The *Journal of Cotton Science* 5:218-223 (2001)
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ECONOMICS & MARKETING

Using a Moving Average to Determine Cotton Futures Market Entry Dates

Blake K. Bennett*

INTERPRETIVE SUMMARY

Cotton producers are faced with a changing market environment, making it necessary to decrease the variability in net price over time - a key consideration to financial survival. One way in which producers can manage the variability in net price over time is through the use of futures and options contracts. Once producers understand the concept of how to use futures in the marketing of their commodity, questions generally turn to how to use the futures market to increase the net price they receive for their commodity. Therefore, producers need guidelines to help them develop a marketing plan to manage the variability in net price over time. The objective of this research was to develop an easily understood strategy that would help determine the time to hedge cotton using the cotton futures market with and without the use of stop orders.

Historical daily December cotton futures closing prices from 1980 through 2000 were analyzed from the beginning of each contract through contract expiration (~18 mo). Because of 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 that comparisons could be made for like time periods across years. Each contract's average closing price associated with each time period was analyzed in relation to the corresponding average price associated with the last 10 days of November. This approach yielded all potential revenues that could have been generated through the placing and later lifting of a cotton futures market hedge for each time period of each contract. The potential revenues generated during 1980 through 1989 were averaged. The time period that provided the highest net returns was used as the hedging entry date for the 11th year (1990). A similar approach was used to determine the hedging entry date by employing a 10-yr moving average of the potential revenues for years 1990 through 2000. The stop order level was determined by evaluating a 10-yr moving average of potential revenues generated from placing a hedge with the use of stop orders ranging from \$0.0110 kg^{-1} to \$0.4409 kg^{-1} on \$0.0110 kg^{-1} intervals.

Results indicated that over the range of data, producers could benefit from placing a cotton futures market hedge using the entry date selection process described in this study. This strategy was found to provide an additional \$0.0549 kg^{-1} of cotton lint on average to net revenues. Furthermore, use of a stop order in conjunction with the hedging strategy discussed above did not provide any additional net revenue.

When the gains and losses from the entry date selection process were added to the average price received by Texas producers for cotton, it was found that the mean of the trading strategy was statistically different from the mean price received by producers. However, tests on the variances suggested that the variance of the trading strategy did not differ statistically from the average price received by producers. These two findings suggest that, on average, net revenues were increased through the use of the entry date selection process described in this study, while the variability in net price over time was unaffected.

What Is the Entry Date Selection Process?

Results of the study suggested that producers could increase the net price received for cotton (cash price plus gain or loss from hedging) by using a 10-yr moving average of cotton prices to determine the date to place a cotton futures market hedge (sell cotton futures). Specifically, results suggested that a cotton futures market hedge placed using the entry date selection process described in this study increased the net price received by \$0.0549 kg^{-1} on

B.K. Bennett, Texas Agricultural Extension Service, Texas A&M Univ., 17360 Coit Road, Dallas, TX 75252. Received 10 July 2001. *Corresponding author (b-bennett@tamu.edu).

average over the range of data. This strategy provided positive returns in 10 of the 11 yr included in the analysis of this study, with the most made in a single year being \$0.0918 kg^{-1} and the most lost in a single year being \$0.0220 kg^{-1}.

What Is the Level of Stop Order to Use?

Given the nature of the market that existed over the range of data, stop orders did provide increased revenues to hedges placed between 1980 and 1989. Specifically, results indicated that the stop order level to use for the 1990 marketing season was \$0.0550 kg^{-1}. However, between 1990 and 2000, the December futures market did not increase to a point where a stop order would have become a market order after the market entry date was determined by this study. Therefore, stop orders used in conjunction with hedges placed using the 10-yr moving average of closing December cotton futures prices entry-date-selection-strategy never became a market order between 1990 and 2000. Because of this nature of the market between 1990 and 2000, no changes in net revenues were observed between hedging with and without the use of stop orders. Furthermore, the stop order level decreased to \$0.0110 kg^{-1} by 2000.

How Does the Date Selection Trading Strategy Affect the Net Price Received for Cotton?

When the returns from the date selection trading strategy were added to the average price received by Texas producers for cotton, it was found that the mean net price of the hedging strategy was statistically different from the mean price received by Texas producers for cotton. However, an *F*-test suggested that the variance of the distribution of the hedging strategy was not statistically different from the variance of the average price received by producers for Texas cotton. This result suggests that the date selection strategy found in this study can significantly increase the mean net price received for cotton, but does not increase or decrease the variation in the net price received.

