Texas Agricultural Extension Service
The Texas A&M University System

Balanced Dairying

ECONOMICS

Volume 18, No. 5
October 23, 1998

In This Issue: **A Case Study: Hedging with Puts & Calls**

A Case Study: Hedging with Puts and Calls

Robert B. Schwart, Professor
David Anderson, Assistant Research Scientist
Mark Waller, Associate Professor

Don Dairyman is a Texas dairy producer. His primary goal is to show a profit, and net worth growth every year. Positive profits help to assure a satisfactory life style for his family now and in the future, when he and his wife retire, and net worth growth. In the risky economic and financial dairy environment he faces, Don is using the futures and options market to shift some of the price risk to others willing to carry it. Don says, "We buy automobile insurance to protect the value of our net worth. We pay the premium for the 'right' to have a wreck but not the obligation. Hedging with puts and calls is analogous to buying price insurance. I can buy an option and pay a premium for the right, but not the obligation to lock in a price using the futures market. "

Options are attractive to the hedger for at least three reasons; 1) brokerage firms usually do not require as much money to open and maintain a trading account; 2) options are not subject to margin calls, which are a standard feature of futures contracts; 3) after an option is purchased, no further action is required on the part of the purchaser.

What Are Options, Puts and Calls?

Options are legally binding contracts giving the buyer the right, but not the obligation, to enter the futures market at the **strike price**. The option is associated with an underlying futures contract. A **put** option is the right to sell a futures contract, but not the obligation. A **call** option is the right to buy a futures contract but not the obligation.

An option is valuable when it is **in the money**. A **put** is **in the money** when the **strike price** is **above** the **current futures price**. The reason is that a put can be exercised at the higher strike price, then a futures contract immediately purchased at the lower price. The gain is the difference between what the futures contract was sold for at the strike price and the futures contract was purchased for at the current price. When the **strike price equals** the **price** of the **underlying futures contract**, the **options** is

said to be **at the money**. If the **put** option **strike price** is **below** the **underlying futures contract price**, then the **put** option is **out of the money**.

A **call** option is **at the money** when the **strike price equals** the **price** of the **underlying futures contract**. A **call** option is **in the money** when the **strike price** is **below the price** of the **underlying futures contract**. A **call** is **out of the money** when the **strike price** is **above** the **price** of the **underlying futures contract**. Generally the old adage, "buy low sell high," applies in the futures and options markets.

The Premium

The **premium** is the **price paid for** an **option**. The premium is composed of two parts. The **intrinsic value** is the **part of the premium** that could be **realized if the option is exercised**. The **extrinsic value** is the **part of the premium** is **determined by** the **time value of money**. The **time value of money** is the **amount buyers** are **willing to give for** an **option** in **anticipation** that over time **it will gain in value**.

Why would a Dairy Producer Use Options and What Options Would be Used?

The futures market is a market to buy and sell risk. **Hedgers,** such as Don, use the market to shift some of the price risk they face to **speculators** who hope to profit from price risk. He uses put options to **lock in** or fix a desired milk price for milk to be delivered at some future date. Don uses call options to **lock in** feed prices.

Currently the most popular futures and options contracts for hedging milk prices are the BFP contracts. BFP options are traded on the Chicago Mercantile Exchange (CME) and the Coffee, Sugar, and Cocoa Exchange (CSCE).

The CME offers two options, a 200,000 pound BFP futures contract and the option for that contract. The other is a 50,000 pound BFP mini option. No 50,000 pound BFP futures contract is offered. The CSCE offers a 100,000 pound BFP futures contract and the option for that contract. The CSCE does not offer a mini option.

The Chicago Board of Trade (CBOT) offers Options for corn, oats, soybeans, soybean oil, soybean meal, and wheat. Corn futures contracts are for 5,000 bushels, which is 2,800 hundredweights or 140 tons. Soybean futures contracts are for 5,000 bushels, which is 3,000 hundredweights or 150 tons. Soybean meal futures contracts are for 100 tons.

Information is the Key

Don knows that information is the key to business planning. Don studies the dairy press for price and supply demand projections for the coming year, He notes the price forecasts made by cooperative economists and the Extension dairy economists. Don knows what influences his local price levels. For example, feed prices are sensitive to the beginning of the harvest of feed grains; the demand for milk picks up in the Fall when schools start, so Class I utilization increases. Utilization levels influence Don's milk price.

