

## **6. Farm Profitability Persistence and Key Characteristics**

### **Jayce Stabel**

**<jstabel@ksu.edu>**

*Jayce Stabel is a recent masters degree graduate in Agricultural Economics department here at K-State. His thesis research primarily focused on the topic of farm financial stability and underlying factors that influence the health of Kansas farms. Born in Oklahoma and raised in southwestern Kansas, Jayce has been a part of swine, beef, and grain production on his family farm in Lakin, KS. He attended and completed his Bachelor's Degree in Agronomy from Kansas State University in 2014.*

### **Terry Griffin**

**<twgriffin@ksu.edu>**

*Dr. Terry Griffin is the cropping systems economist specializing in precision agriculture since joining Kansas State University in February 2015. He earned his bachelor's degree in agronomy and master's degree in agricultural economics from the University of Arkansas and his Ph.D. in Agricultural Economics with emphases in spatial technologies and farm management from Purdue University. He developed methods to analyze site-specific yield monitor data from field-scale experiments using spatial statistical techniques. Terry is a charter member of the International Society of Precision Agriculture. He received the 2014 Pierre C. Robert International Precision Agriculture Young Scientist Award for his work in data utilization. He has also received the 2012 Conservation Systems Precision Ag Researcher of the Year and the 2010 PrecisionAg Awards of Excellence for Research.*

### **Abstract/Summary**

*Farm-level data from the Kansas Farm Management Association (KFMA) were evaluated to determine the probability of farms transitioning between financial vulnerability categories. Although it is intuitive that farms can go from one profitability level to a higher (or lower) level, it was not clear how often farms transitioned between these levels. We present the probabilities and offer insights into what factors contributed to persisting within the current category or moving to another.*



# Estimating Farm Financial Stability and Characteristic Analysis

By  
Jayce Stabel and Terry Griffin  
Graduate Student of Agricultural Economics at Kansas  
State University

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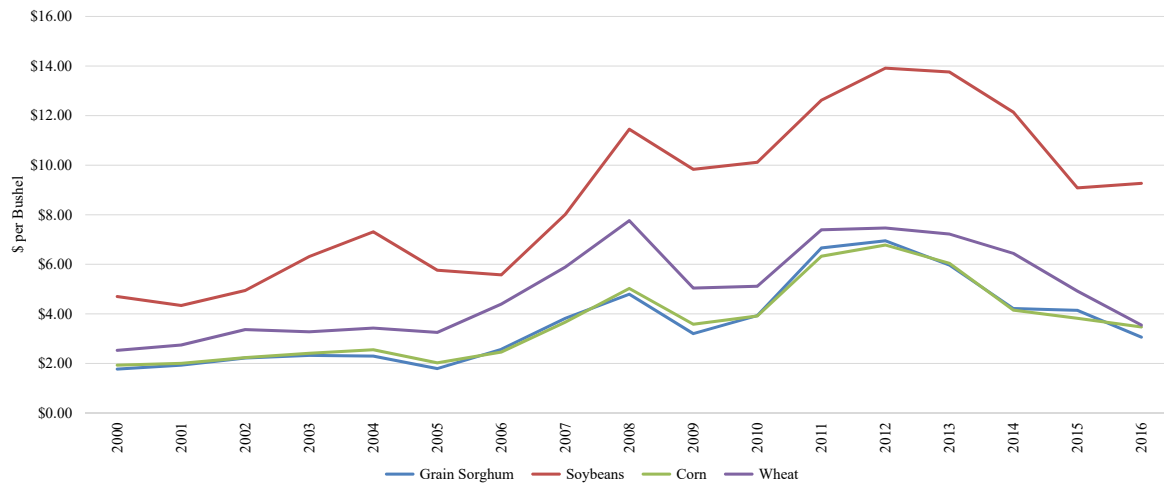


## Current Agricultural Outlook

- Kansas net farm income fell from 6<sup>th</sup> in the nation (\$5,162 M) down to 15<sup>th</sup> in nation (\$ 1,719 M)
- According to the USDA Agricultural Forecast 2016 and 2017 are expected to continue the trend that began in 2014 of decreasing net farm profits
- Debt to Asset ratio = 12.45% (2016) versus 22.19% (1985)
- Decreasing grain prices

