Module 12

Alternative Yield and Price Risk Management Tools for Wheat

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Topics

Introduction

In a prior lesson, the joint yields and price risks were assessed for selected soybean and corn producers. Winter and spring wheat farmers face some of the same perils that were described for producers of feed grains and oilseeds. An old western Corn Belt/plains state adage is that there are at least five wheat crop failures in each crop year. Although the statement is less than factual, there are significant yield risks for individual wheat farmers and for different U.S. wheat production regions. However, the yield and price correlations may be somewhat different for wheat than for corn and soybeans. First, wheat is produced throughout the U.S., whereas corn and soybeans are produced primarily within the Corn Belt. For example, varieties of white wheat are produced in such diverse geographical locations as the Pacific Northwest, and in the states of Michigan and New York. Secondly, the wheat varieties that are produced in these different regions are not perfect substitutes for each other. Soft red winter wheat is used in pastries, hard red winter and spring wheat are transformed into breads, durum is used to produce pastas, and white wheat is processed into noodles and cake mixes. Thus, inclement weather patterns in one part of the country may not be as highly correlated with wheat prices in other wheat growing areas as is the case for feed grains and oil seeds. Further, wheat can be directly substituted for corn as a feed. Corn in contrast cannot be used to produce most major bakery products. Also, wheat production in other parts of the world may partially offset the effects of weather patterns in the U.S. Since the U.S. produces less than 12 percent of the world's wheat, a small (large) U.S. wheat crop may be offset by world wheat production mitigating the inverse correlated effects of U.S. production on wheat prices. In contrast, nearly 30 percent of the world's feed grains, 36 percent of its corn, and nearly half of its soybeans are produced in the United States.

To capture some of the differences among regions and wheat varieties, this lesson creates

histograms and probability distributions for hard red winter wheat producers in Kansas and for hard red spring wheat producers in North Dakota. Comparisons and contrasts are made.

Alternatives Compared *(or go to **Topics**)*

For the 1999 winter wheat crop planted in fall 1998, producers must decide whether to enroll in the insurance program and which insurance product, if any, to select. In most major winter wheat states, the deadline for wheat crop insurance enrollment is September 30, 1998. Pricing decisions can and logically would be made at a later time. Pricing opportunities may appear in late winter or early spring when futures price variability is relatively high. Price variability occurs because traders often have diverse opinions on the quality and quantity of the crop prior to the spring growing season. This is one of the times that the market is ripe for one of the production failure rumors. It is also important to remember that it is useful to understand the interrelations between pricing tools and various types of crop insurance before any decisions are made.

To illustrate potential impacts of pricing and insurance alternatives on gross income of winter wheat producers, we selected an actual farm in Ottawa County, in north central Kansas. Yield data were taken from federal crop insurance files for a farm in the county that had insurance continuously over the entire previous 10 years ending with the 1997 crop (**Figure 1**). Notice that this figure is skewed to left reflecting the fact that output could fall to zero, an occurrence that happened about 4 percent of the time. Since wheat is grown over a very wide cross section of the U.S., the average level and variability of your yields may or may not be similar to those used here. These yields are different from those used in the spring wheat analysis, because of geographic location. The spring wheat yield data are from an actual farm in Ward County, North Dakota. In the summary section of this lesson, we compare and contrast the outcomes for these two different regions.

Figure 2 displays the histogram for the July wheat futures prices based on September 1998 futures prices and options premiums. Since these prices reflect national or even international supply and demand relationships, the probabilities in this one graph are applicable for all winter and spring wheat growers. Like the prior corn and soybean futures price graphs, the figure is skewed to the right reflecting the fact that there is a greater chance for high prices than for very low prices.

