

Milk Futures, Options and Basis

Michael Haigh, Matthew Stockton, David Anderson and Robert Schwart*

Dairy producers confronted with uncertain milk prices can reduce their financial risk in several ways. Hedging with futures or options contracts is one method.

In 2000, the federal order program abolished the Basic Formula Price (BFP) and adopted a new pricing formula for milk. The BFP contract became the Milk contract. This contract settles to the Class III price, which is similar to the BFP. This publication replaces RM2-35, "Hedging Milk with BFP Futures and Options," which was based on the old formula.

Price Risk

No one knows the direction of future prices. The uncertainty associated with the future cash price of a commodity is known as price risk. A dairy producer would want an increase in prices, but a processor wants a decrease. The milk futures and options market enables both producers and processors to manage unfavorable price changes and price risk.

Milk Futures and Options

Currently, two futures and options contracts are traded on the Chicago Mercantile Exchange (CME). One, the Milk contract, corresponds to the USDA Class III price. The other is called the Class IV contract. (For a description of milk prices, see L-5403, "Milk Pricing.") The standardized futures contracts are for delivery of 200,000 pounds of Grade A milk containing 3.5 percent butterfat. Futures contracts for both Class III and Class IV milk trade every month, up to 18 months in advance. Futures and options prices are quoted in dollars per hundred-weight (cwt). For every 1-cent change in a futures contract price, the value of the futures contract changes \$20.00. One option contract equals one futures contract in size.

At a contract's expiration, no milk is actually delivered or received. Instead, contract prices are forced to the corresponding announced Class III or Class IV price for that month. A unique characteristic of the milk market is the announcing of prices for the previous month on or around the 5th of each month. There is a spot market for milk other than Grade A and for some

Grade A milk not associated with a regulated market. However, for milk associated with a regulated market, prices are announced monthly.

Hedging

Hedging is the process of passing risk to someone willing to assume that risk. Hedgers may use the futures market to lock in a price. Producers hedge to minimize the risk associated with a price decline, while product users try to minimize the risk associated with a price increase. Producers selling milk hedge by selling futures contracts. Those buying milk buy futures contracts. The cash and the futures prices move in the same direction. If the producer loses money because of a decline in the cash market, then he or she gains the loss back in the futures market. The opposite is true for the milk buyer.

Risk Management Education



*Assistant Professor, Extension Assistant, Assistant Professor and Extension Economist, and Professor and Extension Economist, The Texas A&M University System.

Margin Accounts

All participants who buy or sell futures contracts are required to maintain a margin account as long as they hold a position in the futures market. A margin account is a performance bond, and the initial margin requirement depends on the type of trader (speculator or hedger) and the contract. Each contract is compared to the closing price at the end of each trading day. A contract that is profitable will add money to the margin account. A hedger in a short position (meaning he has sold a contract) earns a profit if the price of the contract exceeds the closing futures price. The hedger can close out the position at a profit by buying a contract for the same month. The profit is the difference between the price of the contract sold and the price of the contract purchased. This difference is added to the margin account. For example, a November contract was sold for \$13.27; the next day the market closed at \$12.87. The seller could buy the \$12.87 contract and earn \$0.40 per hundredweight or \$800 per contract.

Money is subtracted from the margin account if the contract position is unprofitable. If the value of the margin account falls below the maintenance level, the hedger will receive a margin call. Table 1 illustrates the changes in the margin account balance as the value of the contract changes.

Basis

Basis is the difference between the cash price and the futures price. The basis formula is:

$$\text{Cash price} - \text{Futures price} = \text{Basis} \quad (1)$$

If this basis calculation yields a negative number the market is "normal;" if the calculation yields a positive number the market is "inverted."

The basis formula can be rewritten as:

$$\text{Basis} + \text{Futures price} = (\text{Expected}) \text{ Cash price} \quad (2)$$

The basis can be determined using either a gross price or a "mailbox" price. The mailbox price, sometimes called the net price, is the gross price minus hauling, promotion and marketing charges. Some cooperatives print the gross price on the check printout, while others print the net price. Preliminary research suggests that either the net price or the gross price can be used to calculate the basis.

Milk basis calculations differ from basis calculations for other commodities such as livestock and grain because a milk price is not strictly based on grade or transportation. Milk prices reflect season, market location, quality differences, and milk use. These designations and destination differences determine the pool price. For example, a producer whose milk sells in a pool designated primarily as Class I (beverage) milk receives a higher price than a producer whose milk sells in a pool designated primarily as Class III (cheese) milk. The quality of the milk may be identical, but the end use of the milk determines its price. Except for Grade B milk and some unregulated milk, prices are announced after the product has been delivered and used. These announced prices hold for a whole month. There are no cash market prices quoted or published on a daily basis for Grade A milk. Except for some spot market transactions and some transactions involving Grade B milk or unregulated milk, milk prices are based on USDA formula prices.

Tracking Basis

Tracking the basis is simple because futures contracts are settled in cash at announced milk prices. To determine the basis of a futures contract, the dairy producer subtracts the contract price from the pay price printed on the milk check. Table 2 illustrates this process. Suppose

Table 1. Example—margin account activity.