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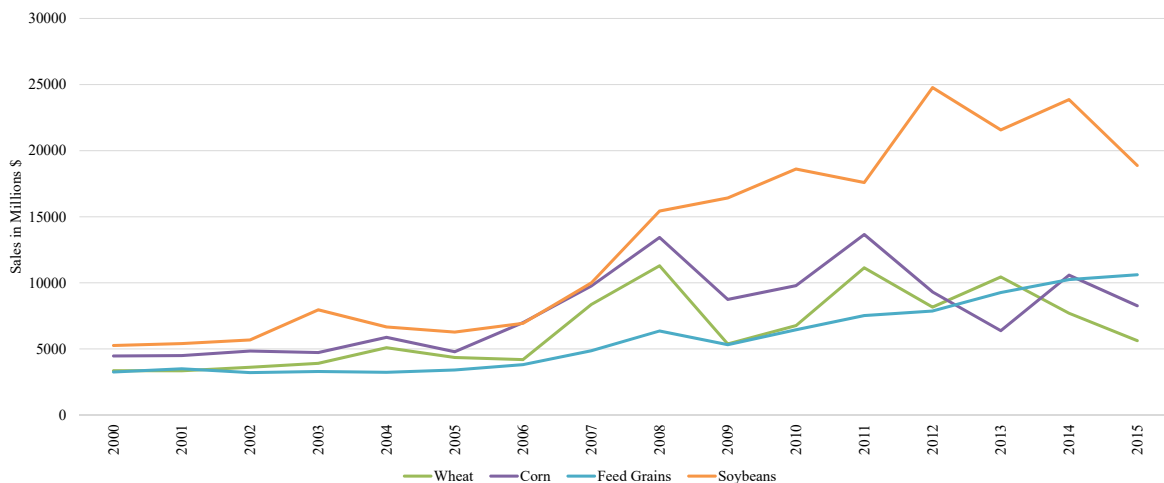
# Kansas Annual Grain Price Received



## Current Agricultural Outlook

- Geopolitical uncertainty strengthening the U.S. dollar and impairing U.S. export competitiveness, especially agricultural products
- Exports in all four of the major grain crops: corn, wheat, soybeans, and grain sorghum have decreased
- Farm prices have fallen as much as 50%

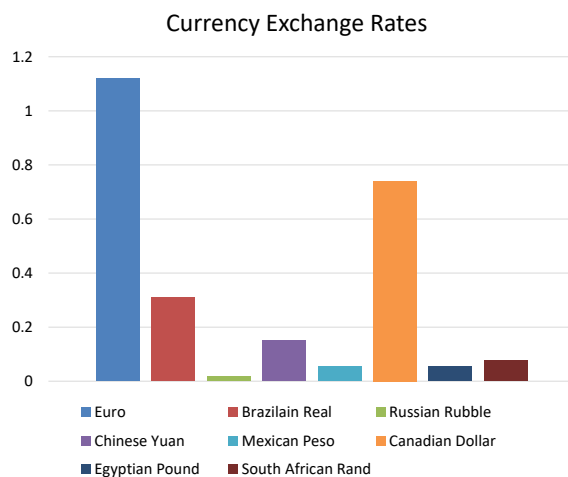
# U.S. Total Exports, 2015



# Current Agricultural Outlook

## • Current Exchange Rate as of 8/18/17:

- Euro - \$ 1.18 (E)
- Brazilian Real - \$ 0.31 (E)
- Russian Rubble - \$ 0.017 (E)
- Chinese Yuan - \$ 0.15 (I)
- Mexican Peso - \$0.056 (I)
- Canadian Dollar - \$ 0.79 (I/E)
- Egyptian Pound - \$ 0.056 (I)
- South African Rand - \$ 0.075 (proxy for African economies)





# Agricultural Lending

- Agricultural lenders are searching for weakness in their borrowers
- Production expenses have fallen slower than commodity prices
- 44% of farms have burn rates of less than 5 years
- 18% of farms classified as having significant deterioration in working capital
- This leads to increasing concern about financial stability of farmers



# Motivation

- Farming is a capital intensive enterprise with 87% of assets being comprised of land and machinery
- New Basel Capital Accord increased bank scrutiny leading to tighter lending rules and equity requirements
- Currently, NPV and Loss-Based Method loan evaluation methods are common
- Is this a fair method to estimate farm loan default probabilities?