During this particular year, climatic conditions in many parts of the country have hindered milk production. Tight milk supplies in many markets have forced the BFP to record highs. For the coming year, feed is expected to be plentiful and prices low. However, Don is worried that the low grain prices will stimulate exports of US feed grain

and that the US might sell grain at subsidized prices to former Soviet bloc countries. Milk supplies needed for the fall and early winter of this current year are expected to be ample to slightly surplus. This condition will likely mean slightly lower than normal milk prices in the early months of the coming year. Don estimates the BFP in December of this year could fall as much as 20 percent below current levels, and pull local milk prices down as much or more.

Don has kept historic price data over the past several years and has developed a fairly accurate index of his seasonal milk price patterns (Appendix Table 1), feed price patterns, and both feed and milk bases. Don has developed estimates of his milk price and feed price bases. The **basis** is the difference between the cash price and the futures price at the time the milk is sold or the feed grain purchased. The basis represents the cost of assembly, and local marketing conditions (Appendix Table 1).

Planning

Suppose it is August 10. Don wants to estimate expected profits. He knows he may not be 100 percent accurate in his projections, but he can identify possible financial and economic problems and can take measures to avoid these problems or at least cope with them. Don's banker requires that he provide fairly detailed pro forma financial statements.

Using the information he has assembled, Don constructs his set of price predictions for the coming market year. He uses his estimates of milk and feed prices to create a budget for the up coming milk production season. Appendix Chart 2 illustrates Don's estimate of milk prices for each month of the coming year, an estimate of the BFP, and an estimate of a breakeven cost of production, which includes the commissions paid to the commodity for executing futures and options trades. He estimates his breakeven price (estimated cost of production) to be $13.60.

Feed represents around 50 percent of Don's cost of producing milk. Locking in feed prices is important for planning. Don has two alternatives for feed prices. He can lock them in by contracting for a given price with a feed supplier or by hedging ingredients using the futures and options market. Don's budgeted corn price is $2.93 but his estimate of corn prices only exceeds his budgeted price for March, April, May, June, and July. Since the producer's net (net of the corn grower's expected basis) is positive, he subtracts this expected basis from his expected price to determine an expected hedging price (Appendix Table 2). Don decides to hedge using options.

Three Milk Hedging Strategies

The following three examples illustrate three possible ways Don could manipulate his hedge to lock in his milk price:

In example 1, Don bought a put option with a strike price of $12.50 per cwt. for $.38 on August 10. The options is slightly out of the money, because the futures price is $12.70. On December 31, Don sells the put option with a strike price of $12.50 for $0.50. The in the money option has an intrinsic value equal to the difference between the strike price and the futures price. It is likely the producer can sell the in the money option for a premium nearly equal the difference. The net gain from the options transactions is $0.12 (-$0.38 + $0.50). On January 5, the BFP for December was announced at $12.00. The

producer's net December BFP is $12.12 ($12.00 + $0.12).

In example 2, Don buys a December put, as in Example 1, but he then sells a December call option with a strike price of $13.25 per cwt. for $0.26. Why would Don also sell a call option? Remember, as the writer, or seller of the call option, Don gets to keep the premium. That premium received offsets some of the cost of the purchased December put option. Also notice that Don sold the call option at $13.25 per cwt., well out of the money. Selling or writing an option is only done when the writer feels the option will be so far out of the money that it will not be exercised by the option buyer. If the option is exercised, the writer is assigned a futures market position opposite the options buyer. In Example 2, the futures price did not rise above $13.25, so the buyer of the option let it expire. Don did not have to forfeit the $0.26 premium. The result is that the net gain on the entire transaction is $0.38 ($0.12 + $0.26). The net gain on the options transactions plus the BFP of $12.00 per cwt. means that the producer effectively locked in a $12.38 BFP for December.

In example 3, Don exercised his put option on the last day possible, then he offset this action by buying a futures contract at the prevailing price of $12.00. Don gained $.50 by exercising the option, but the cost of the December put was $.38. So Don had a net gain of $.12 per cwt. and locked in a $12.12 BFP.

Three Corn Hedging Strategies

Hedging corn is similar to hedging milk. However rather than purchase a put option, as is done when hedging milk prices, Don buys a call (the right to buy) option. Don wants to put a cap on the price paid for feed.

