A Preliminary Investigation of the Feasibility of Cross Hedging Whole Cottonseed in Texas

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INTRODUCTION

Cottonseed is an important joint product of upland cotton production, where roughly 700 pounds of seed on average are produced from each 480 pound bale of cotton (Cotton Inc.) With cotton being the leading cash crop in the largest producing state of Texas, the value of whole cottonseed is an important factor in the overall economics of cotton production, where the returns from whole cottonseed represent slightly below 20% of the estimated gross returns from total production. Whole cottonseed has become an important ingredient in livestock rations, especially for dairy cattle, as it is considered a complete supplement that offers a protein content of 23%, energy in the form of fat of 20%, and 24% crude fiber on a dry matter basis (Cotton Inc.). The high energy and protein stem from the kernel of the seed, while the fiber comes from short strands commonly referred to as “linters” that remain on the seed after the cotton, or lint, is removed. Cotton Incorporated describes one fourth of U.S. whole cottonseed as being sold directly from gins as livestock feed, and another quarter is distributed as livestock feed products after being processed by a cottonseed oil mill. Given the importance of the Texas livestock industry, it may be that the share of Texas whole cottonseed being fed to livestock is greater than the national average.

A majority of cottonseed marketing takes place from September to December after the typical harvest period in Texas. The value of whole cottonseed has traditionally been applied to offset ginning costs and past swings in price occurred as a result of inadequate storage capacities (Cotton Incorporated). Historical observations of Texas whole cottonseed price implies that most of the time the price will be within plus-or-minus $65 per ton around the average price. This level of variation is significant enough to expose growers to occasional ginning cost increases. It might also represent a significant risk to the financial position of gins, co-ops, livestock feeders, and other users. Conventional risk management practices for other storable agricultural commodities consist of longer term storage, forward contracting, and using futures markets as a means to combat unfavorable price movements. However, special considerations must be made for storing such products and no futures market currently exists for cottonseed. This limits users and growers in their marketing planning and risk reduction strategies. The purpose of this study is to identify and evaluate applicable cross hedging strategies for whole cottonseed in Texas.

METHODOLOGY

Because whole cottonseed market distribution information is not widely available, an on-line survey was created and disseminated to cotton gins throughout Texas to gain a better understanding of distribution and utilization patterns, and assess the risk associated with buying and selling cottonseed for gins, growers, and livestock feeders. Many respondents, which consisted of both cooperative and independently owned gins across all regions of Texas, noted that there is risk of fluctuating prices, and longer term storage of seed and forward contracting is used to help mitigate this risk. Cross hedging was mentioned in discussions with gin members as a means to manage price volatility, but this strategy is not typically implemented.

As such, there has been a very limited amount of research on the hedging possibilities for whole cottonseed. With no current contract available for trade on any widely used commodities exchange, cross hedging cottonseed cash prices at the gin or oil mill level might be feasible using futures contracts similar in nature. Possible cross hedging contracts evaluated include soybeans, soybean meal, soybean oil, and corn, all of which are traded at the Chicago Board of Trade, and act as substitutes for cottonseed as protein in livestock rations. Additionally, the canola contract offered by the Winnipeg Commodity Exchange was considered. In order for cottonseed cash prices to be hedged appropriately, there needs to be an adequate correlation between these cash and futures price series.

Correlations between the weekly West Texas whole cottonseed cash price and weekly near month futures prices of the aforementioned contracts were calculated for the price level, price changes, and percent changes in price. Soybeans and soybean meal appear to be most aligned with cottonseed price movement. With this information, optimal hedge ratios using a simple ordinary least squares (OLS) regression model are calculated at the price level to best select the appropriate number of contracts needed within the futures position to sufficiently cover one’s spot, or cash, position. After estimating the ideal number of contracts, empirical tests simulating cross hedging strategies were conducted to analyze returns by a cotton gin in both hedged and unhedged scenarios.

Simulated strategies in this study were explored from the viewpoint of a cotton gin or a seller of physical seed. Since the Texas cotton harvest begins in late August, gins naturally start receiving cottonseed from the ginning process at this time and sales of the seed to either oil mills or livestock feeders continues mostly from then through the end of December. Gins can employ either a pre-harvest based cross hedge or one that takes the limited time of storage into account. A pre-harvest cross hedge involves taking a short position in the futures market before the cotton harvest and then lifting that position as possession of the cottonseed occurs and selling takes place. To remove the hedge, the gin manger must buy back an equal number of future contracts to offset the short position. Alternatively, in the event of storing and holding cottonseed before the sale date, a short position is taken in the nearest futures delivery month when the seed arrives and the hedge is maintained until the time of sale arises. In this situation, if the cottonseed remains in storage when the futures contract matures, the cross hedge is lifted and simply rolled forward into the next delivery month as necessary.