# What is the question?

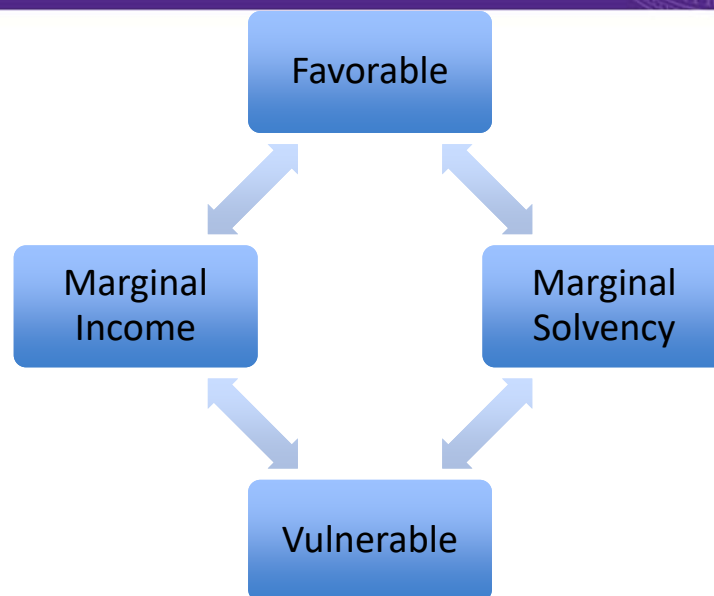


## Initial Assumption

- It is assumed that some farms will outperform their peers.
- This implies financial stability and unique characteristics that allow them to maintain financial stability.
  
- Is this assumption correct?

# What are Conditional Probabilities?

- Conditional probabilities were used to determine farm financial persistence
- The likelihood of a farm persisting in its current financial category or transitioning to a different category
- Conditional upon only the most recent category



# Farm Financial Categories

- The categories were
  - Using the Economic Research Service’s vulnerability benchmarks of Debt to Asset ratio of 0.4 and the net farm income per acre of \$0
- Four Different Categories were created:
  - Favorable: Farms with greater than \$0 NFI/Ac. and a D/A ratio below 0.4
  - Marginal Solvency: Farms with less than \$0 NFI/Ac. and a D/A ratio below 0.4
  - Marginal Income: Farms with greater than \$0 NFI/Ac. and a D/A ratio above 0.4
  - Vulnerable: Farms with below average NFI/Ac. and a D/A ratio above 0.4
- NFI/Ac. was the reported income per acre after operating expenses were removed divided by the number of Total Operated acres

# Farm Financial Categories

	Favorable	Marginal Income	Marginal Solvency	Vulnerable
<b>Debt to Asset</b>	Less than 0.4	Less than 0.4	Greater than 0.4	Greater than 0.4
<b>Net Farm Income Per Acre</b>	(+) positive	(-) negative	(+) positive	(-) negative





