Effects of Crop Insurance and Government Payments on Annual Financial Risk

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Talk Outline

• How are option premiums determined?
• Effects of hedges, puts, and insurance on risk
• How do commodity programs affect risk?
• How much risk is left over to reward management?
• Discussion
Per-Bushel Cost of a Call Option on December Corn Futures (Futures price = 234.75)
Distribution of December Futures Prices as of March 7, 2005
What is the probability of a particular price outcome?

What is the option payoff if that price occurs?

Multiply the probability by the payoff at that price.

0.045 x 0.55 = $0.023

Repeat for all outcomes

What is the strike price?

5.2% chance that price is between $1.70 and $1.80

What is the option payoff if that price occurs?

$0.55

Determining a Put Option Premium
Summing up all outcomes: $0.17 for a $2.30 put option
Powesheik County Soybean Yields: 1957 to 2004

Year
bu/ac

Distribution of Farm (not field) Yields for an Average Poweshiek County Farmer
Per-Acre Yield Option Premiums for Alternative Strike Yield Amounts (Price = $2.30/bu)
Crop Insurance Premiums for Different Coverage Levels  
(Price = $2.30/bu)
Unsubsidized Crop Insurance Premiums for Different Coverage Levels (Price = $2.30/bu)
Crop Insurance Premiums for Different Coverage Levels
(Price = $2.30/bu)

Coverage level
$/acre

"Best" Estimate at Enterprise Unit
Basic Units
Enterprise units

Coverage level

$/acre

60% 65% 70% 75% 80% 85% 90%
Crop Insurance Premiums for Different Coverage Levels
(Price = $2.30/bu)
Distribution of Corn Harvest Revenue Less $180 Variable Cost

$/acre

probability

$/acre
Distribution of Net Revenue with 75% Yield Insurance (APH)
Distribution with Yield Insurance and 75% Hedge
Distribution Using Yield Insurance and Put Options

![Chart showing probability distribution for $/acre.](chart.png)
Distribution with 75% RA and Hedge

$/acre probability

$/acre
Distribution with 75% RA-HPO and Hedge

$/acre

probability

$/acre
Structure of Program Payments for Corn

- **Target Price**
  - Fixed Payment: $2.63
  - Counter-Cyclical Payment: $2.35
  - Loan Deficiency Payment: $1.95

- **Loan Rate**
  - Regardless Of Market: $0.28

- **Prod Req.**
  - Not Tied To Prod

*Only If...*
Distribution of Net Revenue Plus LDPs

-100 -70 -40 -10 20 50 80 110 170 200 230 260 290 320 350 380 410 440 470 500 530 560
$/acre
probability

$/acre
Risk Free Farming?

probability

$/acre

$/acre
Reduced Risk

• With no insurance or government programs:
  – Average return over variable cost = $117/ac
  – 5.2% probability of not covering $180 variable cost

• With all government programs and insurance:
  – Average returns over variable cost = $207/ac
  – 5.9% probability that returns are less than $117/ac
Costs of Benefits of Crop Insurance
Decisions

• What product to buy?
  – APH, RA, RA-HPO, CRC, GRP, GRIP, GRIP-HRO

• What coverage level to buy?
  – CAT, 65%, 70%, 75%, 80%, 85%

• What unit structure to use?
  – (optional, basic, enterprise, whole-farm)
## Effects of Coverage and Unit Structure on Premium

<table>
<thead>
<tr>
<th>Coverage Level</th>
<th>65%</th>
<th>75%</th>
<th>85%</th>
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<tbody>
<tr>
<td><strong>Total Premium</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Optional</td>
<td>6,749</td>
<td>16,594</td>
<td>32,478</td>
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<tr>
<td>Enterprise</td>
<td>4,545</td>
<td>12,425</td>
<td>24,610</td>
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<td>Whole-Farm</td>
<td>2,440</td>
<td>10,270</td>
<td>21,870</td>
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<td><strong>Producer Premium</strong></td>
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<tr>
<td>Optional</td>
<td>2,767</td>
<td>7,452</td>
<td>20,136</td>
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<tr>
<td>Enterprise</td>
<td>1,863</td>
<td>5,591</td>
<td>15,258</td>
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<tr>
<td>Whole-Farm</td>
<td>1,000</td>
<td>4,621</td>
<td>13,559</td>
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<tr>
<td></td>
<td>65% to 75%</td>
<td>75% to 85%</td>
<td></td>
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<tr>
<td>--------------------------</td>
<td>--------------</td>
<td>--------------</td>
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<tr>
<td>Optional</td>
<td>9,845</td>
<td>15,884</td>
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<tr>
<td>Enterprise</td>
<td>7,880</td>
<td>12,185</td>
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<tr>
<td>Whole-Farm</td>
<td>7,830</td>
<td>11,600</td>
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<th>65% to 75%</th>
<th>75% to 85%</th>
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<tr>
<td>Optional</td>
<td>4,685</td>
<td>12,684</td>
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<tr>
<td>Enterprise</td>
<td>3,728</td>
<td>9,667</td>
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<tr>
<td>Whole-Farm</td>
<td>3,621</td>
<td>8,938</td>
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## Expected rate of return from increasing coverage

