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Cornhusker Economics

The Role of Insured Bushels and Pre-harvest Hedging for an Eastern Nebraska County Under Rain-fed Growing Conditions

2-1-19Market Report	Year Ago	4 Wks Ago	4-1-2019
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight.	120.38	*	126.00
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	180.18	180.85	198.82
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	142.54	145.98	170.00
Choice Boxed Beef, 600-750 lb. Carcass.	221.72	219.98	228.20
Western Corn Belt Base Hog Price Carcass, Negotiated	46.56	44.81	*
Pork Carcass Cutout, 185 lb. Carcass 51-52% Lean.	69.83	59.64	79.80
Slaughter Lambs, wooled and shorn, 135-165 lb. National.	142.74	134.24	381.53
National Carcass Lamb Cutout FOB.	366.54	374.77	140.93
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu.	*	4.03	4.10
Corn, No. 2, Yellow **Columbus**, bu.	3.58	3.52	3.44
Soybeans, No. 1, Yellow **Columbus,** bu.	9.52	8.06	7.92
Grain Sorghum, No.2, Yellow Dorchester, cwt.	5.84	5.45	5.48
Oats, No. 2, Heavy Minneapolis, Mn, bu.	2.69	3.13	3.26
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	*	175.00	*
Alfalfa, Large Rounds, Good Platte Valley, ton.	97.50	105.00	112.50
Grass Hay, Large Rounds, Good Nebraska, ton.	*	92.50	*
Dried Distillers Grains, 10% Moisture Nebraska Average.	156.50	144.50	161.50
Wet Distillers Grains, 65-70% Moisture Nebraska Average.	50.50	50.00	47.50

*** No Market**

"It's tough to make predictions, especially about the future." Yogi Berra

At the beginning of the crop year crop producers face unknown yields and prices resulting in a large range of end of season (fall) net income. Producers can chose to participate in risk management tools, resulting in a reshaping of the fall net income distribution. Two of the most common tools are crop insurance and pre-harvest hedging (hereafter referred to as hedging). The most common crop insurance policy sold today is Revenue Protection (RP) where both yield and prices are insured. RP policy represents an intriguing crop insurance contract since it not only insures against price declines between spring and fall but also price increases from spring to fall.[1] Choosing to participate in (and the level of) risk management tools comes from the desire to achieve farm business goals. Risk management stems from the goal of farm survival. Structuring risk management decisions around the goal of achieving the highest beginning of the year expected farm net income along with farm survival implies that under no circumstances risk management strategies that weaken the probability of farm survival will be taken. In other words "You will find out who is swimming naked when the tide goes out" (Warren Buffet).

It has been often stated that with crop insurance you can hedge up to your guaranteed bushels. We tried to find the first time this statement was made but fell short in the myriad of an ever increasing in complexity internet search. At first glance this logic can

[1]A price increase from spring to fall is insured by recalculating liability using the higher price.

appear OK since those bushels are now insured, however, the shortcoming stems from the statement's focus on bushels and not on the net income distribution. Hedging and crop insurance are both costly and failing to account for these costs, or all costs and benefits associated with any strategy, make any statements about that strategy incomplete and misleading. Finding evidence that a statement is untrue, even if it is true 99 percent of the time, makes the statement untrue. Finding any evidence of being untrue is especially important when farm survival is on the line. More importantly, when finding evidence that this statement is untrue, can we update our decision making process to find the conditions that make it true? The goal of this article is to explore whether it is a good idea to consider "hedging up to your guaranteed bushels." Before we begin, a note on risk. We are considering risk to be financial outcomes that put stress on farm survival. Farm survival risk has two characteristics: 1) has a very low probability of occurring and 2) has a high financial consequence. Only financial payoffs can identify risks associated with farm survival. Statements such as "that is unlikely" or "I have never seen that before" fall short of an adequate risk analysis associated with the goal of farm survival. Absence of evidence is NOT evidence of absence. Through the recent historic flooding we are reminded, again, that low probability events with high financial outcomes, even though we have never seen this event, can happen.

Three factors influence the financial payoffs from a financial portfolio relying upon hedging and crop insurance. First is the amount of production risk faced by the farm, second is the strength of the price-yield relation, and third is the cost associated with participating in these two risk management tools. Calculating the costs is relatively straight forward while capturing production risk and strength of the price-yield relation is harder. We capture production risk by examining annual county level historical yield. While our county level analysis breaks away from the farm level analysis one would like to perform (it is difficult to get enough historical farm level yield data) it does give us an understanding of the factors influencing the area's net income distribution. Relying on county level analysis will underestimate the farm yield risk unless farm production is adequately scattered around the county. For the yield-price relation we calculate the Spearman rank correlation coefficient using historical yields and prices.
Our model evaluates multiple harvest hedging levels (zero to 90 percent of APH) and crop insurance contracts (RP with multiple coverage levels) from March 1 to December 1. Hedging level and crop insurance decisions are made on March 1 and net income outcomes are evaluated on December 1. As a result, there is no intra season hedging opportunities. Hedging is conducted through a Hedge-to-Arrive (HTA) contract with an initial fee of $0.06 per bu and if there is a buy-back, an additional fee of $0.10 per bu. Your elevator may have a different HTA fee schedule than presented here. Different methods of hedging will also have different fees. Crop insurance cost equal to the producer paid premium.