For farmers concerned primarily with elimination of very low income possibilities, the left hand side of the probability distribution graphs, **Figures 3 , 4 , 5 , 6 , 7 , 8 , 9 , 10 ,** and **11** will be of great interest. As you read these charts, keep in mind that they reflect gross revenues. In contrast to gross revenues, net profit will vary considerably from farm to farm as was discussed in **Module 3** on financial considerations in risk management. The left hand side of the graphs or the "Y" axis displays the probability for each increment of income that is displayed at the bottom of the graph or on the "X" axis. Low revenues, of course, can reflect either low yields, low prices, or both.

Revenue comparisons for harvest delivery of the winter wheat shown here are based on those available in mid-September from the July 1999 Kansas City Board of Trade futures contracts and implied from the put/call premium structure on the July 1999 options. For spring wheat, comparisons are based on the Minneapolis Grain Exchange September futures contract and put/call premium structure. If pricing strategies are used, actual results will vary

over time depending on price levels when pricing decisions are made, and may or may not reflect the same expectations as the extremely small number of traders currently using the distant options contracts. Normally only a few put contracts would be traded in September for July 1999 wheat but a much larger number of July 1999 futures contracts are traded at the Kansas City Board of Trade. Thinly traded markets do not necessarily reflect future supply and demand relationships and market opinion can change very rapidly as new traders enter the market.

As a wheat grower who has farmed through the last few marketing years, you are well aware that the market can change its price expectations dramatically in a relatively short time. A case in point is the April 1997 southern plains freeze which sent wheat futures prices sharply higher, but was followed by a substantial price decline. In 1996, many southern plains wheat growers suffered severe yield losses, while those farther north or with irrigated farms had much better yields. For some growers, low yields tended to be offset by higher prices for the 1996 crop. For others, high prices were accompanied by high yields. Still others harvested little or no wheat and were unable to benefit from high prices. In short, yields across all wheat regions can vary even more than those for corn and soybeans. Thus, in making pricing and insurance decisions, it is important to evaluate your farm's yield risk using historical data. Reviewing **Module 5** could be of help in creating your yield risk structure. Also, the price/yield correlation can vary widely from area to area. For the Kansas analysis, a price/yield correlation of -.2 was used, reflecting historical price/yield relationships for the area. Squaring this number gives .04, which means that on the average, a 10 percent change in the farm's yield is associated with a 4/10 percent change in the price in the opposite direction. For practical purposes, the relationship between price and yield on this farm is a random one.

All of the figures were developed using the same random, repetitive computer procedure as in **Module 11**. Yields were drawn in the same percentage distributions as have occurred over the last 10 years for the farm in Kansas. Revenue was created through a random process of associating price changes with yield changes in a relationship reflecting the average price/yield correlation of -.2. In effect, this process shows what the gross income distributions look like if you farmed for enough years to obtain all possible price/yield combinations. While no one can farm that long, this procedure gives a view of the probability of various income outcomes. Again, we emphasize that the price portion of these charts reflects expectations of a small group of traders at one point in time, mid-September of 1999.

The ideal risk management tool would be inexpensive, eliminate the chance of low returns, and retain all upside potential. In practical applications, there are trade-offs among cost and income protection features. Some tools have low initial cost but provide little opportunity to gain additional income if prices and/or yields rise. Others cost little, but provide little protection against low incomes. Still others have relatively high cost which reduces the net income but may provide good protection against low incomes.

For the winter wheat farm analyzed here the gross income of $65, after a deduction of an unsubsidized premium of $11 per acre, was considered to be the minimum acceptable level of return. The most likely local harvest price was considered to be $3.03, based on July futures and options markets in mid-1998. The most-likely yield was considered to be 32 bushels per acre, the same as the APH yield. **Figure 3** displays the histogram of gross

revenues/acre for the Kansas farm with no insurance or "market" protection. In most situations, revenues were between $65 and $185 per acre. However, there are times when either price or yield (or both) are low enough to cause revenues to dip below $65. This happened about 20 percent of the time, which means there is a 20 percent chance this producer will have difficulty meeting his/her minimum financial obligations. Notice also there is a small (about 4.5 percent) chance that revenues will be zero. Offsetting these financially difficult but unlikely scenarios is a 4 percent chance of years when revenues will be greater than $230/acre. These highly profitable years occur when this producer has high yields - say 46 bushel/acre, and when local prices exceed $5.00/bushel. In comparison, the no risk management tools histogram of the spring wheat North Dakota farm is more symmetrical with no chance that total revenue would equal zero (**Figure 8**). There was also a less of chance on the North Dakota Farm of receiving the very high revenues.

