How Virginia Dairymen Can Manage Price Risk

Benjamin Burkhart
Scott Sink
Wayne Purcell

Agricultural Competitiveness

Benjamin Burkhart and Scott Sink received B.S. degrees in 1999 and Wayne Purcell is Distinguished Alumni Professor, Department of Agricultural and Applied Economics, Virginia Tech.

July 1999
VCE Pub. No. 448-243/REAP R0045

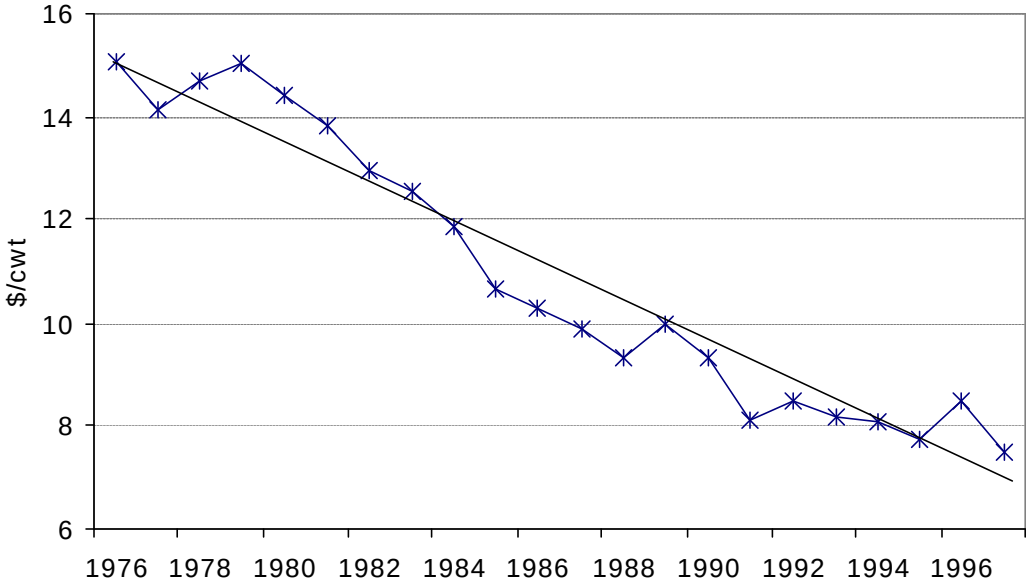
TABLE OF CONTENTS

INTRODUCTION

The dairy industry has used a basic formula price in the form of the Minnesota-Wisconsin milk price since the 1960s. But not until 1995 did Basic Formula Price (BFP) replace the Minnesota-Wisconsin price as the Class III industry price series (USDA, 1996). The BFP is used to determine price levels of all other classes of milk.[1] It reflects the prices paid by processors in Minnesota and Wisconsin for Grade B milk, which is used to make cheese, butter, and nonfat dry milk. The United States Department of Agriculture (USDA) announces the BFP on the fifth day of each month.

Price-risk management is not familiar to most dairymen.[2] For decades, the government program provided milk support prices and sheltered dairy farmers from price risk, but the 1996 farm legislation accelerated the process of moving the dairy sector toward a free market status. Furthermore, milk prices, when adjusted for inflation (using the CPI, 1982-84 = 100), have declined 50 percent over the last 20 years (Figure 1). These price declines and the cost-price squeezes that they prompt illustrate the importance to dairymen of implementing a price-risk management strategy.

Figure 1. Inflation-Adjusted Milk Prices, 1976-1997.



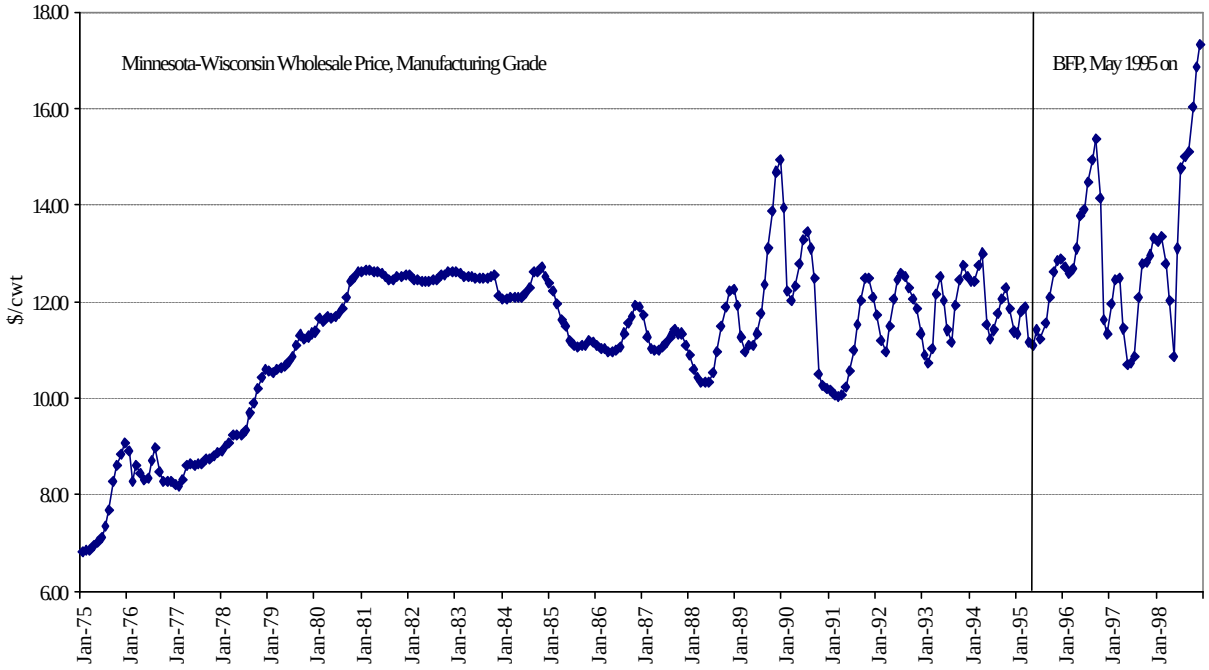
Source: USDA. *Dairy Situation and Outlook Report & Yearbook*, various years.