Again, it is August and Don wants to assure he can purchase corn for his TMR rations in the spring and summer months next year at prices that fit his budget. Appendix Table 2 presents Don's estimate of prices for corn for feed delivered to his dairy for the coming year. Don budgeted for $2.93 per bushel ($5.23/ cwt.) for feed during the coming year. He will take delivery of corn every month next year, beginning in January. Corn contracts are traded on the Chicago Board of Trade for the months of September, December, March, May, and July. The last trading day for corn contracts is the seventh business day prior to the last business day of the month. If he takes delivery of his grain during a contract month, Don assumes he will have paid for delivered grain before the third week of the month. He plans to hedge January and February corn purchases using March contracts. Don thinks March corn purchases will be hedged using the May contract. The cash price the dairy producer pays is the Texas producer price plus a handling (hauling and processing) charge. Don's corn basis is the sum of the local corn basis plus this handling charge. His net basis rises steadily through the marketing year from a low at harvest in the fall through a high in the following spring (Appendix Table 2).

The last trading day for a standard options contract is the last Friday before the first notice day of the corresponding futures contract by at least five days. The first notice day is the first time a holder of a futures contract can tell the exchange he or she will deliver the commodity. Usually that notice day is the last business day of the month preceding the contract month. For example the first notice day for a December futures contract is the last business day of November.

Therefore, the last trading day for a December options would be the last Friday

before the last business day in November by at least five business days. If the last business day in November is Monday the 30th, the preceding Friday by at least five business days is Friday November 20th. The last trading day for an options generally is somewhere between the 19th and 25th of the preceding month. This timing is important for the hedger. The hedger wants to lift the hedge as close to the purchase of feed as possible. Examples 4, 5, and 6 illustrate three possible ways Don could place a corn hedge using futures and options. In these three examples we assume that the corn price is following normal seasonal trends, increasing in the spring.

In Example 4, Don bought a March corn call with a strike price of $2.40 on August 10. March futures contract is trading at $2.382. The premium paid for the option was $0.085. The call option is slightly out of the money. Don wanted to lock in a corn price of $2.93. Effectively, he has locked in a cash price of $3.015, the $2.93 target plus the $.088 option cost. The $2.93 per bushel corn cost represents the strike price of $2.40 per bushel plus the average $0.53 per bushel corn basis (Appendix table 2). On February 17, the futures price had increased to $2.60. Because the call is in the money, Don sells the call for a premium of $0.225. Don's net gain was $0.14 (0.225 - 0.085). The cash price for corn has risen to $3.13. Don's net corn price is $2.99 ($3.13-$0.14).

In Example 5, Don buys a March call option, but at the same time sells a March out of the money put for a premium of $0.0675. This premium Don collects from selling the put helps to offset the cost of his purchased call. He is careful to pick an out of the money put option to sell to reduce the chance of a purchaser exercising the option. Usually out of the money options have some value so there is a small premium. On February 17, Don lifts the hedge by selling the March call for a premium of $0.225. Don's net gain on his hedging transactions involving options is $0.2075 (-$0.085 + $0.0675 + $0.225) Don's net cost for corn is $2.92, $3.13 cash corn price minus the $0.2075 earned from his hedging position. If the futures prices would have fallen below the price for which he sold the put, Don would have lost the premium, and his feed cost would have been higher.

In Example 6, Don exercises the March call option and buys a futures contract for $2.40 on February 17. He then sells the futures contract for $2.60, and gains $0.20 on the sale, and the net gain is $0.115 ($0.20-$0.085). His net corn price is $3.015. ($3.13 - $0.115).

Summing Up

Don uses the futures market because he is not certain what the future does hold. He wants to assure himself a profit, as best he can. He knows information is the key to developing a winning strategy. He has studied his market and is familiar with normal seasonal patterns. Don may not be sure of what the exact price levels will be during a production period, but he uses the futures and options market to lock in with some certainty the prices he will receive for his milk and the prices he pays for feed.

