in the downward trend matrix when further downgrading from the high ROE class to the middle ROE class is 7.4% lower than the unconditional matrix.

In the upward trend matrix, all classes tend to be less likely to stay in their own ROE classes with probabilities ranging from 27% to 31%. Only the low ROE classes tend to be more likely to improve, but the rest of the classes tend to more likely to deteriorate their performance. For example, the highest ROE class has a 31% chance of staying in the same class; however it has the same probability of decreasing to the next, high ROE class. The high ROE class has a higher chance (31.8%) to deteriorate one class down than staying in the same ROE class (29.5%).

The largest difference from the conditional and unconditional matrix is the retention rate for the low ROE class in the no-trend matrix of 70.9% which is 21.3% higher than the unconditional matrix. In the no-trend matrix, all farms tend to be more likely to continue to stay within their respective ROE class than move away from them. For example, farmers in the Low ROE class have a significant decrease in probability to move away from that class. With the Low ROE class having almost 80% retention rate yet, the probability of moving down or up is 12.7% and 14.5%, respectively. The Highest, High, Middle and Lowest ROE classes have above 34% probability of retaining their same class.

When farm businesses experience a downgrade in the previous period, the lowest ROE class has the highest retention rate, which is 5.3% less than the unconditional matrix. For middle class performers, they are less likely to stay in the same class after downgrading, than if they have no change or upgrade. In the downward trend matrix, only the High ROE class is more likely to stay in the same ROE class, while the other classes are less likely to move away. Only the High ROE class is less likely to improve but the rest of the classes are more likely to improve their performance. This indicates trend reversal for most classes. Trend reversal just means that even if ROE starts off being low, it does not mean it will continue to stay low. For example, following a downtrend in the previous year, a farmer in the High ROE Class, has a 22.6% probability of migrating up to the Highest ROE class but only a 19.4% of deteriorating to the Middle ROE class. The same can be shown with the upward trend matrix, if a farmer has a return on equity in the Middle ROE class range, then there is a higher probability (23.6%) of migrating down to the Low ROE class than migrating up to the High ROE class (21.8%).

These results in general confirm the Phillips and Katchova trend-reversal of profitability. With the lower credit quality class having higher transition probabilities for the downgrade matrix indicating that a downgrade in credit quality last period would more likely result in an upgrade in the next period. Even though this study focuses on return on equity it can be compared to Phillips and Katchova because a factor of credit quality is profitability.

Concluding Remarks

The results of this study suggest that farmers with high return on equity will more than likely retain their high ROE in expansion and others will improve their performance during expansion. On the other hand, farmers with a low return on equity will more likely keep a low ROE when the U.S economy is experiencing a recession. Yet, the transition probabilities off the diagonal tend to differ across the business cycles when comparing the unconditional and conditional migration probabilities. This generally confirms results from other agricultural finance studies.

Results also indicate trend reversal for most ROE classes, resulting in the violation of the Markov property. Our findings indicate that past performance predicts future performance because we find trend reversal, so upgrades are more likely after downgrades and vice versa. There could be many explanations for these differences including management skills, weather patterns, agricultural production cycles and the ability to increase net worth.

Kentucky farmers can use this study as a benchmarking tool. If farmers have a benchmark to compare themselves to, more of them might take additional management steps to improve their financial performance. However, not all farmers are able to take the required steps to improve their return on equity for different reasons. KFBM could use the results as a recruitment instrument to show how well farmers perform in their program. By using KFBM data it will help Kentucky farmers gain knowledge about return on equity and where their farm could stand within the ROE classes. One thing that might have some caution attached is that this data mainly represents larger, commercial farms in Kentucky and may not be a good representation for both large and small size farms. Also, the results of this study will not be able to be generalized for farmers in other states.

Further studies are needed to determine if transition probabilities differ significantly when examining a longer time frame (year-to-year vs. year-to-three years). This could bring some insight on how farms perform over time and if their performance should improve. Also, different enterprises should be examined, which was not done in this study. In addition, the finding should be compared against results from other Farm Business Analysis programs that are organized like Kentucky Farm Business Management Program.

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Tables

Table 8. Classes of Return on Equity

Classes based on ROE	Obs.	Minimum	Maximum
Lowest ROE	269	-1.00000	-0.00218
Low ROE	270	0.00234	0.03556
Middle ROE	270	0.03557	0.07730
High ROE	270	0.07734	0.14445
Highest ROE	269	0.14462	1.00000

Table 9. Business Cycle Unconditional Matrix

	Next Year						
Current Year	Lowest	Low	Middle	High	Highest	Farm Obs.	Percent Total
Lowest ROE	0.436	0.227	0.147	0.067	0.123	163	18.59%
Low ROE	0.123	0.458	0.240	0.123	0.056	179	20.41%
Middle ROE	0.124	0.161	0.326	0.223	0.166	193	22.01%
High ROE	0.067	0.116	0.268	0.341	0.207	164	18.70%
Highest ROE	0.096	0.051	0.124	0.253	0.478	178	20.30%

