

# Likelihood of Kansas Farm Financial Persistence

Jayce Stabel ([jstabel@ksu.edu](mailto:jstabel@ksu.edu)), Terry Griffin ([twgriffin@ksu.edu](mailto:twgriffin@ksu.edu)) and Greg Ibendahl ([ibendahl@ksu.edu](mailto:ibendahl@ksu.edu))  
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Do some farms consistently (persist) outperform their peers?

*Persistence: Firm or obstinate continuance in a course of action in spite of difficulty or opposition.*

## Executive Summary

Often times farmers and agricultural lenders alike seek the ability to identify ways to improve farm operations' stability and profitability. Seeking these characteristics has been the goal of many research studies previously. More often than not, luck was credited for contributing the majority of one farm's success relative to their competitors. The goal of this study was to evaluate that assumption and give producers a concrete answer to the question of one farm's ability to maintain their stability weathering even the sharpest market downturns and the worst growing conditions.

Farmers across the United States are subject to many uncontrollable variables leaving them vulnerable to agricultural downturns, such as the one that began in 2014. The unique nature of farms and their profitability creates a difficult situation for farmers and agricultural lenders alike. Identifying and estimating the likelihood of financial instability has become an area of interest for farmers, their advisors, and their financial lenders. Currently, agricultural lenders are bound by traditional loan assessment techniques, such as net present values and loss-based methods. These techniques fail to account for the unique and often long-term investment nature of farming. If an additional method for identifying at-risk farms or at least understanding the likelihood of instability in farm profitability could be found, it would provide an insight into the riskiness of loaning to a farm.

Considering the difficulty associated with predicting farm default rates due to the complexity of the market place, a secondary approach is possible. The dynamic nature of farm financials and the ever changing variables of farming limit traditional statistical methods. This study utilized a new approach in determining farm financial stability

by estimating the probability of transitioning from financial stability to an insolvent precarious financial position. Kansas Farm Management Association (KFMA) data from 1993 to 2014 was used to estimate the probability of transitioning to several different financial states.

This study utilizes a novel approach, in terms of its application, in determining farm financial stability by calculating transition probabilities of Kansas farms and estimating the probability of transitioning from a financially favorable state to a more vulnerable state. The matrix of probabilities generated, when interpreted, provides several insightful facts about Kansas farms. KFMA data of non-irrigated grain farms from 1993 to the year 2014 was used in this study to estimate the probability of transitioning to four different financial states.

## **Introduction**

When a farm is more likely to remain in its current financial category than the chances that it switches to another profitability category, it is said to be persistent. When the probability that a farm switches between financial categories is higher than the likelihood of remaining in the current financial category then persistence is absent. If farm profitability is based on random luck, then farms will freely transition between financial states just as often as remaining in any one financial category. Persistence is a desirable characteristic when a farm is in a financially favorable category; and may be interpreted as the farm being managed by a farmer with above average skills. Conversely, persistence in the financially vulnerable categories is not a desirable characteristic; and can be attributed to poor farm management, poor soils, or adverse precipitation. The lack of persistence across all financial categories may indicate factors outside the control of the management ability of the farmer.

The overall goal of this project was to report transition probabilities for Kansas farms assigned to financial vulnerability categories. Specifically, we determine if farms in the favorable categories are more likely to remain in current category than the financially vulnerable categories. Substantially higher levels of persistence in the favorable categories compared to the financially vulnerable categories would indicate management (a function of marketing,

cropping mixture, fertility program, farming practices, and operation structure), rather than luck, are leading to the difference between the financial states.

### **Data and Methods**

Persistence was tested on nearly 1,300 KFMA farmer-members using panel data from 1993 through 2014. Five different categories were created to categorize farms into different levels of financial stability. Farms were then categorized by different threshold values for the variables: Debt to Asset (D/A) ratio and Net Farm Income by Acre. Debt to asset ratios have often been used when determining the viability of a loan applicant, therefore, it became one of the key determining factors used to categorize farms into different financial categories. A D/A of 0.4 or lower was deemed to be a necessary level where a farm was financially favorable. The second break point was if the farm had a positive net farm income per acre (NFI/AC) or a negative NFI/AC. Due to the nature of farming a positive income is not always possible, but a farm that is able to maintain breakeven production costs shows management skills and an ability to properly control for price risk.

