The Effects of the Agricultural Act of 2014 on the Optimal Choice of Farm-level Insurance Coverage Levels

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Crop Insurance Title is projected to cost twice the Commodity Title
Title I – Commodities (Programs)

- Eliminates:
  - Direct Payments
  - Counter-Cyclical Payments
  - Average Crop Revenue Election (ACRE)
  - SURE
- Retains marketing loans
- Provides a Transition Payment for Cotton in 2014
- Establishes:
  - Agricultural Risk Coverage (ARC) program to assist farmers when revenue (price times yield) drops due to low prices or weather disasters
  - Price Loss Coverage (PLC) program to assist farmers when commodity prices drop below reference levels
Title XI Crop Insurance

- Creates two new shallow loss county triggered programs
  - Supplemental Coverage Option (SCO)
  - Stacked Income Protection Program (STAX) for cotton
- Conservation Compliance for crop insurance
- Traditional crop insurance
  - Enterprise units by dryland/irrigated practice
  - Separate coverage level by practice
  - Numerous studies and pilots
Federal Crop Insurance Program Cost

- Premium Subsidies
- A&O Reimbursement
- Underwriting Loss

Fiscal Year

$ Millions
Subsidy Rates and Participation

1989-2013 Subsidy Percent and Net Acres Insured for U.S. Crop Insurance
Possible Choices

One time Producer Choice

1. Program Choice for the life of the bill (5 years)
   a. County triggered Ag Risk Coverage (ARC)
   b. Farm-triggered ARC
   c. Price Loss Coverage (PLC) [similar to counter-cyclical payment program]

2. SCO or STAX on planted acres every year (beginning in 2015) with a transition payment in 2014
ARC + Crop Insurance

Crop Insurance coverage level

86% Ag Risk Coverage Program 20 or 35% Co-Pay

76%

75%

Yield or Revenue Insurance

Farm or County Level Revenue Coverage (Cotton not eligible)

Yield or Revenue Coverage (Farm or Enterprise)
ARC + Crop Insurance

Crop Insurance coverage level

Yield or Revenue Insurance

Ag Risk Coverage Program

Co-Pay

Farm or County Level Revenue Coverage (Cotton not eligible)

Yield or Revenue Coverage (Farm or Enterprise Level)
SCO + Crop Insurance

- Optional County Yield or Revenue Coverage
- Cotton has the alternative of Area Revenue Coverage under STAX
- Farm Yield or Revenue Coverage
Policy context

• The question: Will producers adjust crop insurance coverage levels in response?
  • ARC can overlap with crop insurance coverage.
  • County triggered programs such as SCO and STAX do not allow overlap with individual coverage.
  • Subsidy levels differ from farm-level insurance.
  • There is basis risk with county triggered programs.
• My analysis is based on work with Eric O’Donoghue and Corey Miller that we hope to have out as a working paper soon.
Farm-level revenue insurance

- \( \text{RevInsIndem}_i = \max[0, (CL_i \times \max(EP, HP) \times APH_i) - (HP \times FY_i)] \)

- where \( EP \) and \( HP \) are the crop insurance pre-planting expected price and the harvest time price, respectively; \( CL_i \) is the coverage level; and \( APH_i \) is the farm’s actual production history (APH) yield and \( FY_i \).

- Revenue insurance is assumed to be actuarially fair, so on average the net indemnity to the producer is the expected indemnity amount (estimated through simulations) minus producer-paid premium. Crop insurance premiums are subsidized at rates that vary by coverage level.
County-based ARC

- Payment when market revenue measured at the county level for a particular crop falls within a fixed range of 86 to 76 percent of expected county revenue, which is determined from Olympic average of yields and prices over the previous five years. The payment function in county \( c \) is:

\[
AveRevPmt_c = 0.85 \times \min\{\max\{0, [(0.86 \times OlyAveRev_c) - Rev_c]\}, (0.10 \times OlyAveRev_c)\}
\]

- where \( OlyAveRev_c \) is the expected revenue and \( Rev_c \) is the market revenue for the producer’s county, \( c \).

