Optimal Climate Crop Insurance Strategy: Contrasting Insurer and Farmer Interests

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Introduction

• Predictability of seasonal climate variations can help in reducing farm risk by tailoring agricultural management strategies to mitigate the impacts of adverse conditions or to take advantage of favorable conditions.

• Crop insurance offers farmers economic stability under the uncertainty of future random events, including climate.

• Our hypothesis is that both conflicts and synergies exist between farmers and insurers regarding crop insurance selection and that they are influenced largely by climate variability.

• Thus, our main goal is to analyze the potential synergies and conflicts of interest between farmers and insurers in the selection of an optimal crop insurance contract. Special attention is given to how climate information influences this decision-making process.
Literature Review

• In general, studies on climate and crop insurance have focused on selecting the best insurance product for farmers (e.g., Cabrera et al., 2006; Leigh et al., 2001; Mjelde et al., 1996); or

• Have developed parameters for potential new crop insurance products (e.g., Turvey et al., 2006; Martin et al., 2001).

• Less frequently, researchers have taken the viewpoint of the insurer (e.g., Ker and McGowan, 2000).

• Few articles have explored the interaction between farmers and the insurer (e.g., Menrad et al., 2005; Wang et al., 2003), and none have formally included climate into the analysis.

• Thus, our paper adds to the literature by contrasting both viewpoints (farmer and insurer) in the assessment of an optimal crop insurance selection process under the influence of climate variability.
DATA

Jackson Co., FL (30.774N, 85.226W) farm
40 ha, non-irrigated, 50% peanut, 50% cotton
Dothan Loamy Sand soil type
65 (1939-2003) ENSO phases
Most popular crop insurance contracts
Premium subsidies included for insurer
Farm Net Income Before Insurance

## Farmer

- **Gain**
- **Loss**
  - Non protected income

## Insurer

- **Same Gain**
- **Less Gain**
  - Received premium
- **Loss**

### Strategy:

- **Maximize Gain**
- **Minimize Loss**

### Diagram:

- Arrows indicating strategy transitions:
  - a, b, c, d
METHODOLOGY

CLIMATIC

AGRONOMIC

ECONOMIC

Historical weather records

Biophysical crop models

Stochastic yield generator

Stochastic price generator

Farm decision model

Crop Insurance Strategy

Crop Insurance
Farmer

$$\max_x E\{U(W_f)\} = \sum_{n=1}^{N} U(W_n) + \sum_{j=1}^{2} Y_j P_j X_j + IY_j PB_j X_j - C_j X_j - Pr_j X_j / N$$

$$U(W_f) = W_f^{1-R_r} / (1 - R_r)$$

Insurer

$$\min_x E\{L\} = \sum_{n=1}^{N} \sum_{j=1}^{2} X_j IY_j PB_j - X_j Pr_j / N$$

$$CVaR_\alpha[L(x, \theta)] \leq \nu$$

Peanut

$$\sum_{m=1}^{9} X_{m,j} = 0.5$$

Cotton

$$\sum_{m=10}^{13} X_{m,j} = 0.5$$

$$X_m \geq 0$$
RESULTS

Farmer’s best section
Insurer’s best selection
Synergies and conflicts
Insurer loss ratio
Insurance: APH or MPCI, CRC, and CAT
Synergies

El Niño: 75APH-70APH

Neutral: 75APH-CAT, 80CRC-70APH, 75APH-65APH

La Niña: 75APH-CAT

All Years: 75CRC-CAT, 75APH-75APH
Indemnity paid / Premium received
Loss Ratio Target: 1.075 Average: 0.32

2004 RMA Cotton: 0.54 Peanut: 1.29

Frequency of loss ratio between 1 and 1.075

El Niño Neutral La Niña All years
Implications

- ENSO climate variability impacts farmer and insurer crop insurance selection
- Conflict of interest exists, but seems workable
- Premiums and/or subsidies could be decreased or better assigned
- Consistent with previous studies: Crop insurance could be privately promoted
- Further study including spatial distribution