16. How Crop Insurance Affects Farm Business Survivability

Youngjune Kim **<yjkim@ksu.edu>**
Youngjune Kim is a Ph.D. student in the Department of Agricultural Economics at Kansas State University. He received his B.A. in Economics from Handong Global University, Korea, in 2012 and a M.A. in Agricultural Economics from Seoul National University, Korea, in 2014. After completing his master degree, he worked as a researcher at the Korea Rural Economic Institute (KREI) for a year and a half. His research is in the areas of the animal health, livestock marketing, and industrial organization.

Dustin Pendell **<dpendell@ksu.edu>**
Dustin Pendell joined the Department of Agricultural Economics as an Associate Professor in 2015. He received his BS in Agribusiness from Illinois State University, MS in Agribusiness Economics from Southern Illinois University and PhD in Agricultural Economics from Kansas State. His research and extension programs are focused in the areas animal health and livestock production economics. He teaches a course at the undergraduate level in data analysis and optimization. Prior to joining K-State, Dustin was a faculty member at Colorado State University where he conducted research on economic issues surrounding animal health and livestock and meat marketing. He has also taught undergraduate and graduate courses in agricultural marketing, production economics, and farm management.

Jisang Yu **<jisangyu@ksu.edu>**
Jisang Yu is an assistant professor in the department of Agricultural Economics, Kansas State University. He received a Ph.D. from University of California, Davis in 2016. He received a Bachelor's degree from Seoul National University in South Korea. His research focuses on analyzing economic consequences of risk management related farm polices both in developed and developing countries. His current research agenda can be described with following three pillars: 1) to measure/estimate various risks in terms of both actual distribution and subjective probability, 2) to analytically describe the optimal allocation of farm or household resources, and 3) to evaluate the impacts of various policy options on the resource allocations, both theoretically and empirically.

Abstract/Summary

This article identifies if, and to what degree, crop insurance payments have influenced farm business survival. The results suggest the farms that purchased crop insurance are prone to survive about seven years longer than farms that did not purchase crop insurance. Also, the results support our hypothesis that crop insurance is positively associated with farm business survivability by decreasing the rate of farm failure by 1.23%.

How Crop Insurance Affects Farm Business Survivability?

Youngjune Kim, Dustin L. Pendell, and Jisang Yu

Risk and Profit Conference

August 17-18, 2017

Background

- Farmers face risks related production and price
  - Globally, crop insurance is available for farmers and help them to cope such risks
- The U.S. Federal Crop Insurance Program (FCIP) expanded rapidly during last two decades
  - More than 0.3 billion acres of farmland with liabilities in excess of $102 billion are covered (RMA 2015)

Farm Exit

- The rate at which U.S. farms go out of business, or exit farming, is about 8 or 10 percent per year
- Driving forces behind farm exit
  - Bankruptcy
  - Passing management to a successor
  - Poor health or death
  - A career or lifestyle change

Motivation

- Crop insurance can increase farm survival
  - Crop insurance can positively affect farm value by reducing production or yield risk
- Crop insurance may not affect farm survival
  - The government offered disaster assistance
  - Farmers also have lots of other mean to manage risk through contracts, saving, storage, futures, and options
- Important to understand the impact of crop insurance on farm survival

Outline

Objective and Method

- The main objective is to identify if, and to what degree, crop insurance has influence farm business survival
- The causal impact of crop insurance on farm survival was estimated by
  - 1) Average Treatment Effect on the Treated (ATT)
  - 2) Kaplan-Meier Estimate
  - 3) Cox Proportional Hazard Model
- We used the Propensity Score Matching (PSM) method
  - PSM enables accurate evaluation of a policy

Crop Insurance as a Risk Management Tool

- Crop insurance can prevent underinvestment by providing stable internal cash flows
- Crop insurance affects farm value
  - Improved productivity is a candidate explanation to bridge the relationship between risk management and farm value

Data

- We set 1995 as the beginning year of analysis
  - After the Crop Insurance Reform Act of 1994 was implemented
- The data used are from the Kansas Farm Management Association (KFMA) and consists of a 1995-2015 panel of farms
- Among 1,292 total farms in 1996, 1,084 farms purchased crop insurance