Our model contains assumptions, making it a "virtual world," not a real world backed up completely with observational data. Consequently, we rely upon the efficient market hypothesis as we do not have enough data to prove or disprove. However, we add real world effects as much as possible. For example, we include in the model transaction costs and as you continue to increase hedging, the more likely you are to encounter buy back penalties. Increasing buy back penalties results in a lower expected value of the hedging net income portfolio. We will describe some of the data to give a better idea of the inputs going into this particular application of the model. A full description of our modelling methods can be found in Walters and Preston 2018.[2]

Data

For our analysis we will rely on non-irrigated corn production in Saunders County, Nebraska. All yield data came from the National Agricultural Statistics Service (NASS). The worst yield event in Saunders County came in 1974 with a yield 54 percent of the 2018 expected yield while the next four worse events ranked by severity were in 1976, 2012, 1995 and 2002. The highest yields were found in 1996 at +43 percent of APH followed by 2009 and 2010. The price-yield relation was found to be -0.51, indicating a strong relation. This result is not surprising since Saunders County is in the Corn Belt. To calculate the futures price probability distribution we used the projected price and the implied volatility factor, which is the same method crop insurance uses.

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[2]Feel free to contact me at cwalters7@unl.edu for a copy of the paper.

Results

We base our model on our stated goals of maximizing farm survival and maintaining the highest expected net income on March 1, given uncertain yields and prices. Farm survival is calculated by taking the average of the worst 5 percent (1 in 20 year event) net income events.[3] For the hedger, the worse possible financial outcomes occur during droughts where harvest prices increase greatly over spring prices. These financial outcomes are portrayed on the x-axis. The y-axis displays expected net income which represents the average of all possible outcomes. Given these two goals we found the highest expected net income with lowest risk, to be RP with 80 percent coverage level, no hedging, Figure 1 (large red dot). The red line moving down and to the right away from the red dot represents an incremental increase in hedging starting at zero with a RP 80 percent coverage level. Each smaller dot represents an additional 5 percent hedging of APH up to 60 percent where each subsequent dot represents an additional 10 percent hedging. Initially hedging past zero reduces risk while also reducing expected net income. This result makes sense since hedging is costly and we are relying upon the efficient market hypothesis. The hedger is indifferent between 35 percent hedging with RP at 80 percent coverage level and 15 percent hedging with RP at an 85 percent coverage level. Said another way, trading up 5 percent coverage level is the same as dropping 20 percent hedging. The minimum risk and highest expected net income occurs at RP with 85 percent coverage level and 40 percent hedging. Hedging past 40 percent lowers expected net income for a while before risk begins to grow. What happened to the recommendation to hedge up to your "guaranteed bushels?" The large black dots represent hedging guaranteed bushels under RP at 80 and 85 percent coverage level. The answer is straight forward, costs. Costs that when accounted for, reshape the net income distribution. The crop insurance premium reduces guaranteed revenue, which uses guaranteed bushels as an input, by the amount of the premium. Maybe we should consider a term like "net bushel guarantee" that removes the producer paid premium from the guaranteed revenue while dividing by the price to get bushels. Hedging is also costly so "net bushel guarantee" would also be incomplete. Hedging costs $0.06 per bushel while every additional bushel hedged increases the probability of experiencing a costly buy-back fee of $0.10 per bu, which in turn begins to grow your financial risk, reshaping your net income distribution.

How much pre-harvest hedging can be done before planting? According to our model that amount varies between 0 (with RP 80 percent coverage level) and 40 percent of APH (with an RP 85 percent coverage level). Notice that RP 75 percent coverage level is not far off of the highest expected net income/lowest risk frontier. Once the threat of a drought passes then the constraint on hedging will be lifted, opening the door for additional hedging.

Our model also provides information on the importance of the federal crop insurance program. Between crop insurance and hedging as risk management tools, insurance provides substantially more risk protection then hedging. Additionally, this application of the model indicates no hedging without crop insurance. Crop insurance is a very valuable risk management tool for agriculture.

This model relies upon unknown spring yield and price expectations and therefore individual results will vary greatly. Hedging any amount, regardless of a crop insurance insured bushel guarantee, may work in any given year. The problem is when something unforeseen happens and that is when our net income model excels. Our model does not base decisions on recent past experience, rather we are basing decisions on rare financially devastating events that have happened over the past 38 years. The recent flooding is a blunt reminder of those rare financially devastating events. Our model implies planting occurs however, flood damaged ground may not allow for planting, triggering the preventative planting option contained in the crop insurance policy. Our model does not capture all possible financial outcomes.