Both scenarios were tested using soybean and soybean meal contracts. The pre-harvest cross hedge was executed by placing the hedge four months prior to the expected sale date and then lifting the short position in the futures market once the physical seed was sold during the September through December time period. Four months prior to harvest was chosen as the time length because the gin is likely aware of the amount of cotton acres planted and can reasonably estimate the expected production and cottonseed volume. Analysis using this approach involved changing the date the hedge was implemented as well as the date when spot market sales were performed so that they remain four months apart. Similarly, a cross hedge was assessed while taking storage into account by placing the hedge in the nearby futures on the first week of July and lifting it at the time of sale between the first week of September through the last week of December. In this scenario, the date the hedge was applied remained constant as the first week July, while the selling of cottonseed changed by a week over the four-month time period. Employing the hedge at this time allows the gin to assess their storage capabilities and cotton yields more accurately just before harvest while still being able to protect against falling prices once possession of the seed takes place.

To calculate the effective net price received by the gin, the revenue from the sale of the cottonseed was added to any gain or loss associated with the futures transaction to determine the total revenue. This value divided by the amount of cottonseed sold results in the realized price received by the gin. A cross hedge using this method is deemed successful and effective when a gain in the futures market occurs due to declining prices and concludes with a calculated net realized price that is greater than the cash price of unhedged whole cottonseed

RESULTS

In the first scenario examined, it is assumed that in the first week of May a cotton gin is aware of estimated cotton production from planted acres and can reasonably assess the amount of cottonseed as well. The gin manager anticipates the need to sell cottonseed in the first week of September, four months away. Because the price of cottonseed might be lower at that time due to increasing supplies at harvest, the gin manager protects against downside risk by currently selling the appropriate number of contracts using either soybean or soybean meal futures. If the futures price declines, a gain is made on the short position and offsets a decline the cash price of cottonseed. On the other hand, a loss is incurred if the futures price rises. Once the gin takes possession and sells the seed in the spot market on the first week of September, the manager buys back the same number of futures contracts to lift the hedge. The loss or gain on the futures transaction can then be added to the value of the cottonseed sold and a net effective price received by the gin can be determined. A successful cross hedge is evaluated by its ability to capture gains from falling prices while minimizing variation and results in an effective net price that is greater than the unhedged cottonseed cash price.

For example, on the first week of May in 2014 the price of cottonseed in the West Texas cash market was $430 per ton. With the need to sell 1,000 tons of cottonseed at what the gin manager foresees as a possibly lower price at harvest, the manager sells four soybean future contracts at the Chicago Board of Trade which is currently trading at $14.65 per bushel or $488.37 per ton. On the first week of September, the gin sells its new crop cottonseed at the now traded cash price of $287.50 per ton for total revenue of $287,500. Although the gin did not have ownership of the seed back in May, this represents a $142.50 per ton decline in the spot price. At the same time, the manager lifts the hedge by buying four soybean futures contracts for $339.73 per ton. The futures transaction results in a gain of $148.64 per ton per contract, not including commission on trades, or a total payoff of $89,191($148.64 × 150 × 4). The total return of $376,691($287,500 + $89,191) results in a net realized price the gin receives of $376.69 per ton. This net price is $89.19 per ton greater than what the gin would have collected by selling unhedged seed in the spot market. This example is shown in Table 1. The same calculations were made every week until the last week of December with the futures position taken four months before the sale date and lifted when the physical cottonseed was marketed. This strategy resulted in an effective net price received due to cross hedging that was greater than the unhedged cash price 69% of the time, over the same months in 2007 through 2015, with the average effective price being $289.36 per ton compared to $271.03 per ton in a no hedge scenario.

Table 1. 4-Month Pre-Harvest Cross Hedging Example Using Soybean Futures

Time	Cash	Futures
First week of May 2014 (Four Months Prior to Sale Date)	$430/ton	Sell 4 soybean futures contracts @ $488.37/ton
First week of September 2014	Sell 1,000 tons of cottonseed @ $287.50/ton	Buy 4 soybean futures contracts @ $339.73/ton Gain = $148.64/ton
Revenue from selling cash cottonseed = $287.50 × 1,000 = $287,500 Profit from futures transaction = $148.64 × 150 × 4 = $89,191 Total revenue = $287,500 + 89,191 = $376,691		
Net effective price = $376,691 ÷ 1,000 = $376.69/ton		

