Crop Insurance and Marketing: Together the Most Successful Tool

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Kentucky Producer
Farmers are paid to take risks. -They face weather, price and input uncertainty -They face physical risks and financial risks. We cannot eliminate risk only manage it!
You never go broke taking a profit

Don’t sell something you don’t have
Background

• Often you will hear ‘you should hedge up to your guaranteed bushels’
  
  • Or

• Grain marketing specialists will tell you to use forward contracting to reduce risk
  
  ▪ But how much of each tools should a producer use?
Crop insurance program has evolved into the largest government supported risk program for producers

- Acres increased from 100 in 1994 to 279 million in 2012
  - 175 of the 279 million are under revenue protection policy
  - Revenue protection (RP) insures both prices and yields

<table>
<thead>
<tr>
<th>Nebraska</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liability</td>
<td>$5.9 Billion</td>
<td>$6.2 billion</td>
</tr>
<tr>
<td>Acres insured</td>
<td>9.0 million</td>
<td>9.0 million</td>
</tr>
<tr>
<td>Premiums</td>
<td>429 million</td>
<td>456 million</td>
</tr>
<tr>
<td>Indemnities</td>
<td>1.2 billion</td>
<td>306 million</td>
</tr>
<tr>
<td>Corn loss ratio</td>
<td>6.91</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Kentucky Corn Yield Deviation from Trend, 1966 to 2013
Nebraska Non-Irrigated Corn Yield Deviation from Trend, 1980 to 2013
Nebraska Corn Loss Ratio

Average Loss Ratio = 5.00
- For every $1 paid in premiums producers have received $5 back, on average
Producer Motivation

• At the beginning of each year the farm is concerned with two things
  
  • Positive expected income
  
  • Farm survival (surviving a rare event (we assume this to be 1 in 100 year event or 18% chance of occurring in 20 years))
Motivation

• How can forward contracting (private tool) and crop insurance (public tool) interact to reduce revenue risk
  • Answer depends upon farm specific characteristics
    • Farm yields (determines guarantee)
    • Farm yield-price relationship
  • Crop insurance contract
    • About 200 different contract combinations exist

• Misunderstanding of these interactions could lead to an inefficient combination of risk and expected income
Crop Insurance

• First requirement – Actual Production History (APH) needs to be as close to expected production as possible
  • This drives how ‘useful’ (i.e., impacts probability of receiving an indemnity) crop insurance will be
  • Two producers both expect 150 bpa. Producer ‘a’ has an APH of 140 and producer ‘b’ is 100 (b)
    • Selecting a 80% coverage level
      • a’s guarantee = 112 bpa
      • b’s guarantee = 80 bpa
  • Value = average of previous years yields, therefore we can say APH is path dependent
Crop Insurance

- Producer makes a number of choices each year when signing up (I will use Multiple Peril Policy’s for examples)
  - **Trend adjustment**
    - Availability depends upon county
      - Corn – All but 2 counties in NE qualify
      - Soybeans – check county availability
      - Wheat – check county availability
    - Need reason not to use it
      - Small number may do this
    - Represents only other way to increase guarantee besides coverage level
Crop Insurance

• Three choices make up the insurance contract
  • **Unit type** – represents the size of the ‘field’
    • Four types available but only two are typically used – Optional (field) and Enterprise (one policy per crop)
  • **Insurance type** – yield or revenue
  • **Coverage level (or deductible)** – select between 50 and 85% in 5% increments
• Without actual production history, producer can make use of transitional yields (T-yields)

• **Indemnity and premium depend upon the insurance contract AND producer specific info**
<table>
<thead>
<tr>
<th>Coverage Level</th>
<th>Non-Enterprise</th>
<th>Enterprise</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td>0.67</td>
<td>0.8</td>
</tr>
<tr>
<td>55%</td>
<td>0.64</td>
<td>0.8</td>
</tr>
<tr>
<td>60%</td>
<td>0.64</td>
<td>0.8</td>
</tr>
<tr>
<td>65%</td>
<td>0.59</td>
<td>0.8</td>
</tr>
<tr>
<td>70%</td>
<td>0.59</td>
<td>0.8</td>
</tr>
<tr>
<td>75%</td>
<td>0.55</td>
<td>0.77</td>
</tr>
<tr>
<td>80%</td>
<td>0.48</td>
<td>0.68</td>
</tr>
<tr>
<td>85%</td>
<td>0.38</td>
<td>0.53</td>
</tr>
</tbody>
</table>
Objective Function

