DEVELOPMENT OF A WEB-BASED COMMODITY OPTIONS EVALUATOR AND TEACHING TOOL

Blake K. Bennett, Ken Stokes, and Mark Waller
Department of Agricultural Economics Texas Cooperative Extension
College Station, TX
Jeanne Reeves
Cotton Incorporated
Cary, NC
Sukant K. Misra
Department of Agricultural and Applied Economics
Texas Tech University
Lubbock, TX

Abstract

The Commodity Options Evaluator was developed to provide producers a user-friendly means to learn about and analyze the effects of implementing a price risk management plan through the use of commodity options. An information based price risk management tool such as the Commodity Options Evaluator will assist producers in making informed marketing decisions, which has become extremely important given the persisting difficult economic environment of low and/or volatile commodity prices.

Introduction

Agricultural producers are faced with a changing market environment making risk management a key to financial survival. One way in which risk has been managed is through diversification. Producing several different agricultural commodities allows producers to capture additional revenue, generate cash flow in the case of a failed crop, as well as the ability to take advantage of yearly price changes that may make certain commodities more profitable than others. Though diversification does provide the opportunity to reduce price risk, producers need to be aware of the opportunities that price fluctuations throughout the growing season may provide. Rather than accept the harvest price for a commodity, which is usually the lowest price of the season, producers may be able to "lock-in" a favorable price ahead of harvest. Typically this type of pricing has been accomplished by forward contracting or through the use of futures and/or commodity options contracts (Hassler 1993).

Many studies have addressed the use of futures contracts to achieve a favorable price at harvest. Specifically, Hurt et al. (1991) found that soybean prices received by farmers familiar with futures markets averaged 3.9% higher than those not familiar with these markets. Furthermore, Johnson and Bennett (2000) found that cotton producers can use moving averages to identify changing cotton futures market trends and select entry and exit points for hedges. Results of this study indicated that cotton producers could add on average an additional $0.02 per pound to the final price they receive for cotton by making trades throughout the year based on moving averages. Similarly, Elam (2000) found that the cotton futures market tended to revert back to a long-run average price. This study suggested that cotton producers could base hedging decisions on whether or not the current futures price is above or below the long-run average. Bennett and Reeves (2001) also found that cotton producers who sold cotton futures contracts between June 11 and June 20 with a $0.015 stop order increased net returns by $0.0379 per pound over the study period.

Other studies have addressed the use of option contracts as a price risk management tool. Herndon et al., 1999 examined the use of a "harvest strategy" in which cotton producers sell cotton at harvest, purchase at-the-money July call options, and exercise these options eight months later. This strategy was found to increase the net price and farm revenues by an average of 6.06 cents per pound over the study period. Bennett and Reeves (2002) examined the purchase of cotton put options at various strike prices and times prior to contract expiration to determine the optimal time and strike price level. Results indicated greatest returns occurred when put options were purchased further in-the-money.

The studies described above suggested strategies that provide price risk management. When a producer attempts to implement a strategy, however, the current price environment must be evaluated to determine if the strategy will provide the desired protection. Even in the simplest example of the purchase of an at-the-money put option as described by Bennett and Reeves (2002), much information must be collected and analyzed to determine the acceptability of the purchase. This information includes but is not limited to the: current futures price, premium, time until contract expiration, and estimate of the local basis. The complexity of analyzing the potential outcomes of using commodity options increases when strategies such as a spread, window, or butterfly are implemented. These strategies require the simultaneous purchase and/or sale of a combination of puts and/or calls. Likewise, many studies have expanded the simplest form of hedging to include multiple hedging positions. Shafer et al. (1978) and Leuthold, Mokler (1980), and Noussinov (1999) examined simultaneous hedging for

the cattle feeding industry. The strategies examined by these studies consisted of taking long positions in input commodities (feeder animal and feed) and a short position in the live cattle, thus locking in a profit margin.

Although many producers may realize that the use of commodity options can protect the price of their commodity, the complexity and amount of information that must be analyzed as well as the time required to evaluate different alternatives may result in an uninformed decision or deter them from taking advantage of such a tool all together. Therefore, an interactive web-based tool that would assist in determining the potential outcomes of various commodity option strategies would be helpful in making informed and deliberate decision.

Program Design

In an attempt to develop the Commodity Options Evaluator that would assist in determining potential outcomes of various commodity option strategies, the authors wished to create a program that could be easily navigated without much assistance, be useful for both producers as well as users of agricultural commodities, be flexible enough to allow the user to evaluate to simultaneous purchase and/or sale of both put and/or call options, provide relevant output in terms of results of a strategy on both brokerage accounts as well as net commodity price, and provide the administrator the ability to add or delete commodities as they begin or cease option trading or update commodity option contract specifications as they change. These elements of the program are discussed below.