We hope to never experience another drought under rain fed growing conditions, but we can tell you that if it comes (yes, it will), we will be prepared, so we can survive. While lots of hedging may work in years without droughts, it is the drought year that will cause heavy hedgers financial pain and according to this model, a worse financial position than less hedging. Those not hedging in drought years will be handsomely financially rewarded with a RP policy (at a reasonable coverage level) to the extent that it puts them on a different future financial path.

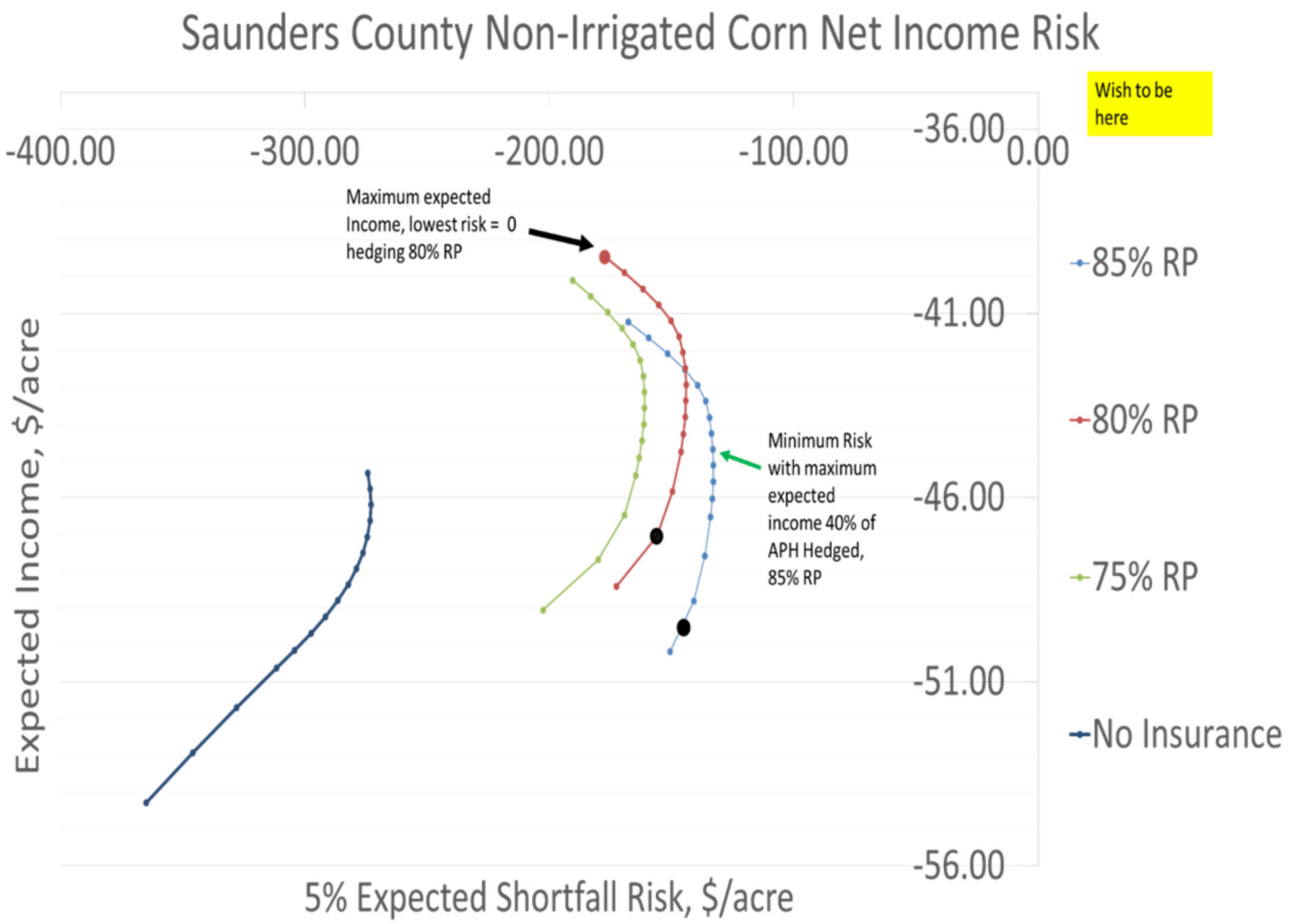
In future articles we will discuss the optimal hedging and crop insurance contract when considering different conditions such as irrigation or moving west across the state.

[3]When defining risk at the 1 percent level the maximum level of hedging was reduced over results in the 5 percent level.

The irrigator (who has access to water during a drought) hits the proverbial farming jackpot. As a result of this interaction, the efficient crop insurance policy changes as well as the role of hedging. Moving our analysis west across the state, where yield risk increases and the price-yield relation weakens, we find a different set of answers.

The crop grown, the practice (irrigated or rain fed or dryland), farm location, the price-yield relation have more to say about optimal use of risk management tools than previously thought.

Figure 1. Saunders County Non-Irrigated Corn Net Income Risk



References

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