Robert B. Schwart
Extension Economist - Dairy Marketing
Department of Agricultural Economics
College Station, TX 77843-2124

Example 1:Milk Price Hedge Using BFP Options							
Date	Action	Market	Strike Price	Futures Price	Premium	Gain	BFP Milk Price
Aug 10	Producer Buys December Put	Options	$12.50	$12.70	$.38	$-.38	$14.44 (Jul)
Dec 31	Producer Sells December Put	Options	$12.50	$12.00	$.50	$.50	$12.20 (Nov)
Jan 5	USDA Announces BFP	Cash	$12.00	$12.00			$12.00 (Dec)
Jan 5	Producer's Net Gain on Options	Options				$0.12	
Jan 5	Producer's net BFP price	Cash					$12.12

Example 2: Milk Price Hedge Using BFP Options							
Date	Action	Market	Strike Price	Futures Price	Premium	Gain	BFP Milk Price
Aug 10	Producer Buys Dec Put	Options	$12.50	$12.70	$.38	$-.38	$14.44
Aug 10	Producer Sells Dec Call	Options	$13.35	$12.70	$.26	$.26	$14.44
Dec 31	Producer Sells Dec Put	Options	$12.50	$12.00	$.50	$.50	$12.20
Jan 5	USDA Announces BFP	Cash	$12.00	$12.00			$12.00
Jan 5	Producer's Net Gain on Options	Options				$0.38	
Jan 5	Producer's net BFP price	Cash					$12.38

Example 3: Milk Price Hedge Using BFP Options							
Date	Action	Market	Strike Price	Futures Price	Premium	Gain	BFP Milk Price
Aug 10	Producer Buys Dec Put	Options	$12.50	$12.70	$.38	-$.38	$14.44
Dec 31	Producer Exercises Dec Put - Sells Dec. Futures contract	Futures	$12.50	$12.00			$12.00
Dec 31	Producer Buys Dec Futures Contract	Futures		$12.00		$0.50	$12.20
Jan 5	USDA Announces BFP	Cash					$12.00
Jan 5	Producer's net gain on Futures	Futures				$0.12	
Jan 5	Producer's net BFP price	Cash					$12.12

Example 4: Corn Price Hedge Using Corn Futures Options							
Date	Action	Market	Strike[1] Price	Futures[1] Price	Premium	Gain	Cash Price
Aug 10	Producer Buys Mar Call	Options	2400	2382	$.085	-$.085	$3.015
Feb 17	Producer Sells Mar Call	Options	2400	2600	$.225	$.225	
Feb 17	Producer's Net Gain on Options	Options				$.14	
Feb 17	Producer Buys Feed	Cash					$3.13
Feb17	Producer's Net Feed Cost	Cash				$.14	$2.99

[1] Corn prices are quoted in cents per bushel. The last digit is in 1/8 cent increments. For example 2382 is $2.3825 per bushel.

Example 5:Corn Price Hedge Using Corn Futures Options							
Date	Action	Market	Strike[1] Price	Futures[1] Price	Premium	Gain	Cash Price
Aug 10	Producer Buys Mar Call	Options	$2400	$2382	$.085	-$.085	$3.015
Aug 10	Producer Sells Mar Put	Options	$2200	$2382	$.0675	$.0675	
Feb 17	Producer Sells Mar Call	Options	$2400	$2600	$.225	$.225	
Feb 17	Producer's net Gain on Options	Options				$.2075	
Feb17	Producer Buys Feed	Cash					$3.13
Feb 17	Producer's Net Feed Cost	Cash				$.2075	$2.92

[1] Corn prices are quoted in cents per bushel. The last digit is in 1/8 cent increments. For example 2382 is $2.3825 per bushel.

Example 6:Corn Price Hedge Using Corn Futures Options							
Date	Action	Market	Strike[1] Price	Futures[1] Price	Premium	Gain	Cash Price
Aug 10	Producer Buys Mar Call	Options	$2400	$2382	$.085	-$.085	$3.015
Feb 17	Producer Exercises Option	Futures	$2400	$2600			
Feb 17	Producer Sells Mar Futures Contract	Futures		$2600		$.20	
Feb 17	Producer Buys feed	Cash					$3.13
Feb 17	Producer's Net Feed Cost					$.20	$2.93

[1] Corn prices are quoted in cents per bushel. The last digit is in 1/8 cent increments for example 2382 is $2.3825 per bushel.