Another approach was tested using a storage-like cross hedge that begins with the seller of seed taking a short position in the futures market on the first week of July regardless of the expected selling date. July was chosen as the naïve month to place the hedge because around this time a more accurate assessment of storage capacity and cotton yields leading up to harvest can be made. It also exhibited the highest and most frequent profit from the futures transaction of all months observed. The gin manager will then lift the hedge whenever the spot sale occurs. In this example, cottonseed is priced at $327.50 per ton and nearby soybean meal futures are trading at $350.93 per ton on the first week of July in 2015. Shorting seven soybean meal contracts is necessary for the gin to protect against a decline in price for 1,000 tons of cottonseed, as mentioned earlier using the optimal hedge ratio. As ginning begins and new crop cottonseed arrives in the warehouse, the gin manager decides to store the seed until the last week of December with the hope that cash prices will increase later in to or after harvest. Unfortunately, on the last week of December when the physical cottonseed is sold, the spot price has fallen to $265.50 per ton; however, the soybean meal futures price has also declined by $76.60 per ton and is trading at $274.33 per ton. Once the futures position is reversed and the hedge is lifted, the transaction has a subsequent profit of $53,620 ($76.60 × 100 × 7), excluding the cost of commission. The cottonseed is sold to an oil mill or livestock feeder at this time for a total of $265,500 ($265.5 × 1,000). This combined with the gain in the futures results in a total return of $319,120 or an effective price of $319.12 per ton received by the gin, which exceeds the unhedged cash price by $53.62 per ton. These calculations can be seen in Table 2. Placing the hedge using soybean meal futures on the first week of July and lifting the position every week from the first week of September until the last week of December produced a higher realized price relative to an unhedged price by an average of $24.62 per ton. The better price experienced by the gin was a 67% occurrence from 2007 to 2015 with an average value of $295.65 per ton.

Table 2. July Storage Cross Hedging Example Using Soybean Meal Futures

Time	**Cash**	**Futures**
First week of July 2015	$327.50/ton	Sell 7 soybean meal futures contract @ $350.93/ton
Last week of December 2015	Sell 1,000 tons of cottonseed @ $265.50/ton	Buy 7 soybean futures contracts @ $274.33/ton Gain = $76.60/ton
Revenue from selling cash cottonseed = $265.50 × 1,000 = $265,500 Profit from futures transaction = $76.60 × 100 × 7 = $53,620 Total revenue = $265,500 + 53,620 = $319,120		
Net effective price = $319,120 ÷ 1,000 = $319.12/ton		

The same test procedures were implemented for the pre-harvest scenario using soybean meal futures as the cross hedging vehicle and taking a short position four months prior to selling cottonseed. Additionally, soybean futures were assessed while taking storage into account by placing the hedge on the first week of July and lifting it at the time of sale between the first week of September through the last week of December. Cash and effective net prices for the four different hedging scenarios were averaged over the 2007 to 2015 sample period and are reported in Table 6. The storage-like July placed hedge using soybean futures as the tool for cross hedging provided the highest returns and most consistent results over this time period.

Table 6. Average Effective Price September-December 2007-2015

	Cash Cottonseed	Soybean July Hedge	Soybean 4 Mo. Hedge	Soybean Meal July Hedge	Soybean Meal 4 Mo. Hedge
Average Net Price ($/ton)	$271.03	$296.60	$289.36	$295.65	$289.06
% of time Hedged Net Price > Cash Price		74%	69%	67%	63%
Avg. Amount Over Cash Price		$25.58	$18.81	$24.62	$18.51
Average Gain Over Unhedged Price		$50.14	$44.09	$51.44	$46.31
Max. Gain Over Unhedged Price		$161.94	$143.11	$135.29	$165.65
Average Loss Below Unhedged Price		$ (37.50)	$ (36.49)	$ (26.54)	$ (29.65)
Max. Loss Below Unhedged Price		$ (85.70)	$ (73.33)	$ (67.80)	$ (77.05)

The effective net prices were averaged for both cross hedged scenarios and the unhedged approach concerning the different weeks examined between the first week of September and the end of December over the 2007 through 2015 sample period. The differences between the strategies can be seen in Figure 1 for the hedges using the soybean contract and Figure 2 where soybean meal was the hedging vehicle. The prices over the observed weeks indicated that the storage-like hedge using either the soybean contract or the soybean meal contract will on average result in an effective net price that is greater than the effective net price found for both the unhedged scenario and the approach where the cross hedge is executed four months prior to selling in the cash market. As noted previously, there is the possibility of experiencing a loss, or a lower effective net price as a consequence of hedging. This takes place in instances where price movement between futures and cash markets become dissimilar. Though these occurrences were observed less frequently with lower magnitudes using this historical data, the average and maximum amounts when hedged prices were lower than unhedged prices are reported in Table 6. The average and maximum values for gains when the hedged prices were higher being also represented. The threat of losses is notable from a financial risk standpoint because they signify occasions when margin requirements must be met by the hedging gins. This has the ability to reduce operating funds and becomes a cash flow issue if the losses from short positions stretch over lengthy periods of time. However, the overall results tend to support that on average the probability of more consistent and higher gains outweigh the less frequent and less severe threat of lower realized prices through hedging.

