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Multiple Year Pricing Strategies for Corn

Authors: David Kenyon, Professor, Department of Agricultural and Applied Economics, Virginia Tech; and Chuck Beckman, Former Graduate Student, Department of Agricultural and Applied Economics, Virginia Tech, and currently employed by Sparks, Inc., Memphis, TN

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Introduction

Once every few years, supply and demand conditions for corn are such that prices reach historically high levels. These high prices are usually caused by reduced supply from poor yields during the summer, but have also been caused by excessive rainfall and government programs. Whatever the reason, these historically high prices provide producers with unique pricing opportunities. This publication explains how to take advantage of these favorable prices by pricing three years production at one time. We will explain the methods, the returns, and the risks associated with multiple year pricing strategies.

When prices reach historically high levels in the first (current) year, two things generally happen in the following two years. First, the high prices in year one lead producers to expand acreage in year two. Second, the high prices in year one have a tendency to reduce demand for feed because of fewer numbers of livestock and poultry on feed. The combination of increased supply and reduced feed demand in year two leads to lower prices in years two and three. The multiple year pricing strategy takes advantage of these tendencies by selling three years expected production during the first year when prices are high.

[Figure 1](#) shows daily December corn futures from 1980 to 1993. In 1980, 1983, and 1988, December corn futures prices traded above \$3.50 bushel. In each case, prices were substantially lower in the two following years. With multiple year pricing, the producer prices three years of expected production in the first year in order to increase prices across all three years. Obviously, this strategy involves substantial risks. What if prices go higher after pricing three years of production? What if prices move to a new price level and do not return to historical equilibrium levels? These are important questions. The strategies presented are based on research designed to minimize these risks.(1)

(1)"Multiple Year Pricing Strategies for Corn and Soybeans Using Cash, Futures, and Options Contracts," unpublished M.S. thesis by Chuck Beckman, Dept. of Agricultural & Applied Economics, Virginia Tech, May 26, 1995. This research was funded by the Virginia Soybean Board.

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Historical Price Distribution

The best way to minimize the risks of higher prices is to only enter into the strategy when the probability of prices going substantially higher is low. [Table 1](#) is the historical distribution of December corn futures closing prices on the 1974 through 1993 contracts. Table 1 shows the historical probability of prices being in specified 10-cent intervals from \$1.50 to \$3.99 per bushel. The table indicates the most frequent price is between \$2.50 and \$2.59 per bushel. From 1974 to 1993, 12.7 percent of December corn futures prices were in this range. The cumulative percentage column indicates that 51.5 percent of all December corn futures prices traded at or below \$2.59 bushel between 1974 and 1993.

Table 1 indicates that historically the probability of prices trading at or above \$3.50 bushel is 5.9 percent (the sum of all probabilities above \$3.50 is 2.2 + 1.5 + 1.3 + 0.8 + 0.1). In other words, if a producer prices at \$3.50 per bushel, there is only a 5.9 percent probability that prices would go higher. Table 1 indicates prices could go \$.40-.50 a bushel above \$3.50, although the probability is small.

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Trigger Price

To determine the most desirable price level to enter the three year strategy (called the trigger price), the strategy was triggered at the top 5, 10, and 15 percent levels of the historical distribution. These trigger price levels are based on prices from previous years. For example, in 1980, only prices from the December 1974 through December 1979 contracts are used. Our research indicates that the 5 percent level gains the highest average return, lowers margin calls from futures positions, and does not miss any of the good pricing opportunities. Hence, the trigger price for entering the three year strategy is set at the 5 percent level of the historical distribution. The 5 percent trigger price for December 1996 corn futures is \$3.53 per bushel.

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Pricing With Options

Another way to avoid missing higher prices is to use options instead of futures. Buying a put option avoids margin calls if prices move higher. But put options can be expensive, especially when prices are extremely volatile, which they usually are at historically high price levels.

The use of options in the three year strategy has another significant advantage. If futures prices do not return to typical historical levels, the producer can sell at higher cash prices and lose only the initial premium. This is a substantial advantage over futures if the producer believes there is a significant risk

that prices will not return to historical price levels.

There are two problems with using options. First, corn options were not traded prior to 1984. This problem can be handled by estimating option premiums prior to 1984 using the Black pricing formula, a well-researched and accurate method of estimating premiums. The second problem is that options are frequently only available for six to eight months into the future. In the three year strategy, the producer needs to be able to price 12 months into the future. This problem is handled by using a May option first and then rolling over to a December option later. More details on this option rollover procedure will be provided later.

