

EVALUATION OF COTTON PUT OPTIONS AS A PRICE RISK MANAGEMENT TOOL

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Abstract

When deciding whether or not to use put options as a marketing tool, the strike price and associated premium levels along with an individual's cost of production must be taken into consideration. The objective of this research was to develop an easily understood strategy that would help determine the time and strike price level to hedge cotton using the cotton options market. Results of this study indicated that put options purchased four cents in-the-money between May 21 and 31 increased net returns by \$0.0167 per pound on average over the study period.

Introduction

Production agriculturalists across the U.S. are attempting to manage production risks and price volatility in order to maintain a desired level of profitability. Attempts have been made to provide revenue security through crop insurance, but have not proven to be very successful in the cotton sector (Herndon et al., 1999). One way in which the commodity production sector has attempted to manage price volatility and further add additional income to their operations is through the use of futures and options contracts. 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. Finally, 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.

Although the use of the cotton futures market will ensure a minimum price for a commodity, margin requirements and the inability to take advantage of upward movements in price may make this alternative unattractive to some producers. Therefore the options market has become an increasingly popular means of hedging price risk and/or adding additional revenue received for a commodity. Specifically, agricultural producers who purchase put options at a particular strike price prior to harvest pay a premium plus commission for that option and have no other financial obligation. If, prior to contract expiration, market prices fall below the level of the strike price at which the option was purchased, the put option may be exercised or offset to capture the additional income. If market prices remain greater than the strike price of the purchased put option throughout the remainder of the contract, the option expires worthless and the producer will only lose the initial premium and commission paid when the option was purchased.

Several factors that play a role in the decision to purchase put options such as the availability of various strike prices, the time value associated with option premium values, and the volatility associated with the market which in turn changes option premium values and complicate the decision made by a agricultural producer. For instance, higher premiums will be paid for put options purchased with higher associated strike prices. Likewise, purchased put options that have a relatively long time period before contract expiration will demand higher premiums than those purchased closer to contract expiration. Finally, premium values for put options purchased in a volatile market will be greater than those purchased in a market with lower volatility.

When deciding whether or not to use put options as a marketing tool, the strike price and associated premium levels along with an individual's cost of production must be taken into consideration. However producers are faced with limited available time for analyzing these factors when attempting to make a decision. Therefore, an understandable set of guidelines that will assist producers in making this decision is required. The objective of this research was to develop an easily understood strategy that would assist in the determination of the time and strike price level at which to hedge cotton using the December cotton options market.

Methods and Procedures

For the purposes of this research, it was assumed that producers would enter and exit the options market only once during the life of each contract. Furthermore, at-the-money or in-the-money put options were offset rather than exercised if possible at contract expiration.

Study Data

Historical daily December cotton futures and option strike prices and premium values from 1985 through 2000 were analyzed for this study from May 1 through its expiration. Due to differences in trading dates (due to weekends and holidays) and in the total number of trading days for each individual contract, a standardized method was developed so comparisons could be made for like time periods across years. This standardized method involved the division of each month for each contract into three time classifications (first through the tenth, eleventh through the twentieth, and the twenty-first through the end of the month). The daily cotton futures prices and option premiums for like strike prices were then averaged.

Hedging

Each contract's average premium value for at-the-money put options associated with each time period was analyzed in relation to the corresponding average price associated with the first ten days of November. If market conditions existed the purchased options were offset, otherwise the option was exercised and the futures position was then offset. This yielded all potential revenues that could have been generated through the purchase and later offsetting or exercising of a cotton put option. A similar approach was used to evaluate cotton put options one, two, three, and four cents in-the-money and out-of-the-money at the time of purchase. Furthermore a \$25 per contract commission charge per round trip was also assessed per round trip whether the purchased put option was offset, exercised, or expired worthless. The resulting potential revenues for each contract were then averaged, and the time period and level of strike price (at-the-money or one, two, three, or four cents in-the-money or out-of-the-money) which provided the highest returns were identified.

Effects on Net Price Received

Returns from purchasing a put option using the time period and strike price level determined by this study were then added to the average price received by Texas producers for cotton (USDA 2000, 1997, 1994, 1991, 1988, and 1985). The mean price received for cotton without hedging (average price received by Texas producers for cotton) was then compared to the mean net price received for cotton using the date and strike price selection process of this study using a paired t-test. Since a larger variance would suggest a greater variability in net revenues generated from the use of the cotton options market, the variances of the net returns from utilizing the cotton options market while using the date and strike price selection process was also compared with the variance of the average price received by Texas producers for cotton to determine if they were statistically different.