Input Information
As discussed earlier, extensive amounts of information is required to analyze the purchase and/or sale of put and/or call options. To obtain this information, a series of prompting questions were developed to assist the user in entering the information. The first question that must be entered by the user is the commodity being examined. This question is answered by the selection of the desired commodity from a drop down menu which contains all agricultural commodities which currently trade commodity options. The second question requires the user to input the current futures price of the selected commodity. This information may be obtained from either their broker or by other means such as electronic services which provide this information.

The next set of questions the user must answer pertain to the option position(s) which will be submitted for analysis. The first question asks the user to select up to four option positions (buy or sell a put or call) from four drop down menus. This is followed by questions concerning the corresponding option strike price(s) and premium value(s). Information concerning the strike price(s) and premium value(s) can be obtained from the same sources as the current futures price.

The final two questions deal with brokerage commission charges and local forecasted basis. Brokerage commission charges for various option positions can be obtained from the user's brokerage firm. However because brokerage firms may alter the fee per contract as more positions (buy and/or sell puts and/or calls) are taken, the question prompts the user to enter the total commission charge rather than the cost per unit (bushels, pounds, etc). Finally, the forecasted local basis refers to the expected difference between the local cash price and the futures price at contract expiration.

Output Information
Once the input information is completed by the user, relevant output information is provided in terms of: a summary of input information, a tabular and graphical representation of the result of the strategy, and a tabular and graphical representation of the result of the strategy on the net cash price of the commodity taking the local basis into consideration. This output information is discussed further below.

Input Summary. All input information provided by the user is summarized and presented to ensure correctness. Also included on the first output table is information concerning the cost to implement the strategy on a per unit basis (per pound, bushel, etc.). This cost to implement the strategy includes the amount paid for purchased options, amount received for sold options, and the brokerage commission charge. Finally, users are provided with information concerning the intrinsic and time value associated with each option that has been selected.

R*esults of the Strategy on the Brokerage Account*. The second output table presents the results of the option strategy at various futures market prices at contract expiration. The first column of the output table presents a range of futures market prices per respective unit at contract expiration. The following four columns presents the resultant value of each option per unit corresponding to each futures market price. The fifth column displays the cost of implementing the strategy per unit. Finally, the last column of the output table summarizes the previous five columns. This summary indicates the gain or loss per unit from implementing the strategy at the various corresponding futures market prices at contract expiration. A graphical representation can also be viewed by the user which shows the relationship between the various futures market prices at contract expiration and gain or loss from implementing the strategy.

Results of the Strategy on Net Cash Price. The final table indicates the results of the strategy under analysis on the net cash price of the commodity per respective unit. As discussed earlier, the first column provides the user with a range of futures

market prices at contract expiration per unit. The second column represents the local cash price. This local cash price is the addition of the range of futures market prices at contract expiration and the estimated local basis. The third column indicates the gain or loss per unit from implementing the strategy at the various corresponding futures market prices at contract expiration. Finally, the last column utilizes the range of estimated local cash prices and the gain or loss from implementing the strategy and provides the user with an estimate of the net cash price of the commodity per unit.

Practical Illustration

For the purposes of illustration, let us assume that a user wishes to evaluate the purchase of an at-the-money cotton put option and the sale of an out-of-the-money put option. The current futures price is $0.54 per pound. A purchased put option with a strike price of $0.54 per pound would have an associated premium of $0.0273 per pound, and a sold put option with a strike price of $0.50 per pound would currently possess a premium value of $0.0107 per pound. The brokerage firm will charge $100 total commission for the purchase and sale of the options, and the estimated local basis is equal to -$0.02 per pound at harvest. Table 1 provides answers and required input information for each question asked by the program.

Table 2 presents the first output from the program which includes the cost to implement the strategy and the associated intrinsic and time values of the two options. The cost to implement the strategy is 1.661 cents per pound which is the addition of the premium of the purchased put option (2.73 cents per pound), the premium of the sold put option (-1.07 cents per pound), and the commission (0.001 cents per pound ($100/100,000)). Furthermore, since both put options were not in-the-money, the intrinsic value of each is equal to zero. Finally the time values associated with the purchased and sold put options equal 2.73 and 1.07 cents per pound, respectively.

The results of the strategy on the brokerage account are presented in table 3. In this scenario if the futures price at contract expiration is equal to 58 cents per pound, both the purchased and sold put options would expire worthless, and the premium associated with the sold put option (1.07 cents per pound) would be retained. Taking the cost to implement the strategy which equaled 1.661 cents per pound, the strategy would net a loss of 0.591 cents per pound. However if the futures price at contract expiration is equal to 47 cents per pound, the purchased put option with an associated strike price of 54 cents per pound would now be worth seven cents per pound while the sold put option with an associated strike price would be worth -1.93 cents per pound (47.00-50.00+1.07). Taking both the gain from the purchased put option and loss from the sold put option into consideration along with the initial cost, the strategy would net a gain of 3.409 cents per pound if the futures price equals 47 cents per pound at contract expiration.