Break points, loosely based upon the USDA Economic Research Service financial vulnerability definition, were used and each farm was assigned to a category for each year that their data were available in the KFMA data set. Once farm observations not meeting the inclusion criteria were omitted, 28,294 observations remained for further analysis. Outliers were farms that had D/A above 1 or were negative, an impossible scenario that may indicate a corrupt entry. Category 1 farms were farms considered to be financially favorable with a positive NFI/AC and a D/A ratio greater than the lending industry standard of 0.4. These farms were designated as favorable because of their profitability and their solvent nature. Category 2 farms were farms with a negative NFI/AC, but were not highly leveraged with a D/A below 0.4 and were called Marginal Income. Category 3 was similar to Category 1 except these farms had a positive NFI/AC and were considered highly leveraged and lacking the preferred solvency, hence the term Marginal Solvency. It should be noted that Category 3 and Category 4 were not ordinal but could be considered equivalent when attempting to rank across categories. However, Category 4 was the poorest rating, including farms that were highly leveraged with a D/A above 0.4 and negative NFI/AC giving them the designation of Vulnerable. The

final category that farms were able to transition to was Category 0. This category was designed to capture the probability of farms entering or exiting the KFMA system so that analysis could determine which category that those farms were most likely to enter in and which category they were most likely to exit.

**Table 1. Farm Financial Categories**

	Category 1	Category 2	Category 3	Category 4
Debt to Asset	Greater than 0.4	Greater than 0.4	Less than 0.4	Less than 0.4
Net Farm Income	(+) positive return	(-) negative return	(+) positive return	(-) negative return
Per Acre	per acre	per acre	per acre	per acre

The resulting dataset for this analysis included farms from across Kansas with a relatively larger portion (27%) coming from the Southeastern region. Both Western regions were sparsely represented compared to the remaining regions with the Northwest and Southwest regions making up 10% and 8 % of the observations, respectively. Most farms were smaller than 700 acres with average operator ages in the mid-fifties. For the last ten years the farms were fairly diversified in their crops, which is to be expected with a statewide analysis. The primary crop by percentage was wheat, typically this crop was 30% of the farms' crop mix.

**Table 2. Geographical Farm Distribution (1993-2014)**

KFMA District	Number of Observations	Percent of Farms
Southwest	2336	8%
Northwest	2880	10%
North Central	4787	17%
South Central	5958	21%
Northeast	4761	17%
Southeast	7501	27%

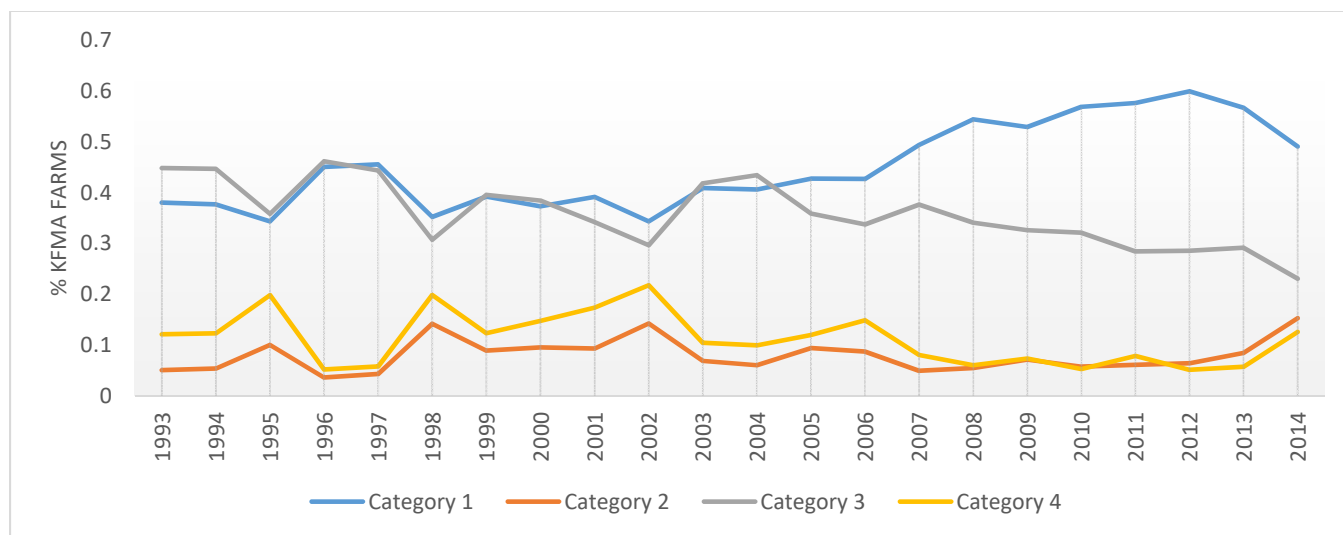
## Results

**Table 3. KFMA Farm Transition Probabilities 1993-2014**

<i>Category</i>	<i>0</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
<i>0</i>	0.92	0.03	0.01	0.03	0.01
<i>1</i>	0.15	0.67	0.09	0.07	0.02
<i>2</i>	0.21	0.49	0.21	0.05	0.04
<i>3</i>	0.19	0.1	0.01	0.56	0.13
<i>4</i>	0.23	0.07	0.02	0.42	0.26

