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 Put Option on December Corn Futures (Futures price = 227.5)
Per-Bushel Cost of a Call Option on December Corn Futures (Futures price = 227.5)
Distribution of December Futures Prices as of Feb 4, 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.

0.052 x 0.55 = $0.0286

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

$0.55

Repeat for all outcomes

Determining a Put Option Premium
Summing up all outcomes: $0.19 for a $2.30 put option
Distribution of Farm (not field) Yields for an Average Boone 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)
Distribution of Corn Harvest Revenue Less $180 Variable Cost

Probability distribution graph showing the distribution of corn harvest revenue less $180 variable cost. The x-axis represents the revenue in dollars per acre, ranging from -100 to 560, and the y-axis represents the probability, ranging from 0.00 to 0.12.
Distribution of Net Revenue Hedging 75% of Expected Production

$/acre

probability

$/acre
Distribution of Net Revenue Hedging 75% of Expected Production

$/acre

probability

$/acre
Distribution Hedging 75% of Expected Production with Put options

The graph shows the probability distribution of $/acre with a range from $-100 to $500. The x-axis represents the $/acre values, and the y-axis represents the probability. The distribution is skewed, indicating a higher probability of lower $/acre values compared to higher values.
Corn Acres Insured in Boone County in 2004

- Actual Production History
- Crop Revenue Coverage
- Revenue Assurance
- Group Risk Income Protection
- Group Risk Plan

Coverage Level:
- 50%
- 60%
- 65%
- 70%
- 75%
- 80%
- 85%
- 90%

Acres:
- 0
- 5,000
- 10,000
- 15,000
- 20,000
- 25,000
- 30,000
Distribution with Yield Insurance and 75% Hedge

probability

$/acre

$-100 -70 -40 -10 20 50 80 110 140 170 200 230 260 290 320 350 380 410 440 470 500 530 560

$/acre

Distribution Using Yield Insurance and Put Options

The graph shows the distribution of probabilities across different $/acre values. The x-axis represents the $/acre values ranging from $-100 to $560, while the y-axis represents the probability values ranging from 0.00 to 0.12. The distribution is skewed with a peak at around $140 to $170, indicating higher probabilities for these values.
Distribution with 75% RA and Hedge

![Graph showing distribution with 75% RA and Hedge. The x-axis represents $/acre, and the y-axis represents probability. The graph shows a distribution with a peak at around $150/acre, with probabilities decreasing as the value of $/acre increases or decreases.]
Structure of Program Payments for Corn

Target Price

Not Tied To Prod

Prod Req.

Fixed Payment

Loaned Rate

Counter-Cyclical Payment

Loan Deficiency Payment

Regardless Of Market

Only If...

$2.63

$0.28

$2.35

$1.95
Risk Free Farming?

Probability distribution of $/acre income.
Reduced Risk

• With no insurance or government programs:
  – Average return over variable cost = $143/ac
  – 3.8% probability of not covering $180 variable cost

• With all government programs and insurance:
  – Average returns over variable cost = $235/ac
  – 5.6% probability that returns are less than $143/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>
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<tr>
<td>Optional</td>
<td>6,749</td>
<td>16,594</td>
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<td>Whole-Farm</td>
<td>2,440</td>
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<td><strong>Producer Premium</strong></td>
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<td>1,863</td>
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<td>Whole-Farm</td>
<td>1,000</td>
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<td>65% to 75%</td>
<td>75% to 85%</td>
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<tr>
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<td>Whole-Farm</td>
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<td>11,600</td>
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<tr>
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<td>3,728</td>
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<td>Whole-Farm</td>
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<td>65% to 75%</td>
<td>75% to 85%</td>
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<tr>
<td>----------------------</td>
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</tr>
<tr>
<td>Optional</td>
<td>110%</td>
<td>25%</td>
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<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

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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>
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<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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GRIP and GRIP-HRO

- GRIP guarantee =
  Factor*CBOT Springtime Price*Expected County Yield

- GRIP-HRO guarantee =
  Factor*CBOT Fall or Spring Price*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 Boone County (Expected Yield = 167.5 bu/ac)

<table>
<thead>
<tr>
<th></th>
<th>Maximum Coverage Per-Acre $/acre</th>
<th>Total Premium $/acre</th>
<th>Producer Premium $/acre</th>
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<tr>
<td>GRIP</td>
<td>570.34</td>
<td>33.59</td>
<td>15.12</td>
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<tr>
<td>GRIP-HRO</td>
<td>570.34</td>
<td>42.20</td>
<td>18.99</td>
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Historical Indemnities that Would Have Been Paid Out Under GRIP and GRIP-HRO in Boone County

$/acre

GRIP
HRO

Payoff from GRIP and GRIP-HRO

• Total payout = 7.5% of liability for GRIP and 8.2% of liability for HRO from 1975 to 2004.

• Premium rate = 5.89% of liability from GRIP and 7.4% of liability from GRIP-HRO.

• Since 1975, rate of return = 26.5% for GRIP and 11.1% for HRO.
Subsidized rate of return for GRIP and GRIP-HRO

- 2005 Premium = $15/acre for GRIP and $18 for GRIP-HRO
- Expected Payout from 1975 to 2004: $42 for GRIP and $47 for HRO
- Expected Payout from 1957 to 2004: $34 and $42.
- Expected return = $25 or $19 per acre for GRIP, $29 or $24 per acre for HRO.
Distribution with 90% GRIP

$/acre

probability

$/acre
Distribution with 90% GRIP-HRO

$/$acre

probability

$/acre

probability

-100 -70 -40 -10 20 50 80 110 140 170 200 230 260 290 320 350 380 410 440 470 500 530 560
How Does GRIP-HRO Perform Relative to the Gold Standard?

The diagram shows the probability of different $/acre values for RA + DP, LDP, CCP and GRIP + DP, LDP, CCP. The x-axis represents $/acre values, and the y-axis represents probability. The comparison highlights the performance of GRIP-HRO against the gold standard.
Impact of Proposed Changes to Marketing Loan Program

Production (billion bushels)

Revenue ($ billion)

Market

Market+CCP+LDP

Prod. at Trend*Effective Target Price

Market+AdjCCP

Market+CCP+AdjLDP

Legend:

- Market
- Market+CCP+LDP
- Prod. at Trend*Effective Target Price
- Market+AdjCCP
- Market+CCP+AdjLDP
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• Discussion