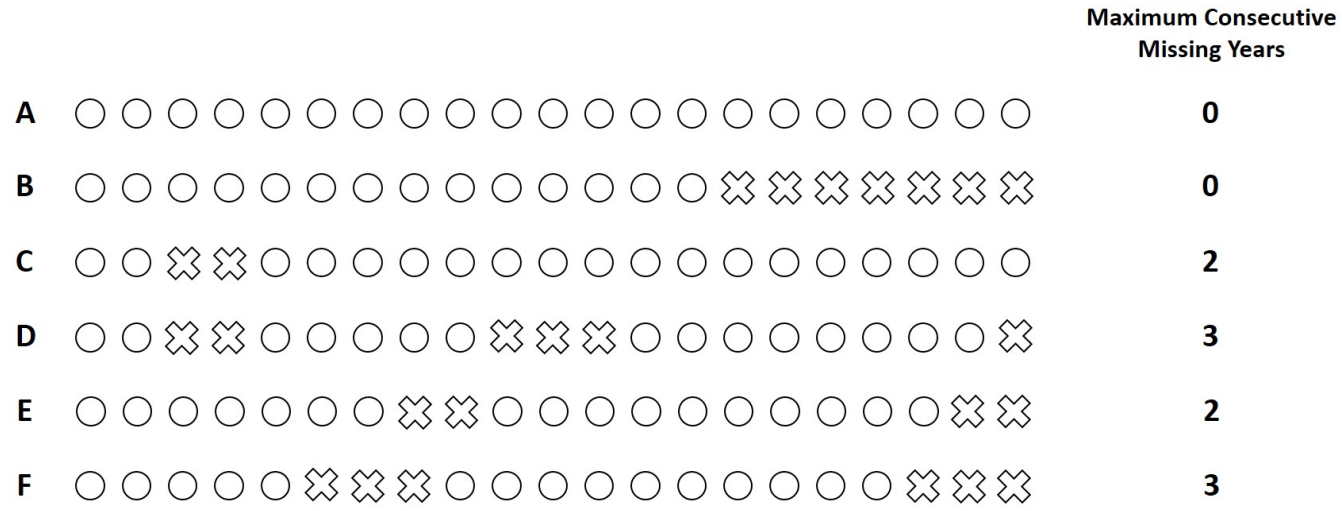
Crop Insurance Reform Act of 1994

- Producers of insurable crops were eligible to receive a basic level of coverage, Catastrophic risk protection program (CAT)
  - CAT initially covered 50% of a producer's approved yield at 60% of the expected market price
  - The premium cost of CAT coverage was fully subsidized by the government
  - Producers were required to pay a sign-up fee equal to $50 per crop per county
- CAT was mandatory in order to participate in farm programs
  - This mandate was repealed in 1996
- The 1994 act increased premium subsidy rates on coverage levels above 50% (buy-up levels)

Definition of Farm Exit

- Previous literature defined a farm as out of business if there is no response
- It is impossible to figure out a farm left the dataset is because 1) a farmer actually has gone out of business or 2) left the dataset but continued farming

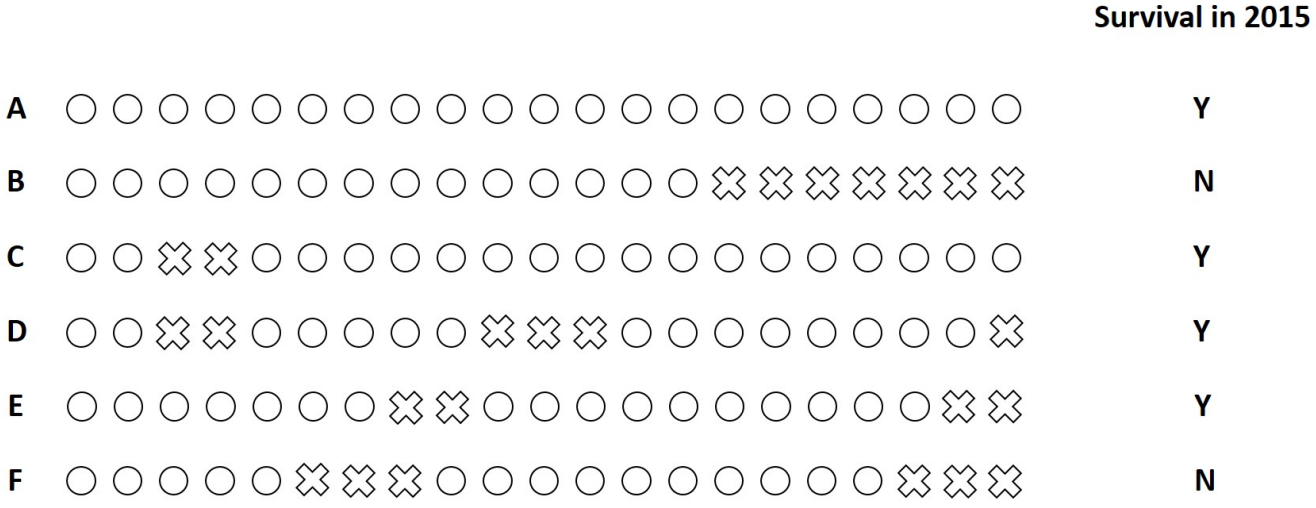
Average length of the Maximum Consecutive Missing Years



Average length of the Maximum Consecutive Missing Years in 1996: **2.66**

Average length of the Maximum Consecutive Missing Years

We define farm exit as a farm not being surveyed more than two years from the last survey year, 2015



Controlled Experiments

Plant Growth Chamber

Example of Treatment and Control 1

How does type of soil affect the rate of germination?