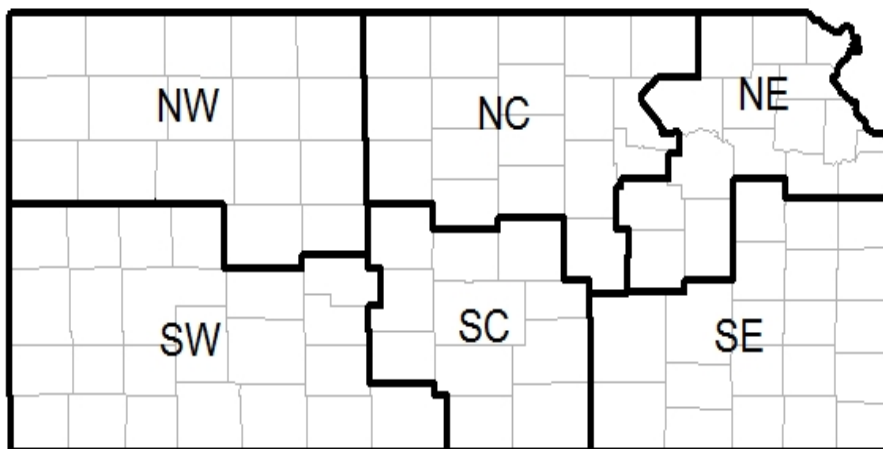
# First Things First

**The answer is only as good as the data used!**

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# Data Summary



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## Geographical Farm Distribution

KFMA District	Number of Observations	Percent of Farms
Southwest	1837	8%
Northwest	1998	9%
North Central	3880	17%
South Central	5065	22%
Northeast	3821	17%
Southeast	6276	27%



## Average KFMA Farm

- Farm Size = 1429 acres
- Operator Age in the mid-fifties
- Primary crop is wheat at 47% of the crop rotation
- Operating Expense = \$256,678
- Gross Profit Margin = 9%
- NFI/Ac. = \$51.73
- D/A = 0.36



## Conditional Probabilities

Categories	Favorable	Marginal Income	Marginal Solvency	Vulnerable
Favorable	0.86	0.07	0.06	0.01
Marginal Income	0.63	0.26	0.08	0.04
Marginal Solvency	0.16	0.01	0.70	0.12
Vulnerable	0.05	0.03	0.61	0.31



## Variables of Interest

- Crop Choice
  - Corn, Soybean, Wheat, and Grain Sorghum
- Farm Structure
  - Producer Age, Farm Size, % of Owned Land
- Financial
  - Gross Profit Margin and the Prior Year's Financial Category

# Multinomial Logit Model

- Multinomial logit models (MNL) are used to estimate the relationship between a set of regressor variables and multiple discrete responses. This discrete-choice model is used when multiple discrete outcomes arise. The strength of this method is the ability to analyze multiple outcome categories.
- 259 farms from KFMA
- 15 years (2000-2014)

## Expected Variable Impacts

Variable	Favorable	Marginal Income	Marginal Solvency	Vulnerable
Age	(+)	(+)	(-)	(-)
% Owned	(+)	(-)	(+)	(+)
% Corn	(+)	(-)	(+)	(-)
% Wheat	(+)	(-)	(+)	(-)
% Soybean	(+)	(-)	(+)	(-)
Gross Profit Margin	(+)	(-)	(+)	(-)
Farm Size	(+)	(-)	(+)	(-)
Lag 1	(+)	(+)	(-)	(-)
Lag 2	(+)	(+)	(-)	(-)
Lag 3	(+)	(+)	(-)	(-)

## Estimated Variable Signs

Variable	Favorable	Marginal Income	Marginal Solvency	Vulnerable
Age	(+)	(-)	(-)	(+)
% Owned	(-)	(-)	(+)	(-)
% Corn	(-)	(-)	(+)	(+)
% Wheat	(-)	(+)	(+)	(-)
% Soybeans	(-)	(-)	(+)	(+)
Gross Profit Margin	(+)	(-)	(+)	(-)
Farm Size	(+)	(-)	(-)	(+)
Lag 1	(+)	(+)	(-)	(-)
Lag 2	(+)	(+)	(-)	(-)
Lag 3	(+)	(+)	(-)	(-)

## Conclusions

- Farms will easily transition between positive and negative net farm incomes, but D/A ratios aren't likely to change quickly
- Top performing farms (Favorable) have 83% probability of financial stability
- Vulnerable farms have a 55% probability of leaving that category for Marginal Solvency
- Key Variables of interest
  - Crop Choice
  - Percentage of Owned Land



# Questions

*Thank you for your time.*