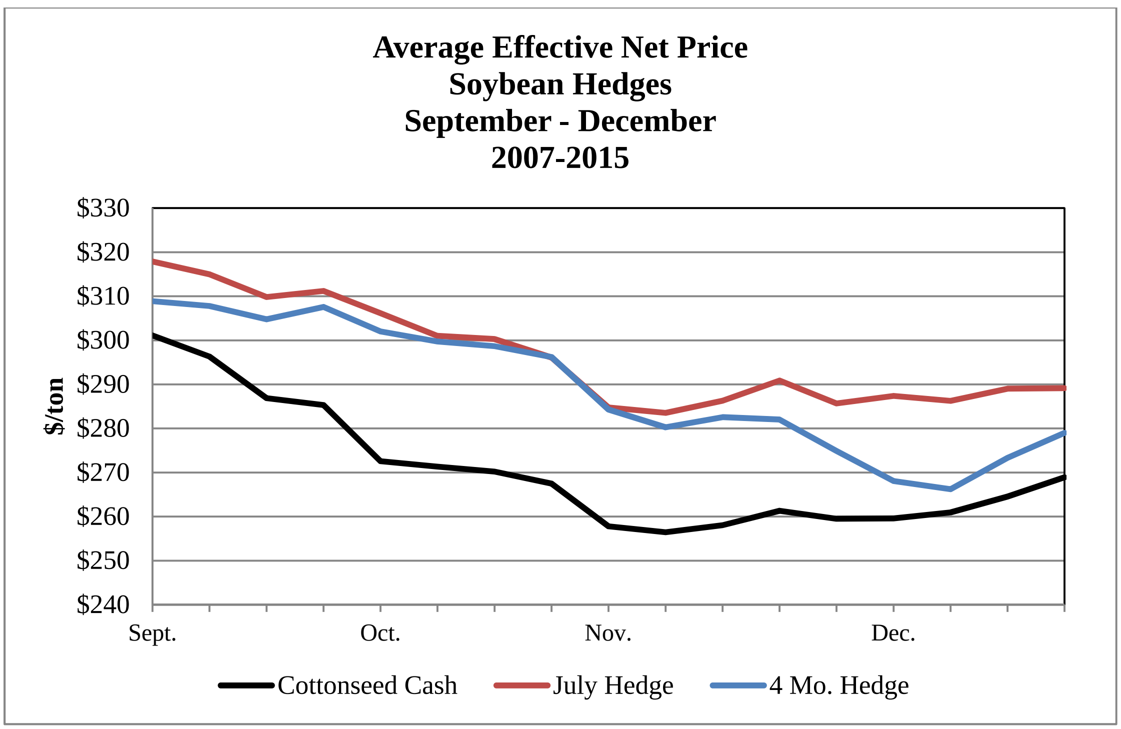

Figure 1. Average Effective Net Price from Cross Hedging Using Soybeans

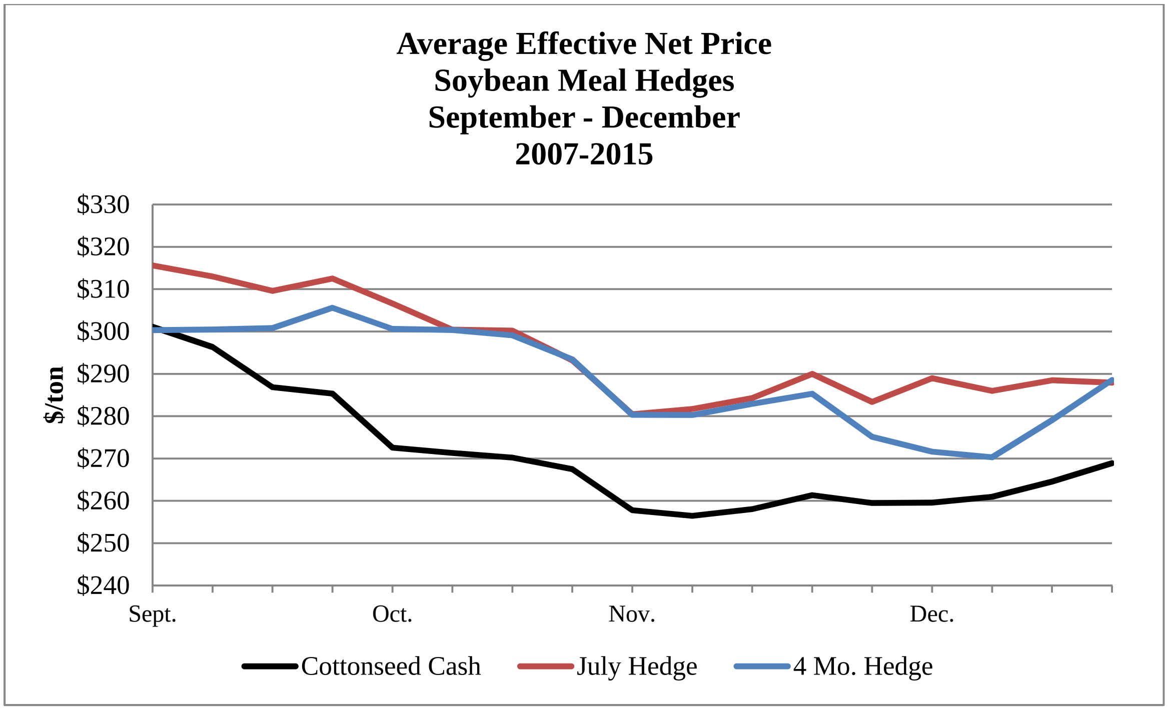

Figure 2. Average Effective Net Prices from Cross Hedging Using Soybean Meal

Outlying years in 2007 and 2010 produced no weeks in which any hedges were profitable. This is presumably the result of highly uncharacteristic and unexpected movement in prices due worldwide factors mentioned earlier. Additionally, the cost of trading in the form of brokerage commissions and margin requirements were taken into consideration; however, the varying amounts for these costs and their lack of any significant influence on the ultimate outcome resulted in their exclusion during calculations. Total commission costs would vary slightly between the scenarios as different hedging lengths were used requiring the need to roll contracts into the proper delivery month and different quantities of contracts were bought and sold depending on the cross hedging vehicle chosen. There would also be different margin requirements associated with the separate exchange-traded commodities. When selecting the appropriate strategy, if a hedger is not merely seeking the highest return but is concerned with cash flow and liquidity then these factors are important and will need to be accounted for.

CONCLUSION

Opportunities for research to build upon this study exist as it assumed that there are factors affecting cottonseed that do not necessarily have an impact on soybean or soybean meal prices. Outside influences such as government intervention in the form of farm program supports, demand for goods of processed commodities, and available supply of competing crops have an effect on these prices. Additionally, protein and dairy markets may have a growing impact on whole cottonseed price movement due to its increasing use as an ingredient in cattle feeding.