Table 10. Business Cycle Conditional Matrix

	Next Year						
Current Year	Lowest	Low	Middle	High	Highest	Farm Obs.	Percent Total
Expansion							
Lowest ROE	0.431	0.262	0.162	0.069	0.077	130	20.80%
	(-0.005)	(0.035)	(0.014)	(0.002)	(-0.046)		
Low ROE	0.126	0.469	0.245	0.119	0.042	143	22.88%
	(0.003)	(0.010)	(0.005)	(-0.004)	(-0.014)		
Middle ROE	0.119	0.164	0.366	0.201	0.149	134	21.44%
	(-0.005)	(0.004)	(0.039)	(-0.021)	(-0.017)		
High ROE	0.073	0.136	0.236	0.364	0.191	110	17.60%
	(0.006)	(0.021)	(-0.032)	(0.022)	(-0.016)		
Highest ROE	0.102	0.056	0.139	0.204	0.500	108	17.28%
	(0.006)	(0.005)	(0.015)	(-0.049)	(0.022)		
Recession							
Lowest ROE	0.545	0.136	0.091	0.045	0.182	22	12.79%
	(0.110)	(-0.091)	(-0.056)	(-0.022)	(0.059)		
Low ROE	0.160	0.560	0.200	0.080	0	25	14.53%
	(0.037)	(0.102)	(-0.040)	(-0.043)	(-0.056)		
Middle ROE	0.242	0.182	0.303	0.152	0.121	33	19.19%
	(0.118)	(0.021)	(-0.023)	(-0.071)	(-0.045)		
High ROE	0.083	0.111	0.389	0.222	0.194	36	20.93%
	(0.016)	(-0.005)	(0.121)	(-0.119)	(-0.013)		
Highest ROE	0.089	0.054	0.107	0.357	0.393	56	32.56%
	(-0.006)	(0.003)	(-0.016)	(0.104)	(-0.085)		

Expansion years: 1998, 1999, 2000, 2002, 2007, 2010
Recession years: 2001, 2008, 2009
Number is parentheses are differences between the probabilities in the business cycle one year conditional matrix and the unconditional matrix

Table 11. Drift Ratings Unconditional Matrix

Current Year	Next Year: Lowest	Low	Middle	High	Highest	Farm Obs.	Percent Total
Lowest ROE	0.418	0.235	0.153	0.061	0.133	98	15.99%
Low ROE	0.128	0.496	0.224	0.088	0.064	125	20.39%
Middle ROE	0.117	0.188	0.325	0.227	0.143	154	25.12%
High ROE	0.052	0.121	0.267	0.328	0.233	116	18.92%
Highest ROE	0.100	0.058	0.117	0.267	0.458	120	19.58%

Table 12. Drift Ratings Conditional Matrix

Current Year	Next Year: Lowest	Low	Middle	High	Highest	Farm Obs.	Percent Total
Upward Trend							
Lowest ROE	-	-	-	-	-		
	-	-	-	-	-		
Low ROE	0.192	0.308	0.385	0.115	0	26	13.98%
	(0.064)	(-0.188)	(0.161)	(0.027)	(-0.064)		
Middle ROE	0.218	0.236	0.273	0.218	0.055	55	29.57%
	(0.101)	(0.048)	(-0.052)	(-0.009)	(-0.088)		
High ROE	0.091	0.159	0.318	0.295	0.136	44	23.66%
	(0.039)	(0.038)	(0.051)	(-0.032)	(-0.096)		
Highest ROE	0.066	0.115	0.098	0.361	0.361	61	32.80%
	(-0.034)	(0.056)	(-0.018)	(0.094)	(-0.098)		
No Trend							
Lowest ROE	0.478	0.283	0.152	0	0.087	46	18.40%
	(0.060)	(0.048)	(-0.001)	(-0.061)	(-0.046)		
Low ROE	0.127	0.709	0.145	0	0.018	55	22.00%
	(-0.001)	(0.213)	(-0.079)	(-0.064)	(-0.046)		
Middle ROE	0.061	0.184	0.469	0.245	0.041	49	19.60%
	(-0.056)	(-0.005)	(0.145)	(0.018)	(-0.102)		
High ROE	0	0.049	0.268	0.341	0.341	41	16.40%
	(-0.052)	(-0.072)	(0.001)	(0.014)	(0.109)		
Highest ROE	0.136	0	0.136	0.169	0.559	59	23.60%
	(0.036)	-0.058	(0.019)	(-0.097)	(0.101)		
Downward Trend							
Lowest ROE	0.365	0.192	0.154	0.115	0.173	52	29.38%
	(-0.053)	(-0.042)	(0.001)	(0.054)	(0.040)		
Low ROE	0.091	0.341	0.227	0.182	0.159	44	24.86%
	(-0.037)	(-0.155)	(0.003)	(0.094)	(0.095)		
Middle ROE	0.060	0.140	0.240	0.220	0.340	50	28.25%
	(-0.057)	(-0.048)	(-0.085)	(-0.007)	(0.197)		
High ROE	0.065	0.161	0.194	0.355	0.226	31	17.51%
	(0.013)	(0.041)	(-0.074)	(0.027)	(-0.007)		
Highest ROE	-	-	-	-	-		
	-	-	-	-	-		

Number is parentheses are differences between the probabilities in the business cycle one year conditional matrix and the unconditional matrix

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VITA

EDUCATION:

BS Agricultural Economics, University of Kentucky May 2012

PROFESSIONAL EXPERIENCE

Graduate Student Research Assistant, Ag Economics Department at University of Kentucky. July 2012 – January 2013

Staff Support in the Agricultural Economics Department of the University of Kentucky. August 2009 – July 2013

EXTENSION EXPERIENCE

KFBM Independent Project, Ag Economics Department, University of Kentucky. August 2012 – January 2013

KyFarmStart, Ag Economics Department, University of Kentucky.
October 2011 – February 2012

PRESENTATIONS

"Helping Beginning Farmers Transition into Kentucky Agriculture" Presentation to KY Legislatures, Frankfort, Kentucky, February 2012

"Helping Beginning Farmers Transition into Kentucky Agriculture" Undergraduate Showcase, Lexington, Kentucky, April 2012