Now let's assume this farmer buys MPCI crop insurance (**Figure 4**). When yields are below the deductible, the farmer is compensated via insurance indemnity payments. The effect of MPCI insurance is to greatly reduce the chances of a financially difficult year. Therefore, MPCI crop insurance works to stabilize revenues. However, there are years when prices are low and yields are also low, but not low enough to trigger MPCI crop insurance payments. In about 20 percent of the possible outcomes, revenues are less than $65/acre. This means that MPCI does not provide all of the desired protection against low revenues because it does nothing to protect against low prices. Similar conclusions can be reached for the North Dakota farm (**Figure 9**).

The histogram in **Figure 5** shows the effect on the revenue distribution caused by the purchase of put options in mid-September 1998. The purchase of the put options does not protect the Kansas producer's risk of revenue loss from low yields. In fact, this grower has about a 4 percent chance of a zero(0) revenue outcome because of yield losses. This occurs when yields are zero and the market price increases causing the put options to expire worthless and leaving the grower with no bushels to sell at the relatively high price. In these years, the revenue losses caused by low yields will be greater than any benefits generated from higher cash prices.

Net returns from options purchases will vary depending on the level of futures prices at the time of purchase and the length of time until contract expiration. Buying July 1999 wheat options in September 1998 is relatively expensive because of the high time value in the premium to carry the option to maturity nine months later. Unless futures prices are unusually high at that time, most producers would probably be inclined to wait until time value is lower before buying puts.

One sure way of reducing risk is to buy MPCI crop insurance and put options. **Figure 6** shows the potential outcomes from this strategy for the Kansas farmer. There are no occurrences below $65/acre. However, this strategy is also very expensive if done in September before the next summer's harvest. The extra expense limits income in years of high yields and prices, and would cost more than $12/acre ($8/acre for put options, based on mid-September 1998 options premiums and futures prices, and $4.00/acre for MPCI crop insurance). The cost is based on current at-the-money put premiums and subsidized crop insurance premiums. Out-of-the-money puts would cost less but give less protection. Without the MPCI crop insurance subsidies, the cost per acre would be even higher. One reason the put option/MPCI insurance strategy is relatively expensive is that there can be

years when prices fall and yields are good, and vice-versa. In these years, the put option or yield insurance will pay off even though revenues are at or above the target level. However, the low price/yield correlation suggests that these occurrences are infrequent for the winter wheat farm analyzed here. Similar results are displayed in **Figure 10** for the spring wheat North Dakota farm.

A new risk instrument was recently made available to wheat growers that will reduce risk to a level resembling but not necessarily equaling the put option/MPCI crop insurance strategy. Crop Revenue Coverage (CRC), now available for wheat growers in 38 states, has a similar effect on the shape of the revenue distribution as does the put option/MPCI crop insurance scenario, but it costs less than the former if puts are purchased in September when producers must enroll in crop insurance (see **Figure 7** for Kansas). CRC guarantees a minimum revenue. If yields are low and prices are high, the CRC coverage will also automatically increase and provide enough dollars to replace the guaranteed bushels at current market value (with some variation for basis risk). That contrasts with MPCI yield insurance that is based on a MPCI insurance price that was set months earlier and does not change. The CRC alternative is useful for producers who sell their crop in advance via futures, hedge-to-arrive, or forward contracts because the lost bushels are replaced at their harvest time value. Average net results will not necessarily match those of the put option/MPCI combination because of basis differences and feasible CRC percent coverage that tends to peak out in the 65-70 percent level. Also, in the real world producers who use puts will probably, in most cases, wait until some time later to buy them, rather than purchasing options in September before harvest when time values are high. As noted earlier, the put option/MPCI comparisons shown here are for puts purchased in mid-September 1998. The CRC insurance participation choice can be made at only one point in time (September for winter wheat in most states), and is based on average futures prices for only one month out of more than 12 that are available from which producers may choose prices. In contrast, options pricing may be done using individual daily prices and premiums. The use of an insurance product selected by the end of September, and later implementation of a put option position if prices rise significantly, may produce higher net returns than shown here. If the minimum revenue guarantee in CRC is relatively low in a given year due to low futures prices, a producer might choose to self-insure or use the CCC loan program unless prices rise to more attractive levels, at which time he/she might then choose to purchase put options. For comparative purposes, see **Figure 11** for the North Dakota farm where similar results were achieved.