In conclusion, this study has developed a hedging strategy for cotton producers. No uniform market entry date was found. Furthermore, due to the environment that existed in the December cotton futures market over the range of data used for this study, the use of stop orders was irrelevant. Caution should therefore be used when implementing the stop order level decision tool developed by this study. However, it was found that the use of a strategy such as the one provided in this study can provide additional support to cotton producers attempting to hedge their cotton price through the use of the futures market.

ABSTRACT

A persisting question in using the cotton (*Gossypium hirsutum* L.) futures market to increase the net price received is that of determining the time to place hedges. The objective of this research was to develop an easily understood hedging strategy that would help cotton producers determine the time to hedge their cotton price with and without the use of stop orders. Historical daily December cotton futures closing prices from 1980 through 2000 were analyzed from the beginning of each contract through contract expiration. A 10-yr moving average was used to determine the hedging entry date. Results of the study suggested that the use of this strategy in determining the hedging market entry date increased the net price received by cotton producers \$0.0549 kg^{-1} on average. When the returns from the date selection trading strategy were added to the average price received by Texas producers for cotton, the mean net price of the hedging strategy was statistically different from the mean price received by Texas producers for cotton. However, an *F*-test showed that the variance of the distribution of the hedging strategy was not statistically different from the variance of the average price received by producers for Texas cotton. These results suggest that the date selection strategy found in this study can significantly increase the mean net price received for cotton, but does not increase or decrease the variation in the net price received.

Producers are faced with a changing market environment, making risk management a key consideration to financial survival. Price risk management (or the marketing of commodities) is one facet of risk management of great concern to producers (Dobbins and Robbins, 1983). In an attempt to combat price risk, many producers have turned toward the use of futures markets. Hedging price risk using the futures market involves taking an equal and opposite position in the futures and cash markets. If futures and cash prices decrease while a

hedge is in place, profits from the futures market offset lower cash prices. Conversely, if prices increase, losses in the futures market are offset by the improved cash price. Use of the futures market to manage price risk has proven to increase average prices received by producers. In fact, 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.

Previous research concerning the use of commodity futures markets has found that producers can take advantage of price volatility to add to the selling price of their cotton. Specifically, 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. This study found that cotton producers could add, on average, an additional \$0.0441 kg^{-1} to the final price they receive for cotton by making trades throughout the year on the basis of moving averages. Likewise, 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.

Turner and Heboyan (2001) examined the use of the high volatility in futures prices to lock in favorable cotton prices through the use of a rollover hedging strategy. Distributions were developed from a 7-yr moving average of historical daily futures prices. These distributions were then used to determine whether to hedge in the eighth year. Examination of hedges initiated when prices entered the 1, 2.5, and 5th percentiles in the distribution suggested that both single-year and 3-yr strategic rollover hedges improved producer net returns, but they were associated with higher risk. Gardner (1989) also investigated the strategy of using rollover hedging as a price risk-management tool for corn (*Zea mays* L.), cotton, and soybean [*Glycine max* (L.) Merr.]. A sequential rollover hedging strategy yielded the same expected returns as cash sales, annual futures sales, or a multi-year futures contract in the absence of bias or trends in futures market prices. Hedging strategies reduced the variance of returns unpredictably, with consecutive rollover hedges being the most unpredictable. Finally, Gardner (1989) concluded that rollover hedging strategies are more predictable in the ability to lock in a price for a given time period.

After the concept of how the futures market can be used is understood, producers generally look to the futures market as a means of adding additional income to their operation through timely hedges. A timely-placed hedge can add significantly to the net price producers receive. A poorly timed hedge, on the other hand, can result in financial losses until producers sell their commodity.

While the previous research does indicate that producers can acquire improved net returns through the use of various futures market hedging strategies, the complexity of such strategies may deter many producers from adopting them. Therefore, producers need an understandable set of guidelines that would help them develop a marketing plan to increase the net price they receive for their commodity. The objective of this research was to develop an easily understood strategy that would help determine the time to hedge cotton using the cotton futures market with and without the use of stop orders.

