Climate Variability and Crop Insurance: An Optimization Analysis

Glyen Holmes II  
MS Student  
Agribusiness Program, College of Agriculture and Food Sciences,  
Florida A&M University  
glyen_holmes@yahoo.com

Alfredo Lorenzo  
Professor  
Agribusiness Program, College of Agriculture and Food Sciences,  
Florida A&M University  
alfredo.lorenzo@famu.edu

Daniel Solís  
Assistant Professor  
Agribusiness Program, College of Agriculture and Food Sciences,  
Florida A&M University  
daniel.solis@famu.edu

Michael Thomas  
Professor  
Agribusiness Program, College of Agriculture and Food Sciences,  
Florida A&M University  
michael.thomas@famu.edu

Selected Poster prepared for presentation at the Southern Agricultural Economics Association’s 2016 Annual Meeting, San Antonio, Texas, February 6-9, 2016

Copyright 2016 by Holmes, Lorenzo, Solís and Thomas. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.
Agricultural production is a risky endeavor. Farmers face uncertain yield (revenues) due to climate conditions, pest infestations and other stochastic production factors. Crop insurance offers farmers economic stability under these environments. This study focuses on the impact of climate variability on row crop production in North Florida. The climate in Southeast US is influenced by El Niño Southern Oscillation (ENSO). Recent scientific advances have improved the ability to predict climate fluctuations and provide opportunities to improve the management of climate-associated risks for agriculture. The study case includes farmers growing four crops: corn, cotton, peanuts, and soybeans in Jackson County, Florida. We use enterprise budgets along with historical yield harvest data related to ENSO to create whole farm management of climate variability on row crop production in North environments. This study focuses on the impact of uncertain yield (revenues) due to climate conditions, pest infestations and other unavoidable liabilities. Agricultural production is a risky endeavor. Farmers face associated risks for agriculture. The objective of this study is to assess optimal crop insurance strategies for farmers under alternative climate scenarios. The specific objectives are:

1. Determine average crop production cost from yearly Enterprise Budgets
2. Trace El Niño Southern Oscillation (ENSO) phases from previous years
3. Conduct a linear program to optimize results to draw conclusions and implications

The specific objectives are:

- Determine average crop production cost from yearly Enterprise Budgets
- Trace El Niño Southern Oscillation (ENSO) phases from previous years
- Conduct a linear program to optimize results to draw conclusions and implications

Methods

A linear program model is used to optimize maximum profitability for each enterprise so farmers can better consider the best crop insurance to purchase.

\[ \sum_{j=1}^{n} (P_j \times X_j) - \sum_{k=0}^{n} (C_k \times X_k) \]

subject to

where: \( A_{jt} \) : amount of resource \( i \) consumed by each unit of activity \( j \) in period \( t \);
\( X_{jt} \) : level of activity \( j \) in period \( t \); and
\( B_{it} \) : amount of resource \( i \) available in period \( t \).

\[ \pi_t = P_t \times X_t \]

where:
- \( \pi_t \) : farm profit (gross margin) in period \( t \);
- \( P_t \) : product price for growing activity \( j \);
- \( X_t \) : level of activity \( j \);
- \( C_k \) : variable cost of activity \( k \); and
- \( X_k \) : level of activity \( k \).

Crop Insurance

- **Yield Protection**: is insurance covering yield losses from a farm or unit. It provides comprehensive protection against weather-related causes (drought, excessive moisture, hail, wind, frost, etc.), insects, disease and other unavoidable liabilities.
- **Revenue Protection**: Coverage provides protection against a loss in yield due to most all natural disasters.

Expected Results

- Determine the optimal value of an acre field from the linear program model that is irrigated or non-irrigated, along with the best choice of a crop insurance coverage.

Historical Yields

<table>
<thead>
<tr>
<th></th>
<th>El Nino</th>
<th>La Nina</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn (bu.)</td>
<td>58.56</td>
<td>67.9</td>
<td>76.1</td>
</tr>
<tr>
<td>Cotton (lbs.)</td>
<td>457.5</td>
<td>453.1</td>
<td>533</td>
</tr>
<tr>
<td>Peanuts (lbs.)</td>
<td>2402.2</td>
<td>2569.3</td>
<td>2380.7</td>
</tr>
<tr>
<td>Soybeans (bu.)</td>
<td>26.1</td>
<td>22.8</td>
<td>25.6</td>
</tr>
</tbody>
</table>

Average ENSO phase Prices

<table>
<thead>
<tr>
<th></th>
<th>El Nino</th>
<th>La Nina</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>2.34</td>
<td>2.21</td>
<td>2.42</td>
</tr>
<tr>
<td>Cotton</td>
<td>0.58</td>
<td>0.85</td>
<td>0.70</td>
</tr>
<tr>
<td>Peanuts</td>
<td>0.25</td>
<td>0.26</td>
<td>0.24</td>
</tr>
<tr>
<td>Soybeans</td>
<td>5.61</td>
<td>4.47</td>
<td>5.25</td>
</tr>
</tbody>
</table>

References


Acknowledgements

For more information contact author at glyen_holmes@fmu.edu, glyen_holmes@yahoo.com, or phone # (850) 209-9553