For the hard red winter wheat Kansas producer who has limited risk-bearing ability, realistic insurance choices may center on the last two strategies because both guarantee that gross revenue will remain above the assumed critical $65 level. So long as premiums for both are actuarially fair, the choice will depend on the specific attributes of the policy; the value a farmer places on ability to purchase options later at a possible higher futures price and lower net cost than in September; and his/her preferences regarding the risk of being exposed to low revenues vs. the short-term cost savings from self-insuring and avoiding options and insurance premiums. Actuarially sound premiums in this case would mean that premiums to the individual farmer accurately reflect the loss history of the individual farm. Producers who like to set a minimum price floor may use put options combined with MPCI or they may prefer options and CRC to provide income to cover lost options premiums in situations where prices rise and yields fall. Producers who like to use the futures market, non-roll HTAs, and/or forward contracts may prefer the CRC contract because of its ability to insure

inventory replacement value, rather than value at a prior time.

Lending Considerations *(or go to **Topics**)*

A wheat grower's lender may want the grower to insure with CRC before advancing money for put purchases. If markets rise sharply, the put will expire worthless but the cash price will be higher. However, if the crop fails, the grower will lose the put premium and will have no crop to sell at the higher price. The grower's MPCI indemnity payment with a 30 percent or more deductible will probably barely cover operating expenses. Because CRC coverage would increase, the grower's indemnity payment would cover both the operating expenses and the lost put premiums. The lender's position is protected by insuring the collateral with CRC. The same principle works for non-roll HTA, futures market sales, and forward contracts, although market "losses" are larger.

Note on Basis Risk *(or go to **Topics**)*

CRC income guarantees are available at 100 percent (95 percent was used in this analysis) of the June average of the Kansas City Board of Trade July wheat futures price. This insured price can and often does differ from the local cash price that a producer receives, because producers typically sell on a series of daily prices that may cover more or less than one month. Therefore, a basis risk is involved when this or other revenue insurance products are used.

To help you visualize more completely the interaction of farm financial conditions with yield and revenue insurances, and put purchases and sales through futures hedges, **Module 13** will analyze these tools with high and low prices and yields for a corn farm. Net returns will be shown in tables with specific income numbers for various tools and combinations of tools, in descending order of income.

Risk assessment assignment:

1. If you have a yield history for your farm, calculate the average yield, the trend over time, and variations from average of the extreme high and low years. If you do not have past yields, your extension office or crop insurance agent may be able to provide county average yield history for this analysis. If you have a yield history for several years, check with your local elevator or extension office to obtain corresponding average harvest cash prices.

For each year, calculate the average percent change in your yield from the previous year, and the average percent change in price from the previous harvest period. Average these percentage changes to create an approximation of your price/yield correlation. Divide the average percent change in price by the average percent change in yield to get an approximate correlation. If this number is very high (for instance -.90 to -.95,) it means that much of a decline in your individual average yield tends to be offset by rising prices. Note also the variability of this figure from year to year for your farm.

End of Module *(or go to **Topics**)*

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