Futures Activity				Margin Account Activity		
Day	Action	Value	Gain	Profit or loss	Initial deposit or margin call	Account balance
1	Sell 1 Nov.	\$13.27			Deposit \$1,500	\$1,500
2	Market close	\$12.87	+ 40 cents	\$800		\$2,300
3	Market close	\$13.27	- 40 cents	-\$800		\$1,500
4	Market close	\$13.57	- 30 cents	-\$600		\$ 900
5	Market close	\$13.67	- 10 cents	-\$200		\$ 700
5					Call for \$800	\$1,500

the producer wants to determine the basis for each month of the year 2000. If the January pay price for the producer's milk was \$11.46, and the announced Class III price for January 2000 was \$10.05, the producer's basis for January 2000 was \$1.41. As Table 2 shows, the basis varies 38 percent over the year 2000.

Table 2. Basis calculation for a central Texas dairy for 2000.

	Cash	- Futures	= Basis
Month or contract	Pay price	Class III \$	Basis
January	\$11.46	\$10.05	\$1.41
February	\$11.09	\$9.54	\$1.55
March	\$11.22	\$9.54	\$1.68
April	\$10.89	\$9.41	\$1.48
May	\$10.25	\$9.37	\$0.88
June	\$11.35	\$9.46	\$1.89
July	\$11.84	\$10.66	\$1.18
August	\$11.93	\$10.13	\$1.80
September	\$11.99	\$10.76	\$1.23
October	\$12.16	\$10.02	\$2.14
November	\$11.92	\$8.57	\$3.35
December	\$11.84	\$9.37	\$2.47

For the basis to be of use, the producer should determine it for each month over at least 3 years. To estimate a monthly basis, the producer could average the basis for each month over several years. Table 3 illustrates the process of estimating monthly basis. Adding the latest year's data and dropping the earliest years creates a running average monthly basis.

Table 3. Three-year average basis calculation for a central Texas dairy.

	1998	1999	2000	3-Year avg.
Jan.	\$1.72	\$1.76	\$1.41	\$1.63
Feb.	\$1.68	\$6.00	\$1.55	\$3.08
Mar.	\$1.81	\$4.14	\$1.68	\$2.54
Apr.	\$2.45	\$0.71	\$1.48	\$1.55
May	\$3.05	\$1.61	\$0.88	\$1.85
June	\$1.01	\$2.28	\$1.89	\$1.73
July	(\$1.55)	\$2.08	\$1.18	\$0.57
Aug.	\$0.51	\$1.77	\$1.80	\$1.36
Sep.	\$1.71	\$3.30	\$1.23	\$2.08
Oct.	\$1.25	\$3.14	\$2.14	\$2.18
Nov.	\$0.60	\$2.82	\$3.35	\$2.26
Dec.	\$0.51	\$0.07	\$2.47	\$1.02

Using the Basis

By knowing the basis, the hedger can estimate a potential cash price for the time when milk will be sold. Dairy producers hedge to protect themselves against a decline in prices by the time the milk is delivered. Dairy producers want to receive a milk price high enough to at least cover all expenses for the period. Adding the estimated basis to a futures price being considered helps the producer estimate what the cash price will be at the time milk is sold if the producer sells the futures contract or buys a put option (the right but not the obligation to sell) using the futures price.

Basis Risk

If basis could be predicted perfectly, future cash price could be known with certainty and all risk could be eliminated. Unfortunately, no one knows exactly what the basis will be. This uncertainty is known as basis risk. Reducing basis risk requires knowledge of the factors that can alter it. The most obvious factors are milk quality, how the milk will be used, producer market location, and milk components. The Producer Price Differential (PPD) is one part of the basis. It reflects the use of Class I, Class II and Class IV milk relative to Class III milk, and the locations of the Class I plants receiving producer milk. Producers can influence quality and component content. Producers can move and, in some instances, producers can choose the handler receiving the producer's milk. Tables 4 and 5 illustrate the effect on prices when the basis changes, as in an inverted market.

The producer with a highly predictable basis faces less basis risk. An effective hedge is one where basis risk is less than the original price risk. Even though a basis change may be "bad" for the producer, a hedge is better than no hedge in most situations.

Summary

The futures and options markets are viable tools for producers who have large enough quantities of milk to hedge. Understanding basis can help a producer decide whether using futures and options could reduce risk. Basis is fundamental, and every producer has a unique basis. Market conditions, individual producer conditions, and the classes of milk marketed affect basis. Basis has some inherent risk. Futures and options contracts should not be used if the basis risk is greater than the underlying milk price risk.

Figure 4. Example hedge—basis narrows.

Date	Action	Futures market	Cash market
15-Jan	Sell 1 June futures contract	\$12.15	
	Expected basis		\$1.63
	Expected hedged cash price		\$13.78
5-Jul	Buy 1 June futures contract	\$10.05	
	Class III cash price from milk sales		\$10.05
	Cash price on milk check		\$11.58
	Basis (cash - futures)		\$1.53
	Gain in the futures market	\$2.10	
	Net price received (futures gain + milk check cash price)		\$13.68

Figure 5. Example hedge—basis widens.

Date	Action	Futures market	Cash market
15-Jan	Sell 1 June futures contract	\$12.15	
	Expected basis		\$1.63
	Expected hedged cash price		\$13.78
5-Jul	Buy 1 June futures contract	\$10.05	
	Class III cash price from milk sales		\$10.05
	Cash price on milk check		\$11.78
	Basis (cash - futures)		\$1.73
	Gain in the futures market	\$2.10	
	Net price received (futures gain + milk check cash price)		\$13.88

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