- The 0.85 factor reduces the total payout of the program and acts as a co-payment.
- The range of 10 percent of the Olympic average revenue bounds this program to shallow losses.
- All enrolled producers in the county would receive a payment, and no premium would be charged for the coverage.
Price Loss Coverage (PLC)

- FSA delivered and functions much like CCP
- Payment = 85% x Base acres x base yield x [Reference price – maximum of loan rate or Market Year Average (MYA) price]
- Cotton not eligible
- Reference Prices
  - Corn, $3.70 per bushel.
  - Long and medium grain rice $14.00 per hundredweight
  - Soybeans, $8.40 per bushel
  - Peanuts $535.00 per ton
  - Wheat, $5.50 per bushel
  - Sorghum, $3.95 per bushel
- Could also opt for PLC and Supplemental Coverage Option (SCO)
SCO – Supplemental Coverage Option

- This insurance program would provide an indemnity payment when market revenue measured at the county level falls below 86 percent of the expected county revenue. The payment size would be determined by the proportion of the range of the loss below 86 percent down to the nominal coverage level of the producer’s farm-level crop insurance.

- The indemnity function for producer $i$ in county $c$ is:

$$SCOIndem_i = \min(\max\left(0, \frac{Rev_c}{ExpRev_c} \right), 1) \times (0.86 - CL_i) \times ExpRev_c$$

- where $Rev_c$ is market revenue for the producer’s county, $ExpRev_c$ is expected revenue for the county and $CL_i$ is the producer’s coverage level for farm-level revenue insurance.

- The payment would depend on an individual’s crop revenue insurance coverage level.

- A producer would pay 35 percent of the actuarially-fair premium (65 percent subsidy) for this supplemental coverage.
Methods

• Model several hundred counties for cotton, wheat, soybeans, rice and corn with data from 2004 to 2011
• Market-year average prices from NASS, 1974-2011
  • Relative price changes are computed
• Representative farm-level yield variability obtained by:
  • Searching for an expansion factor, K, which when multiplied by county yield deviations will produce the RMA 65% coverage crop insurance rate

\[ \tilde{y}_{ft} = \mu_f + \beta(\tilde{y}_{ct} - \mu_c) + \varepsilon_{ft} \quad \forall \ f \in c \]
Methods

- Market-year average prices from NASS, 1974-2012
  - Relative price changes are computed
- County, state, and national yields from NASS, 1975-2012
  - Yields detrended
- Simulations maintain spatial correlations by taking random draws for all locations and all crops simultaneously
Expected Utility Maximization

- We assume that producers maximize a constant relative risk aversion (CRRA) utility function, represented mathematically as:

\[(1) \quad E(U) = \sum_{t=1}^{n} \omega_t \frac{W_t^{1-r}}{1-r}\]

- A moderately risk-averse producer \(r=2\)
- \(\omega_t\) is the probability weight
- \(W_0\) represents initial wealth. Then \(W_t = W_0 + NR_t\), where \(NR_t\) is a stochastic annual net returns
- We set the farm’s initial wealth equal to $1,000,000. Certainty equivalents (CE) are calculated as:

\[(2) \quad CE = [(1 - r)E(U)][(1 - r)E(U)](\frac{1}{1-r})\]
Scenarios Evaluated

• Individual-level crop revenue insurance only,
• Individual-level crop revenue insurance and ARC,
• Individual-level crop revenue insurance, PLC, and SCO
• For cotton only individual-level crop revenue insurance and STAX.
• All farms are assumed to have purchased enterprise unit coverage at the individual level.
## Representative Counties

<table>
<thead>
<tr>
<th>Crop</th>
<th>Actual Planted Acres</th>
<th>Simulation Data Set Planted Acres</th>
<th>Acres Covered by Simulation Data Set Percent</th>
<th>Counties Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>86,001</td>
<td>76,992</td>
<td>90</td>
<td>1,107</td>
</tr>
<tr>
<td>Rice</td>
<td>2,689</td>
<td>2,151</td>
<td>80</td>
<td>48</td>
</tr>
<tr>
<td>Soybeans</td>
<td>75,046</td>
<td>60,578</td>
<td>81</td>
<td>940</td>
</tr>
<tr>
<td>Wheat</td>
<td>54,409</td>
<td>31,276</td>
<td>58</td>
<td>733</td>
</tr>
</tbody>
</table>
Calibration of models