The results of the strategy on net cash price are presented in table 4. Results suggest that if the futures price at contract expiration is equal to 58 cents per pound, the local cash price would equal 56 cents per pound. Furthermore, the strategy would lose 0.591 cents per pound thus making the net cash price equal to 55.409 cents per pound. However, if the futures price at contract expiration is equal to 51 cents per pound, the local cash price would equal an estimated 49 cents per pound. This would also result in a gain of 2.409 cents per pound from using the strategy which would translate to a net cash price of 51.409 cents per pound.

Summary Conclusions

Agricultural producers are faced with a changing market environment making risk management a key to financial survival. One way in which risk has been managed is through diversification. Many studies have suggested various commodity futures and option strategies that will assist producers in achieving a favorable price. However when a producer attempts to implement a strategy, the current price environment must be evaluated to determine if the strategy will provide the desired protection. This analysis involves the examination of many aspects of the current price situation as well as factors such as the local basis. Due to the complexity and amount of information that must be analyzed as well as the time required to evaluate different alternatives the Commodity Options Evaluator was developed to assist in determining the potential outcomes of various commodity option strategies. The Commodity Options Evaluator can also be used by those attempting to provide educational programs concerning the use of options as a price risk management tool.

The Commodity Options Evaluator provides users the ability to analyze taking up to four simultaneous commodity option positions and produces results pertaining to the potential outcomes that could result from the position(s) in terms of the brokerage account as well as the impact on cash price. Given the flexibility of the program, users can evaluate various positions quickly and easily. Changes can easily be made to the program giving users the ability to analyze various positions quickly and easily. The Commodity Options Evaluator can be found at http://dallas.tamu.edu/econ/optionseval.

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Table 1. Relevant input information required by the user.

Question	Answer	Input Information
Select a commodity to evaluate.	Cotton	Cotton
What is the current futures price?	$0.54/lb	54
Select the positions you would like to take.		
Position One	Buy a Put	Buy a Put
Position Two	Sell a Put	Sell a Put
Enter the strike price associated with each position.		
Enter the strike price of position one (the bought put).	$0.54/lb	54
Enter the strike price of position two (the sold put).	$0.50/lb	50
Enter the premium value associated with each position.		
Enter the premium value of position one (the bought put).	$0.0273	2.73
Enter the premium value of position two (the sold put).	$0.0107/lb	1.07
What is the total commission charge for this strategy?	$100	100
What is the forecasted local basis at harvest?	-$0.02	-2

Table 2. Cost to implement the strategy, intrinsic values, and time values.

Output Category	Cents Per Pound
Cost to Implement the Strategy.	1.661
Intrinsic Value	
Bought Put Option ($0.54 Strike Price)	0.00
Sold Put Option ($0.50 Strike Price)	0.00
Time Value	
Bought Put Option ($0.54 Strike Price)	2.73
Sold Put Option ($0.50 Strike Price)	1.07

Table 3. Results of the options strategy on the brokerage account.

| | Value of the: | | | |
Futures Settlement Price At Contract Expiration (Cents/lb)	54.00 Bought Put Option (Cents/lb)	50.00 Sold Put Option (Cents/lb)	Initial Strategy Cost (Cents/lb)	Strategy Gain/Loss (Cents/lb)
58.00	0.00	1.07	1.661	-0.591
57.00	0.00	1.07	1.661	-0.591
56.00	0.00	1.07	1.661	-0.591
55.00	0.00	1.07	1.661	-0.591
54.00	0.00	1.07	1.661	-0.591
53.00	1.00	1.07	1.661	0.409
52.00	2.00	1.07	1.661	1.409
51.00	3.00	1.07	1.661	2.409
50.00	4.00	1.07	1.661	3.409
49.00	5.00	0.07	1.661	3.409
48.00	6.00	-0.93	1.661	3.409
47.00	7.00	-1.93	1.661	3.409
46.00	8.00	-2.93	1.661	3.409
45.00	9.00	-3.93	1.661	3.409
44.00	10.00	-4.93	1.661	3.409

Table 4. Results of the options strategy on net cash price.

Futures Settlement Price at Contract Expiration (Cents/lb)	Local Cash Price at Contract Expiration (Cents/lb)	Strategy Gain/Loss (Cents/lb)	Net Cash Price (Cents/lb)
58.00	56.00	-0.591	55.409
57.00	55.00	-0.591	54.409
56.00	54.00	-0.591	53.409
55.00	53.00	-0.591	52.409
54.00	52.00	-0.591	51.409
53.00	51.00	0.409	51.409
52.00	50.00	1.409	51.409
51.00	49.00	2.409	51.409
50.00	48.00	3.409	51.409
49.00	47.00	3.409	50.409
48.00	46.00	3.409	49.409
47.00	45.00	3.409	48.409
46.00	44.00	3.409	47.409
45.00	43.00	3.409	46.409
44.00	42.00	3.409	45.409