Alternative hedging approaches should also be considered in future work. Different hedging horizons and lengths can be explored and dynamic time-varying hedge ratios can be implemented for possibly more effective hedges. A gin also has the option of selling its cottonseed in the cash market and taking a long position in the futures market thereafter. This would allow the gin to take advantage of rising prices that were missed due to no longer having possession of the seed. When gins engage in forward contracts with oil mills, this different kind of risk is introduced and can be managed by implementing this strategy. Hedges using options is also a common method that can be investigated. These derivatives may offer improved price risk reduction but have different cash flow considerations to take into account. Furthermore, using the same approaches with out-of-sample data or simulating future values would also aid in determining the effectiveness of these methods and could better forecast possible outcomes.

The main objective of this study was to examine cottonseed supply and usage patterns within Texas and to analyze the feasibility of price risk management strategies by cross hedging cash cottonseed with soybean and soybean meal futures. The relationship between cash and futures prices were deemed to be significant enough to warrant further investigation and hedge ratios allowing for the proper risk coverage for a seller of seed were estimated. Additionally, a measurement of hedge effectiveness was considered and resulted in cross hedges using either soybean or soybean meal contracts providing reasonable amounts of risk reduction when compared to an unhedged position. Practical testing from a seller's perspective using historical data produced outcomes that showed that effective net prices from cross hedging were typically higher than unhedged cash prices over the considered time period (Figures 1, 2). This allows for an additional potential outlet for cotton gins to market cottonseed aside from the traditional methods, and possibly improve their financial position and profitability.