The other way to avoid some margin calls is to use cash contracts for the first of the three years. In most cases, cash contracts are not available for the second and third year, so futures or options must be used for years two and three.

Our research compared average returns and risks for 49 strategies using various combinations of 5, 10, and 15 percent trigger prices and various combinations of cash, futures, and options contracts. The rest of this publication concentrates on analyzing in detail the returns and risks associated with the best three-year strategies analyzed during years 1980-1993.

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Pricing With Futures

The highest returns were obtained by selling futures to cover the next three years production when current December futures prices reached the 5 percent trigger level. The transactions of this procedure are illustrated in [Table 2](#) using 1988 as an example. In 1988, the 5 percent trigger price for December corn futures was \$3.61 per bushel. On June 27, 1988, December 1988 corn futures closed at \$3.63, two cents above the trigger price of \$3.61--the signal to sell three years production at current prices. On June 27 or the day after, the producer sold three December 1988 futures contracts at \$3.63. These three contracts (15,000 bushels) are sold to price 5,000 bushels of corn to be produced in 1988, 1989, and 1990. Producers will need to decide based on their own historic yield variability what percentage of expected production to forward price.

Once these contracts are sold, they are held until harvest which is assumed to be September 15. On September 15, 1988, the three December 1988 contracts are bought back at \$2.96. On that same day, two December 1989 contracts are sold at \$2.71 to price 5,000 bushels of the 1989 and 1990 crops. These two contracts are held until September 15, 1989, when they are bought back for \$2.30. On September 15, 1989, one December 1990 contract is sold for \$2.33 to cover the 1990 crop. The December 1990 contract is bought back on September 15, 1990, completing the three-year strategy.

The 1988 three-year strategy returned \$14,500 on 15,000 bushels produced across three years (1988, 1989, 1990), for an average price increase of \$.97 per bushel. Most of the increased cash flow occurred in years one (1988) and two (1989), \$10,050 and \$4,100, respectively. But the real value of this strategy occurred from pricing the 1989 and 1990 crops in the summer of 1988. The harvest cash price for the 1989 crop was \$2.30. (2) The three-year strategy added \$1.08 per bushel by making \$0.67 in December 1988 futures and \$0.41 in December 1989 futures. The harvest cash price in 1990 was \$2.26 a bushel. The three-year strategy added \$1.15 per bushel to this price by making \$0.67 in December 1988 futures, \$0.41 in December 1989 futures, and \$0.07 in December 1990 futures. Commissions and interest on

margin money would lower these returns \$.06-.07 per bushel.

(2) *Cash prices are for Tappahannock, Virginia.*

[Table 3](#) contains the transactions necessary to implement the three-year strategy using options. The option strategy is based on buying put options with a strike price closest to the futures price on the day of the transaction. On June 27, 1988, December 1988 futures closed at \$3.63, so three \$3.60 December put options are purchased for 27 cents per bushel. Total premium expense on June 27, 1988, is \$4,050 (\$0.27 bu. x 15,000 bu). At harvest on September 15, 1988, the three \$3.60 December 1988 puts are sold at \$0.64 bushel, for a profit of \$0.37 bushel on 15,000 bushels. On September 15, 1988, the producer would like to buy two December 1989 put options, but they are not trading. So the producer buys two \$3.00 May 1989 put options for \$0.19 per bushel based on a current May 1989 futures price of \$3.04. Then on April 1, 1989, the producer rolls over the two \$3.00 May puts by selling them and simultaneously purchasing two \$2.60 December 1989 put options. The \$2.60 December put is selected because December 1989 futures are trading for \$2.63 on April 1, 1989. On September 15, 1989, the producer sells the two \$2.60 December puts and buys one May 1990 put option. The May 1990 put is rolled over on April 1, 1990, to a December 1990 option which is sold on September 15, 1990. The premiums associated with each of these transactions is recorded in Table 3.

The option strategy requires about twice as many transactions and has higher commission expense, but there are no margin calls. [Table 4](#) contains the initial option premiums for this strategy.

The three-year option strategy returns \$10,000 across 1988, 1989, and 1990 compared to \$14,500 from the futures strategy across the same years. Producers will have to decide if the tradeoff between elimination of margin calls plus leaving open the possibility of higher prices in the option strategy versus reduced returns is acceptable to them.