<table>
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<tr>
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<th>65% to 75%</th>
<th>75% to 85%</th>
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<tbody>
<tr>
<td>Optional</td>
<td>110%</td>
<td>25%</td>
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<tr>
<td>Enterprise</td>
<td>111%</td>
<td>26%</td>
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<tr>
<td>Whole-Farm</td>
<td>116%</td>
<td>30%</td>
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Expected rate of return to changing unit structure

<table>
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<tr>
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<th>Whole-Farm to Enterprise</th>
<th>Enterprise to Optional</th>
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<tr>
<td>65%</td>
<td>144%</td>
<td>144%</td>
</tr>
<tr>
<td>75%</td>
<td>122%</td>
<td>124%</td>
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<tr>
<td>85%</td>
<td>61%</td>
<td>61%</td>
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Distribution of Returns by Unit Structure

Freq. (out of 5K)

Net Return

-80 -40 0 40 80 120 160 200 240 280 320 360 400

No Insurance
Optional Units
Enterprise Units
Whole Farm
GRIP and GRIP-HRO

- GRIP guarantee =
  \[ \text{Factor} \times \text{CBOT Springtime Price} \times \text{Expected County Yield} \]

- GRIP-HRO guarantee =
  \[ \text{Factor} \times \text{CBOT Fall or Spring Price} \times \text{Expected County Yield} \]

Factor lies between 0.6 and 1.5.
Who Should Buy GRIP?

- Farmers who do not have a representative APH yield
- Farmers who are lower risk than that assumed in APH program
- Farmers with yields that are highly correlated with county yields
GRIP and GRIP-HRO in Poweshiek County  
(Expected Yield = 154.9 bu/ac)

<table>
<thead>
<tr>
<th>Maximum Coverage</th>
<th>Per Acre ($/acre)</th>
<th>Total Premium ($/acre)</th>
<th>Producer Premium ($/acre)</th>
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<tbody>
<tr>
<td>GRIP</td>
<td>$553</td>
<td>$32.30</td>
<td>$14.53</td>
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<tr>
<td>HRO</td>
<td>$553</td>
<td>$47.28</td>
<td>$21.28</td>
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</table>
Historical Indemnities that Would Have Been Paid Out Under GRIP and GRIP-HRO in Powesheik County

$/acre

Historical Indemnities that Would Have Been Paid Out Under GRIP and GRIP-HRO in Powesheik County


$/acre


Historical Indemnities that Would Have Been Paid Out Under GRIP and GRIP-HRO in Powesheik County

$/acre

GRIP
HRO
Payoff from GRIP and GRIP-HRO

- Total payout = 6.2% of liability for GRIP and 7.6% of liability for HRO from 1975 to 2004.
- Premium rate = 5.84% of liability from GRIP and 8.55% of liability from GRIP-HRO.
- Since 1975, rate of return = 6% for GRIP and -12% for HRO.
Subsidized rate of return for GRIP and GRIP-HRO

• 2005 Premium = $14/acre for GRIP and $21 for GRIP-HRO

• Expected Payout from 1975 to 2004: $34 for GRIP and $42 for HRO

• Expected Payout from 1957 to 2004: $27 and $39.

• Expected return = $20 or $13 per acre for GRIP, $21 or $18 per acre for HRO.
Distribution with 90% GRIP

$/acre

probability

$/acre
How Does GRIP-HRO Perform Relative to the Gold Standard?
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- Discussion