Results

The results of this study are presented below in two different sections. The first section presents the results of the date and associated strike price levels that provided the highest net returns from purchasing the various cotton put options. The effects of the purchase of put options between four cents out-of-the-money and four cents in-the-money on the net price received for Texas cotton are presented in the second section.

Returns from Hedging with Put Options

Results of the study suggested that cotton put options purchased near planting time and in-the-money provided the greatest returns over the range of data (Table 1). Specifically, cotton put options purchased four cents in-the-money between May 21 and 31 produced the greatest average return of \$0.0167 per pound. Likewise, results suggested May 21 and 31 was the date that produced the greatest average returns for cotton put options purchased three and two cents in-the-money, however these average returns (\$0.0137 and \$0.0101 cents per pound, respectively) were less than those associated with the purchase of put options during this same time period four cents in-the-money. Average returns were observed to continue to decline for put options purchased between one cent in-the-money and four cents out-of-the-money, however results suggested that put options with these relative strike prices should be purchased between June 11 and 20.

Results also suggested that put options purchased further in-the-money produced a greater percentage of positive trades as compared to put options purchased out-of-the-money using the dates discussed above (Table 1). Specifically, 25 percent of the put options purchased four cents out-of-the-money between June 11 and 20 produced positive trades as compared to about 44 percent positive trades for at-the-money put options purchased between June 11 and 20. The percentage of positive trades produced using the trading dates discussed above was observed to continue to increase as the purchased put options moved

further in-the-money with the exception of put options purchased four cents in-the-money between May 21 and 31. Furthermore, this trend was also observed when all potential trades made over the range of data are examined rather than just the dates suggested above as producing the greatest average return (Table 2). Specifically, the about 20 percent of the total number of four cent out-of-the-money put option purchases that could have occurred over the range of data were positive as compared to about 33 percent of the at-the-money and about 43 percent of the four cent in-the-money put option potential purchases.

Effects on Net Price Received

The effects purchasing put options between four cents out-of-the-money and four cents in-the-money on the average price received by Texas producers for cotton are presented in Table 3 along with the mean prices of the price series. When the mean net prices produced from purchasing put options were compared with the mean price received by Texas producers for cotton, results indicate put options purchased between four cents out-of-the-money and three cents in-the-money using the dates that produced the greatest net returns were not statistically different from the mean price received for Texas cotton (Table 4). The mean net price from purchasing four cent in-the-money put options between May 21 and 31 was statistically significant at the 0.15 level. An F-test of the variances of the price series suggest that the variances of the distributions of using put options were not statistically different from the variance of the average price received by producers for Texas cotton. These findings suggest that the purchase of put options during the time periods discussed earlier did not increase or decrease the variability in net returns and only significantly increased the net price received for cotton when the option was purchased four cents in-the-money.

Summary and Conclusions

The commodity options market has become an increasingly popular means for agricultural producers of hedging price risk and/or adding additional revenue received for a commodity. When deciding whether or not to use the options market as a marketing tool, the strike price and associated premium levels along with an individuals cost of production must be taken into consideration. However producers are faced with limited available time for analyzing these factors when attempting to make a decision. Therefore, an understandable set of guidelines that will assist producers in making this decision is required. The objective of this research was to develop an easily understood strategy that would help determine the time and strike price level to hedge cotton using the cotton options market.

Results indicate that over the range of data, cotton producers increased net returns through the purchase of in-the-money cotton put options near planting time. Specifically, cotton put options purchased four cents in-the-money between May 21 and 31 produced the greatest average return of \$0.0167 per pound. As the level of the strike price relative to the futures price decreased from four cents in-the-money to four cents out-of-the-money at the time of purchase, average returns were observed to decline. Results also suggested that put options purchased further in-the-money produced a greater percentage of positive trades as compared to put options purchased out-of-the-money using the entry dates found in this study. Furthermore, this trend was also observed when all potential trades made over the range of data are examined rather than just the dates suggested above as producing the greatest average return.

When the mean net prices produced from purchasing put options were compared with the mean price received by Texas producers for cotton, results indicate put options purchased between four cents out-of-the-money and three cents in-the-money were not statistically different from the mean price received for Texas cotton. The mean net price from purchasing put options four cents in-the-money between May 21 and 31 was statistically significant at the 0.15 level. An F-test of the variances of the price series suggest that the variances of the distributions of using put options were not statistically different from the variance of the average price received by producers for Texas cotton. These findings suggest that the purchase of put options during the time periods discussed earlier did not increase or decrease the variability in net returns and only significantly increased the net price received for cotton when the option was purchased four cents in-the-money.