The potential for large margin calls is greatest in the first year since the expected production of three years has been priced. One way to reduce potential margin calls is to use a cash contract for the first year of the three-year strategy. Cash contract prices were assumed to be available at \$.05 less than the current futures price.

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Comparison of Strategy Returns

The returns for three of the best strategies analyzed are reported in [Table 5](#). The three-year strategies are all initiated at the 5 percent trigger price in 1980, 1983, and 1988. The F/F/F strategy means futures contracts are used for each of the three years. The C/F/F strategy means a cash contract is used in year one and futures are used for years two and three. C/O/O means a cash contract is used in year one and options are used for years two and three. The one-year hedge uses the 5 percent trigger but only prices the current year using futures. Cash is the harvest price on September 15 in Tappahannock, Virginia.

Table 5 indicates the three-year futures strategy (F/F/F) increased corn prices \$.71 per bushel compared to cash sale at harvest, and increased price \$.56 per bushel compared to pricing one instead of three years. Substituting a cash contract for futures in the first year reduced returns \$.01 a bushel, but reduced margin calls (see [Table 6](#)). The cash contract and option strategy (C/O/O) increased average price by \$.42 per bushel compared to cash. The C/O/O strategy returns were \$.29 per bushel lower than the all

futures strategy. Of course, the options strategy involved no margin calls.

Table 5 indicates that the three-year strategy achieves its greatest gains in the second and third year. For example, under the futures strategy (F/F/F), the average increase in price per bushel compared to cash is \$.27 in year one, \$.67 in year two, and \$1.21 in year three. The option strategy has a similar pattern with larger returns in years two and three. These results confirm that the real gains from the three-year strategy accrue from hedging more than one year's expected production when current prices reach historically high levels.

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Margin Calls

The three-year pricing strategy using futures will involve margin calls. The dates and amounts of margin calls for the all futures strategy (F/F/F) are reported in Table 6. These margin call calculations are based on selling 5,000 bushels each for years one, two, and three. Margin calls are received at each \$.09 price increase above the entry price. The largest single margin call is \$1,350 on August 29, 1980. The accumulated margin calls for the 1980-1982 three-year strategy is \$6,300. The accumulated margin calls for the 1983-1985 and 1988-1990 periods are much less- -\$900 and \$3,600 respectively. During the three year periods, an average of six margin calls was received.

Since margin calls will occur when using futures, producers should thoroughly discuss this pricing strategy with their banker before entering into the futures market. The discussion needs to include the procedures for placing, lifting, and rolling over contracts and the likely amount of margin calls. The strategy results presented assume that once the initial position is taken, no selective hedging occurs. The producer could price additional amounts of expected production, but no premature lifting of futures contracts is assumed. If the producer and banker do not have complete agreement on how the strategy is to be implemented and maintained, the producer should either finance the strategy personally or use the option strategy (O/O/O) or the combined cash contract/option strategy (C/O/O).

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Summary

Pricing three years of expected production when December corn futures reach the top 5 percent level of historical futures prices would have increased producer returns \$.71 per bushel, compared to selling for cash at harvest. Since 1980, the strategy would have been implemented three times--in 1980, 1983, and 1988. Hence, during the period 1980-1995, nine out of the 16 years would have been priced using this strategy.

If futures contracts are used, there will be margin calls. Based on the historical price distribution, margin calls could be as much as \$2,000 per contract. These margin calls can be avoided by using put options instead of futures. However, during the three times and nine years priced using this strategy between 1980-1995, average returns were reduced \$.29 per bushel using options compared to using futures. Producers will have to decide if this is an acceptable reduction in average price in order to avoid margin calls.

In March 1996 when this report was written, December 1996 corn futures were trading around \$3.15 per bushel. Based on historical December futures prices since 1974, the 5 percent trigger price for the three-year pricing strategy in 1996 is \$3.53 per bushel. If December 1996 corn futures reach this trigger price before September 15, 1996, producers need to consider selling a portion of their expected production in 1996, 1997, and 1998. Each producer will need to carefully evaluate the potential risk of this strategy and decide on what combination of cash contracts, options, and futures to use. Only producers who fully understand futures and options trading and the risks associated with the three-year strategy should use it. But history shows that this strategy has the potential to raise prices by over \$.70 per bushel when it is implemented.

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