The results from this analysis were as expected. Some Kansas farms consistently outperformed their peers due to an unknown management, geographical, or structural advantage. Despite farmers being exposed to many uncontrollable variables such as: temperature, rainfall, soil characteristics, and local supply and demand fluctuations they were able to persist within their current financial categories. Table 3 presents the estimated probability for a farm to persist in the current financial category or to transition to another financial category, i.e. transition probabilities. The diagonal can be interpreted as the probability of a farm to persist or remain in the same financial category. For example, a farm classified in Category 0 has a likelihood of 92% to remain in that state. The diagonal of probabilities indicates that farms in Category 1 and Category 3 are more likely to stay in their current financial categories than transition to any other financial category. Farms in Category 1 (financially favorable with positive NFI/AC and D/A below 0.4) had the highest probability (67%) indicating that Category 1 farms are most persistent. Close inspection of the probabilities along the diagonal shows that Category 1 and 3 hold similar probabilities, but Category 2 and 4 are not persistence. Farms in these two categories are likely to transition away from their current financial categories to another category. This phenomenon is due primarily to a farmer's ability to have more control of their D/A than their NFI/AC. Farms are likely to achieve positive NFI/AC and improve their standings, but their D/A is a longer-term challenge that is not easily changed. A final key observation that can be garnered from this table is the financial category that a farm is most likely to exit or enter the KFMA data set. In both cases (enter/exit) probabilities are evenly dispersed between 1 and 3%. This shows that KFMA is a diverse statewide dataset and does not favor any one type of farm, according to NFI/AC and D/A.

Figure 1 graphically presents the proportion of farms in each financial category (minus Category 0) for each year. The relationship between the four categories and how farms annually transition between categories is presented. Key events such as the spike in farms with positive NFI/AC during 1995 and 1996 can be observed. Following the Renewable Energy Act in 2007 farms begin to enter Category 1 leaving specifically Category 3. The softening of the commodity market in 2014 and a large portion of farms entering Category 2 and 4 with negative NFI/AC can be observed (Figure 1).



**Figure 1. Distribution of Kansas farms across financial vulnerability categories**

**Conclusions and Future Research**

Kansas farms for the last 22 years have shown that they do in fact exhibit persistence within Category 1 and Category 3, with positive NFI/AC. This indicates that year in and year out KFMA farms are able to beat the uncertainties and uncontrollable downfalls that were believed to be an inherent trait for agriculture. They consistently are able to generate a positive return, despite what their peers do. The transition probabilities not only dismiss this fallacy, but reinforce the emerging trend that specific farms consistently outperform their peers. The probabilities also show the impact of D/A ratios and how difficult they are to change. The transition probabilities between Category 2 and moving to Category 1 (0.49), and Category 4 and moving to Category 3 (0.42) are much greater. This indicates that D/A are not likely to change, whereas NFI/AC is easily changed. Farm and management

characteristics are taking center stage as the key to farm financial stability. Moving forward the research focus should be squarely positioned on proving which characteristics are most strongly correlated with success.

In following these results, the next focus of research should be on identifying farm characteristics of persistence farms as well as the characteristics of farms that transition between financial categories. A potential method for identifying those characteristics lies within an ordinal logit model or a multinomial logit model, depending upon the area of interest. Several characteristics have been hypothesized to have a large impact upon farm persistence. First and foremost is climate conditions (rainfall, temperature, soil types). The state of Kansas holds several distinct climate ranges with the semi-arid, warm southwest region with its Ulysses and Richfield silt loams to the wetter northeastern corner of the state with its glacial soil types. The variety and range of climates across the state means that a statewide comparison like above should be scrutinized to avoid comparing, you might say “apples to oranges”. Therefore, an additional focus should be paid to the regional associations that KFMA members are in so that they can better be compared to their peers. The second key characteristic believed to play a role in a farm’s category is their lifespan. Farms are expected to be at least 3 generations old and having been in the family farm forever. A younger farm may not be financially unstable, but because they carry a larger D/A due to the capital intensive nature of farm ground acquisition then they hold the potential for being Category 3. Not only does farm age play a role, but farm size could play a large role in a farm’s D/A ratio. Economies of scale could be lending themselves to a farm’s efficiency and profitability as well, allowing it to outperform its peers.

By attempting to identify characteristics of farms from each category, the hope is that poorer performing farms will be able to emulate their more stable and persistent peers, and the top performing farms will be able to see pitfalls of their more unstable and transient peers and avoid such mistakes.

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K-State Agricultural Economics | 342 Waters Hall, Manhattan, KS 66506-4011 | (785) 532-1504 | fax: (785) 532-6925

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