<table>
<thead>
<tr>
<th>Crop and Location</th>
<th>Average Calculated Optimal Coverage Level (%)</th>
<th>Average Coverage Level with Most Acres Enrolled, 2013 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn, Iowa</td>
<td>79.0</td>
<td>81.7</td>
</tr>
<tr>
<td>Corn, Missouri</td>
<td>75.0</td>
<td>74.2</td>
</tr>
<tr>
<td>Rice, All</td>
<td>75.9</td>
<td>71.3</td>
</tr>
<tr>
<td>Soybeans, Illinois</td>
<td>79.5</td>
<td>78.5</td>
</tr>
<tr>
<td>Soybeans, North Carolina</td>
<td>75.0</td>
<td>69.9</td>
</tr>
<tr>
<td>Wheat, Kansas</td>
<td>73.0</td>
<td>71.4</td>
</tr>
<tr>
<td>Wheat, North Dakota</td>
<td>71.0</td>
<td>70.5</td>
</tr>
</tbody>
</table>
Average certainty equivalents by combinations of individual-level crop revenue insurance and county-level ARC, or PLC + SCO

<table>
<thead>
<tr>
<th>Crop</th>
<th>(1) Crop Revenue Insurance Only</th>
<th>(2) Crop Revenue Insurance and ARC</th>
<th>(3) Crop Revenue Insurance, PLC and County-level SCO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Certainty Equivalent</td>
<td>Increase in CE from Crop Insurance Only CE</td>
<td>Increase in CE from Crop Insurance Only CE</td>
</tr>
<tr>
<td>Corn</td>
<td>$712,225</td>
<td>2.8</td>
<td>2.3</td>
</tr>
<tr>
<td>Soybeans</td>
<td>$538,713</td>
<td>2.4</td>
<td>2.3</td>
</tr>
<tr>
<td>Rice</td>
<td>$882,044</td>
<td>3.4</td>
<td>3.9</td>
</tr>
<tr>
<td>Wheat</td>
<td>$347,825</td>
<td>2.5</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Expected ARC Payouts drop quickly

National Average Simulated Corn ARC

County ARC Start price = $3.90
Implications for Crop Insurance Coverage

<table>
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<tr>
<th>Crop</th>
<th>Policy Combination</th>
<th>Percent of Counties in Various Coverage Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Corn</td>
<td>Insurance Only</td>
<td>0</td>
</tr>
<tr>
<td>Corn</td>
<td>With ARC</td>
<td>0</td>
</tr>
<tr>
<td>Corn</td>
<td>With PLC + SCO</td>
<td>0</td>
</tr>
<tr>
<td>Rice</td>
<td>Insurance Only</td>
<td>0</td>
</tr>
<tr>
<td>Rice</td>
<td>With</td>
<td>0</td>
</tr>
<tr>
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<td>Soybeans</td>
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<tr>
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Soybean change in individual-level crop revenue insurance with SCO insurance

Optimal coverage declines to 75%
Optimal coverage remains at 75%
Corn change in individual-level crop revenue insurance with SCO insurance

Optimal coverage declines to 75%
Optimal coverage remains at 75%
Discussion

• Results suggest some reduction in coverage levels
• The recent popularity of enterprise units underlying these results
• Questions
  • Will producers behave as an expected utility model predicts?
    • Perceptions of gaming the program
    • Will producers prefer a free program or a potentially more lucrative program that has a premium?
  • What role would delivery by FSA versus crop insurance industry play?
  • What role will complexity play in the decision?
Final Thoughts

- Farm Bills are getting harder to pass
- Expect
  - less subsidy in future
  - more ties to environmental outcomes
  - more attempts to insure the uninsurable
- Dialogue about what is the appropriate role for government
  - Subsidy
  - provision