Example of Treatment and Control 1

- Outcome: The rate of germination
- Control Variables: The humidity level, the daylight level
- Treatment and Control
  - Treatment group: Pots filled with clay soil
  - Control group: Pots filled with sandy soil
- Treatment Effect =
  $Avg(Germination|Treatment) - Avg(Germination|Control)$

Example of Treatment and Control 2

How does polio vaccines affect the rate of polio?

Example of Treatment and Control 2

- Outcome: The rate of polio
- Control Variables: race, sex, family income
- Treatment and Control
  - Treatment group: Children treated with the polio vaccines
  - Control group: Children treated with the placebo
- Treatment Effect $= Avg(Polio|Treatment) - Avg(Polio|Control)$

Treatment and Control in Our Analysis

- Treatment group: Farms that purchased crop insurance in 1996
- Control group: Farms that **did not** purchase crop insurance in 1996
- What is the difference between our analysis and Example 1 & 2?

Comparison of Treatment and Control Characteristics

Without Matching

Variables	Mean treated	Mean control	P-value
Total crop acre	1,219	355	0.000
Operator's age	50	54	0.016
Crop labor percentage	0.805	0.449	0.000
Tenure*	0.324	0.547	0.000
Non-farm income	15,649	17,872	0.268
Debt asset ratio	0.490	0.340	0.008
Number of observation	893	123	-

* Tenure: A ratio of owned acres to total acres operated

Propensity Score Matching

- We match farms that purchased crop insurance to similar farm that did not, based on the similarities of explanatory variables
- After matching, the differences between treatment group and control group get smaller

Comparison of Treatment and Control Characteristics

With Matching

Variables	Mean treated	Mean control	P-value
Total crop acre	1,219	1,205	0.343
Operator's age	50	50	0.183
Crop labor percentage	0.805	0.895	0.000
Tenure	0.324	0.321	0.852
Non-farm income	15,649	12,748	0.003
Debt asset ratio	0.490	0.382	0.035
Number of observation	1074	1074	-

* Tenure: A ratio of owned acres to total acres operated

Methods

- Average Treatment Effect on Treated (ATT)
  - The impact of crop insurance on **survival year**
- Survival Analysis: A method used for analyzing data where the outcome variable is the survival time, or duration of time, until an event of interest happen
  - 1) Kaplan-Meier Estimate
    - Compare survival functions for treatment and control group
  - 2) Cox Proportional Hazard Model
    - The effects of crop insurance on **the probability of farm failure**

Average Treatment Effects on Treated (ATT)

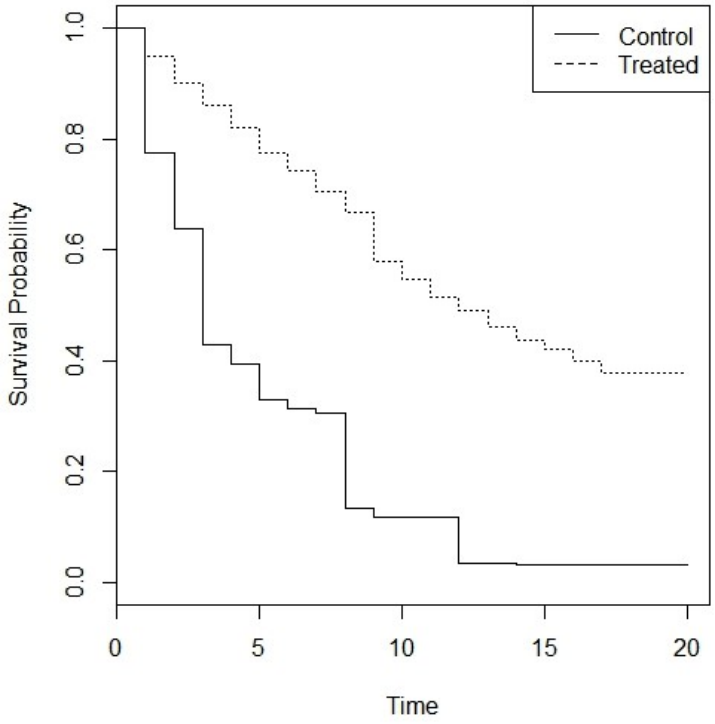
Treatment group are likely to stay in business about **seven** years longer

Variables	Coefficient	Standard Error
Crop insurance	7.073	1.595***
Number of observations		2148
Number of treated		1074
Number of control		1074

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Kaplan-Meier Estimate

Treatment group are more likely to stay in business longer



Cox Proportional Hazard Model

Crop insurance decrease the instantaneous rate of farm failure by **1.23** %

Variables	Coefficient	Standard Error
Crop insurance	-1.226	0.052***
Number of observations	2148	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Conclusion

- Crop insurance has a positive effect on farm business survival
- The results support the role of crop insurance as a risk management tool
  - Preventing underinvestment by providing stable internal cash flows
  - Affecting farm value by increasing productivity

Open Questions

- How does proposed budget cuts in crop insurance affect farm survival?
- How does lower net farm income in 2017 affect the impact of crop insurance on farm survival?
- What type of farm is affected more?
- How does non-farm income affect farm survival?