MATERIALS AND METHODS

For the purposes of this research, it was assumed that producers would enter and exit the futures market only once during the life of each contract. Furthermore, it is recognized that the December cotton futures contract generally expires during the first 10 days of December. However, because of price irregularities associated with the last few trading days of a contract before it expires, it was assumed that producers would lift futures market hedges during the latter part of November.

Study Data

Historical daily December cotton futures closing prices from 1980 through 2000 were analyzed from the beginning of each contract through contract expiration (~18 mo). Because of 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 that comparisons could be made for like time periods across years. This standardized method involved the division of each of the 18 mo for each contract into three time classifications (the 1st through the 10th,

the 11th through the 20th, and the 21st through the end of the month). The daily cotton futures closing prices were then averaged for each time period. This provided 54 time periods for each contract (18 mo at three standardized time periods per month).

Hedging Without a Stop Order

Each contract's average closing price associated with each time period was analyzed in relation to the corresponding average price associated with the last 10 days of November. This yielded all potential revenues that could have been generated through the placing and later lifting of a cotton futures market hedge for each time period of each contract. The potential revenues generated during 1980 through 1989 were then averaged. The time period that provided the highest net returns was then used as the hedging entry date for the 11th yr (1990). A similar approach was used to determine the hedging entry date by employing a 10-yr moving average of the potential revenues for years 1990 through 2000.

Hedging With a Stop Order

When producers hedge their cotton through the use of a futures contract, they alleviate their downside price risk. However any upside price movement is also lost because of the nature of their position in the futures market. In other words, producers who place a hedge are protected against decreasing prices, but are not allowed to participate in increasing price movements unless the placed hedge is lifted. To combat this problem, the use of a stop order was evaluated by a similar approach discussed above in determining the market entry date. The stop order level was determined by using the market entry date and evaluating potential changes in returns through the use of stop orders ranging from \$0.0110 kg^{-1} to \$0.4409 kg^{-1} on \$0.0110 kg^{-1} intervals. The potential revenues with the use of all stop orders generated during 1980 through 1989 were averaged, and the stop order level that provided the highest returns was then used as the stop order level for the 11th year (1990). A similar approach was used to determine the stop order level by employing a 10-yr moving average of the potential revenues for the years 1990 through 2000.

Effects on Net Price Received

Returns from both hedging strategies (with and without the use of a stop order) for the years 1990 through 2000 were added to the average price received by Texas producers for cotton (Texas Agricultural Statistics Service, 1990, 1992, 1997, 1999). The mean price received for cotton without hedging (the average price received by Texas producers for cotton) was then compared with the mean net prices received for cotton using the time to place cotton hedges with and without stop orders using a paired *t*-test. Furthermore, since a larger variance could suggest a greater amount of risk associated with a given strategy, the variances of hedging with and without stop orders were compared with the variance of the average price received by Texas producers for cotton to determine if they were statistically different.

RESULTS AND DISCUSSION

The results of this study are presented below in three different sections. The first section presents the results of the time to place a cotton hedge (selling futures contracts) and the later lifting of that hedge between 21 and 30 November without the use of a stop order. The second section presents the results of placing and lifting a cotton hedge using the date selection strategy determined by this study, but includes the use of a stop order. The final section presents the results associated with the effects of the date selection strategy on the net price received by Texas producers.

Hedging Without a Stop Order

Results of the study suggested that producers could increase their net price (cash price plus gain or loss from hedging) from the use of cotton futures market hedging. Specifically, the use of a 10-yr moving average to determine when to place a cotton futures market hedge (sell cotton futures) increased the net price received by \$0.0549 kg^{-1} on average (Table 1). Using this strategy provided positive returns in 10 of the 11 yr under consideration, with the most made in a single year being \$0.0918 kg^{-1} and the most lost in a single year being \$0.0220 kg^{-1}.

Table 1. Entry date, resulting gain or loss from hedging, and stop order level.

Year	Entry date	Hedging gain or loss	Stop level
		——— $ kg^{-1} ———	
1990	9/21/90–9/30/90	0.0504	0.055
1991	9/21/91–9/30/91	0.0338	0.055
1992	7/1/91–7/10/91	0.0771	0.055
1993	6/21/93–6/30/93	0.0824	0.055
1994	7/1/93–7/10/93	0.0620	0.055
1995	7/1/94–7/10/94	−0.0220	0.055
1996	6/11/96–6/20/96	0.0190	0.055
1997	6/11/97–6/20/97	0.0607	0.055
1998	6/11/98–6/20/98	0.0697	0.055
1999	6/11/99–6/20/99	0.0793	0.055
2000	6/11/00–6/20/00	0.0918	0.0110
Average 10-yr return		0.0549	

Table 2. Average price received for Texas cotton and net price received from hedging with and without a stop order (1982–1984 = 100).