In conclusion, this study found that greater returns were associated with the purchase of cotton put options further in-the-money over the range of data. Furthermore, a greater percentage of trades resulting in positive returns were observed at higher strike price levels relative to the underlying futures price at the time of purchase. While the results of this study do not suggest that market conditions will persist into the future that will produce similar results, this study does suggest that strike prices further in-the-money do warrant examination when attempting to hedge price risk using cotton put options.

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Table 1. Results from purchasing Out-of-the-Money, At-the-Money, and In-the-Money put options.

Purchased Put Option	Put Option Purchase Date	Premium Paid (Cents/lb.)	Percentage of Years Having Positive Gains (Percent)	Average Net Gain/Loss (Cents/lb.)
Cents Out-of-the-Money				
4	6/11 - 6/20	1.89	25.00	-0.04
3	6/11 - 6/20	2.07	31.25	-0.02
2	6/11 - 6/20	2.43	37.50	0.12
1	6/11 - 6/20	2.89	43.75	0.18
At-the-Money	6/11 - 6/20	3.37	43.75	0.29
Cents In-the-Money				
1	6/11 - 6/20	3.77	43.75	0.83
2	5/21 - 5/31	4.48	50.00	1.01
3	5/21 - 5/31	4.87	56.25	1.37
4	5/21 - 5/31	5.49	43.75	1.67

Table 2. Potential put option returns between 1985 and 2000.

Purchased Put Option	Number of Potential Trades		Total Number of Potential Trades	Percentage of Potential Trades Resulting in Positive Returns
	Number of Potential Trades Resulting in Negative Returns	Number of Potential Trades Resulting in Positive Returns		
Cents Out-of-the-Money				
4	203	51	254	20.08
3	222	57	279	20.43
2	216	68	284	23.94
1	204	80	284	28.17
At-the-Money	190	94	284	33.10
Cents In-the-Money				
1	174	100	274	36.50
2	163	104	267	38.95
3	144	106	250	42.40
4	128	95	223	42.60
All Trades	755	1,644	2,399	31.47

Table 3. Average price received for Texas cotton and net returns from purchasing put options (1982-84 = 100).

Year	Avg. Price Received by Texas Producers (Cents/lb.)	Cents Out-of-the-Money				At The Money	Cents In-the-Money			
		4	3	2	1		1	2	3	4
2000	29.85	28.80	28.59	28.36	28.11	27.85	27.61	29.85	29.85	29.85
1999	24.85	24.74	25.02	25.34	25.66	25.95	26.23	27.40	27.91	27.82
1998	35.64	36.60	36.95	37.31	37.62	37.92	38.20	36.58	35.88	36.99
1997	37.45	36.72	36.94	37.25	37.60	37.89	38.16	37.84	37.94	37.45
1996	41.81	41.24	41.54	41.90	42.22	42.53	42.82	44.67	45.83	45.42
1995	48.95	46.87	46.59	46.31	46.01	45.70	45.37	44.93	44.69	48.95
1994	46.90	45.73	45.51	45.26	44.97	44.66	44.70	45.11	45.30	46.90
1993	37.02	36.02	35.83	35.69	45.66	35.77	35.99	36.90	37.90	37.41
1992	35.00	37.52	37.93	38.65	39.06	39.43	39.77	36.58	38.83	37.35
1991	39.35	43.99	44.50	44.95	45.38	45.79	46.53	46.94	46.87	39.35
1990	48.36	46.74	46.49	46.37	45.81	45.81	48.36	48.36	48.36	48.36
1989	47.58	46.48	46.21	45.91	45.52	45.12	45.23	47.55	44.79	47.54
1988	43.62	46.91	47.31	47.94	48.49	48.77	49.92	45.07	45.88	45.69
1987	52.46	50.71	50.84	51.12	51.49	51.85	52.21	52.46	52.46	52.46
1986	42.06	42.06	41.41	40.98	40.67	40.09	39.56	38.58	38.20	37.28
1985	47.96	47.96	47.31	47.06	46.63	46.93	47.38	48.70	50.07	49.05
Average Price Received	41.18	41.19	41.19	41.28	41.31	41.38	41.75	41.72	41.92	41.74

Table 4. Results of the paired t-tests and F-tests between the average price received for cotton by Texas producers and the net price from hedging with the use of put options.

	Average Price Received for Cotton by Texas Producers and Purchased Put Options									
	Cents Out-of-the-Money				At-the-Money	Cents-In-the-Money				
	4	3	2	1		1	2	3	4	
t-Statistic	-0.028	-0.014	-0.158	-0.185	-0.269	-0.714	-0.817	-0.967	-1.204	
(P value)	(0.489)	(0.495)	(0.438)	(0.428)	(0.396)	(0.243)	(0.213)	(0.174)	(0.124)	
F-Statistic	1.088	1.114	1.125	1.140	1.136	1.058	1.140	1.175	1.089	