Table 1: Example: Don's Own Estimates of Milk Prices for the Coming Year

	Seasonal Price Index	Estimate of Price	Year Average Basis	Estimated BFP I Need
Jan	99.29%	$13.66	$1.83	$11.84
Feb	97.56%	$13.42	$1.56	$11.87
Mar	96.14%	$13.23	$1.26	$11.97
Apr	96.53%	$13.28	$1.23	$12.05
May	97.75%	$13.45	$1.51	$11.95
Jun	99.32%	$13.67	$1.70	$11.97
Jul	98.88%	$13.61	$1.61	$12.00
Aug	100.96%	$13.89	$1.56	$12.33
Sep	102.25%	$14.07	$1.33	$12.74
Oct	103.95%	$14.30	$1.58	$12.73
Nov	104.99%	$14.45	$2.13	$12.31
Dec	102.39%	$14.09	$1.96	$12.13
Annual Outlook Price	100.00%	$13.76	$1.60	$12.16

Table 7: Don's Own Estimate Expected Corn for Feed Price

	Expected Corn Price	Expected Basis at my Dairy	Projected Futures Price Needed
Sep	$2.79	$.54	$2.25
Oct	$2.80	$.54	$2.26
Nov	$2.78	$.55	$2.23
Dec	$2.79	$.55	$2.24
Jan	$2.82	$.56	$2.26
Feb	$2.90	$.56	$2.34
Mar	$2.96	$.58	$2.38
Apr	$3.04	$.62	$2.42
May	$3.07	$.63	$2.44
Jun	$3.11	$.64	$2.48
Jul	$2.94	$.66	$2.29
Aug	$2.92	$.68	$2.24
AVG	$2.93	$.53	$2.40

Chart 1: Don's 5 Year Average Milk Price Seasonality

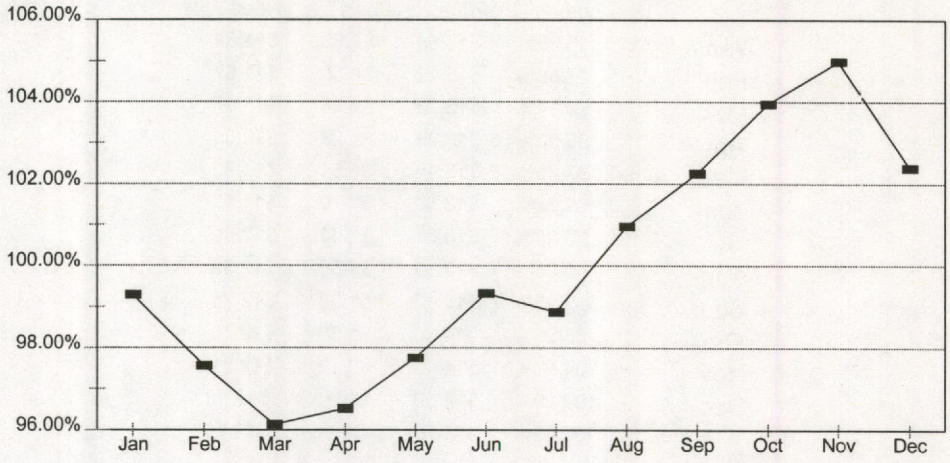

Chart 2: Don's Predictions of
Milk Prices for Next Year

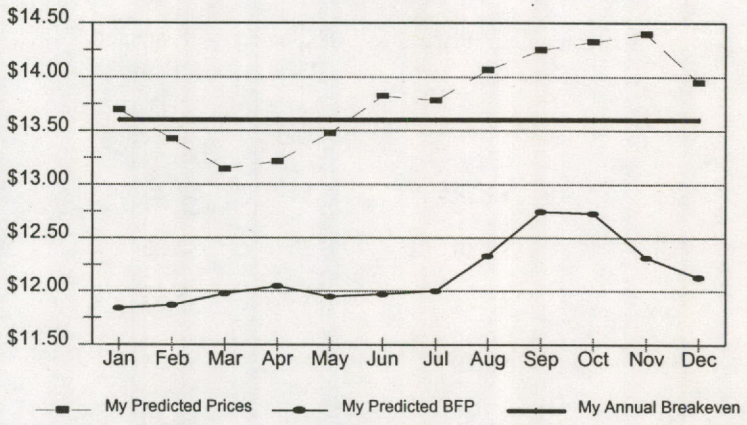

Chart 4: Average Seasonality of Texas Corn Prices,