Year	Average Texas cotton price received by producers	Net price received by Texas producers: Hedging without a stop order	Stop order level	Net price received by Texas producers: Hedging with the stop order
	——— $ kg^{-1} ———			
1990	1.0660	1.1046	0.055	1.1046
1991	0.8676	0.8924	0.055	0.8924
1992	0.7715	0.8265	0.055	0.8265
1993	0.8162	0.8732	0.055	0.8732
1994	1.0339	1.0757	0.055	1.0757
1995	1.0792	1.0647	0.055	1.0647
1996	0.9217	0.9339	0.055	0.9339
1997	0.8255	0.8633	0.055	0.8633
1998	0.7858	0.8286	0.055	0.8286
1999	0.5478	0.5954	0.055	0.5954
2000	0.6581	0.7113	0.0110	0.7113
Mean	0.8521	0.8882		0.8882
Var.	278.5590	240.4357		240.4357
St. dev.	16.6901	15.5060		15.5060

Hedging With a Stop Order

Given the nature of the market that existed over the range of data, stop orders did provide increased revenues to hedges placed between 1980 and 1989. Specifically, results indicated that the stop order level to use for the 1990 marketing season was \$0.0550 kg^{-1}. However, between 1990 and 2000, the December futures market did not increase to a point where a stop order would have become a market order after the market entry date was determined by this study. Therefore, stop orders used in conjunction with hedges placed using the market entry date selection method determined by this study never became a market order between 1990 and 2000.

Table 3. Results of the paired *t*-tests and *F*-tests.

	Date selection strategy and average Texas cotton price received
t-statistic	−5.5938
(*P* value)	(0.000115)
F-statistic	0.863141

Because of this nature of the market between 1990 and 2000, no changes in net revenues were observed between hedging with and without the use of stop orders. Furthermore, the stop order level decreased to \$0.0110 kg^{-1} by 2000.

Effects on Net Price Received

The effects of the date selection strategy on the average price received by Texas producers for cotton are presented in Table 2, along with the mean, variance, and standard deviations of the price series. When the mean values of the price series were evaluated using a paired *t*-test, results indicated that the mean net price of hedging cotton using the date selection strategy found in this study was significantly different from the mean price received by Texas producers for cotton at the 0.01 level (Table 3). An *F*-test of the variances of the price series showed that the variances of the distributions of the price received by Texas producers for cotton and the net price received by Texas cotton producers using the date selection strategy found in this study were not significantly different. These results suggest that the date selection strategy found in this study can significantly increase the mean net price received for cotton, but does not increase or decrease the variation in the net price received.

CONCLUSIONS

Results indicated that over the range of data, producers could benefit from placing a cotton futures market using a 10-yr moving average of closing December cotton futures prices to determine the market entry date. This strategy was found to provide an additional \$0.0549 kg^{-1} of cotton lint on average to net revenues. Furthermore, a stop order, used in conjunction with the hedging strategy discussed above, did not provide any additional net revenue.

When the gains and losses from the hedging strategy were added to the average price received by

Texas producers for cotton, the mean of the trading strategy was statistically different from the mean price received by producers. However, tests on the variances suggested that the variance of the trading strategy did not differ statistically from the average price received by producers. These two findings suggest that, on average, net revenues were increased through the use of the date selection strategy described in this study, while the variability in net price over time was unaffected.

In conclusion, this study has shown that the use of a 10-yr moving average to determine the market entry date has provided price protection to cotton producers over the range of data. Specifically, the use of a strategy such as the one described in this study provided additional returns relative to making no marketing decisions prior to harvest. Such strategies can assist cotton producers in making the difficult decision about when to market their cotton. Furthermore, due to the environment that existed in the December cotton futures market over the range of data used for this study, the use of stop orders was irrelevant. Caution should therefore be used when implementing the stop order level decision tool developed by this study.

ACKNOWLEDGMENT

Supported by Cotton Incorporated grant no. 00-835.

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