- Crop Income = yield*fall cash price
  + Crop Insurance(APH Yield, coverage level (65-85%), unit type (enterprise), insurance type [ (RP, RP-HPE) (base price, harvest price)], trend adjustment, premium)
  + hedged yield*hedged price
  + hedging cost (buying back over contracted bushels, interest on margin calls)

- **Balance Risk vs. Reward.** Risk = 1 in 100 year event. Reward = expected income
Modeling 2014 Income Uncertainty

- Focus on net income
- Crop: Corn

- Revenue = yield*price
  - Empirical yield distribution = Producer yield data

- Price probability distribution
  - December 2014 futures market options prices
    - Contains all market info available

- Cost
  - Break cost into fixed and variable portion
    - Cost is a function of yield = $0.58 per bushel
Farm Corn Yield

DIRTY DUCKS = Yields in 1983 and 2012. Rare events do happen!

Farm average = 144.4 bu/acre

Most years expect yields between 110 and 170 bu/acre.
Farm Corn Yield
Crop Income With and Without Insurance

- Coverage level: 80%
- Revenue Protection (RP) and RP- Harvest Price Exclusion

Insurance payments
Crop Income and Insurance

- With no insurance payments difference is the premium (small!!)
- Coverage Level: 80%
- Revenue Protection (RP) and RP Harvest Price Exclusion (HPE)
- Zero Income

- 80% CL, enterprise units does not guarantee positive income
- No hedging at this point
Crop Income, Insurance and Hedging

- Coverage Level: 80%
- Revenue Protection (RP) and RP Harvest Price Exclusion
- Hedging: 50% of expected production

- HEDGING PLUS INSURANCE (RP, 80% Coverage Level, Enterprise units), 50% hedged reduces risk to about -$30/acre
Income Across Coverage Levels with 50% hedging

• Coverage levels and hedging
• Benefit when a bad outcome occurs
• Cost when a bad outcome does not occur
Crop Income, Insurance (80% CL, Ent, TA), Hedging

- Insurance increases expected income – about $24/Acre
- Insurance reduces risk – about $330/Acre

Efficient Frontier

Average Income, $/Acre

Tail Risk at 1% Percentile, $/Acre
Forward contracting bushels equal to your coverage level reduces expected income by nearly $20/Acre and risk is similar to hedging around 5% of APH.
Looking into 2014
80% Coverage Level zero hedging
Looking into 2014
Hedging at 30% Expected Production
Looking into 2014
30% Hedged, 85% Coverage Level
2014 Comparison of 80% APH hedged with No hedging and no insurance Ballard County

Why? – Existence of dirty ducks and strong price/yield relation

Over hedging:
1) Lowers upside potential
2) Lowers probability of losing $
3) Increases downside risk

Why? – Existence of dirty ducks and strong price/yield relation
2014 Comparison of 80% APH hedged with No hedging and no insurance Ballard County
Summary

• Everyone faces the same futures prices but not basis
• Results are specific to risk faced by this farm
  • Location, planting dates, soil types, etc…
  • APH relationship to actual
    • 2012, APH = 138.7, expected = 143.5 (-4.8)
    • 2013, APH = 132.7, expected = 145.0 (-12.3)
• Hedging without crop insurance increases risk of farm failure even though it reduces income uncertainty
  • Validity in – ‘he gambled on the futures market’ or ‘don’t sell a crop you don’t have’
  • Results change when using a different definition of risk
• RP dominates all other insurance contract types when hedging is involved and a bad outcome occurs.
Summary

• Results indicate that crop revenue risk (the ‘dirty duck’ rare event of 1 in 100 years) are reduced when using crop insurance (RP, enterprise units, 80% CL)
  • - $333/acre
• Income risk is further reduced by futures hedging
  • - $39/acre (30% hedged)

• Consequently, this producer does not need to hold as much capital in reserves for a bad event
  • Can invest this money
Summary

• For 2014,
  • This producer better have about $150 per acre in working capital available for a bad event, even with insurance (RP, TA, Ent, 80% CL) and 30% hedging.
    • Without insurance this amount increases to about $450 per acre.
  • About 50/50 chances of making or losing $ this year in corn – regardless of risk management option. Risk management just reduces the bleeding, if it occurs.
  • For Nebraska, harvest basis is wider and yield risk is different. How do you stack up?
Caution

- Portfolio evaluation
  - March 1\textsuperscript{st} (Base price just set) to last trading day in November (December futures enter delivery)

- No storage consideration

- No carry or basis consideration

- No continuous hedging decision making

- No option contracts
Insurance Coverage Level

Payouts

- Highest coverage level provides the highest chance of receiving a payment
- It also costs the most