With changing policy in the farm sector, nominal milk prices (not adjusted for inflation) (Figure 2) have exhibited great volatility. Corn is the primary input in dairy feed, and corn prices have long been volatile (Figure 3). Producers and cooperatives can manage price risk through forward delivery contracts or hedging in the futures market. Either cash contracts or futures positions in corn and soybean meal can provide producers with protection against a rapid price rise in feed and protein supplement costs. Futures exchanges now trade BFP milk contracts, enabling producers to forward price their milk output to help protect them against falling milk prices.

[1] USDA is in the process of redefining the components of BFP.

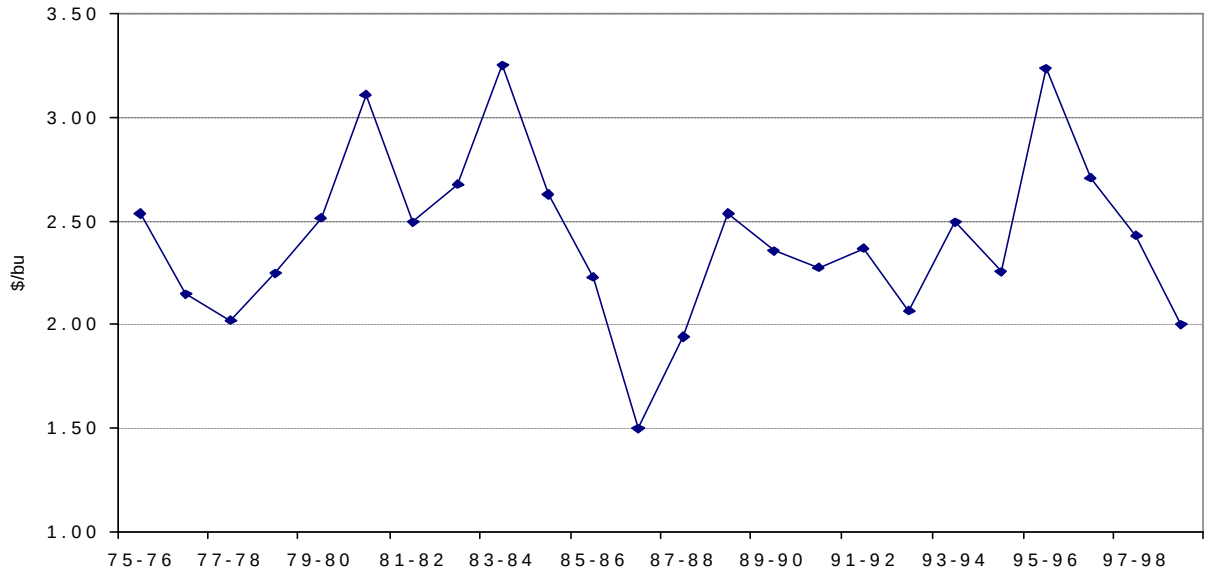
[2] Dairymen and dairyman are used as generic terms and are not intended to exclude women as managers or owners ofdairy operations.

Figure 2. Nominal BFP Milk Prices, January 1975 – December 1998



Source: USDA, *Dairy Yearbook* and Table 36, various dates

Figure 3. Nominal U. S. Season Average Corn Prices, 1975-1999



Source: USDA. *Feed Situation and Outlook Yearbook*

The proper use of the futures market is as a price-risk management tool rather than as a way to try for the highest possible price for outputs or the lowest possible price for inputs. Futures contracts are designed to allow users of a commodity to protect themselves against rising input costs or falling output prices. This form of protection is called *hedging* and is the economic function for which the futures markets were established.

Before implementing any new management practice, thoroughly researching and understanding the practice and requirements of such a venture is important. The objective of this publication is to serve as a guide for dairymen and cooperatives in their efforts to understand, develop, and implement a price-risk management strategy. The emergence of dairy futures presents new and valuable opportunities for dairymen and cooperatives to manage increasingly volatile prices.

THE FUTURES MARKET

Futures Contract Specifications

When trading futures in different commodities, farmers and cooperatives need to know the contract specifications, which vary depending on the exchange where the contract is traded (Table 1), and the months when the contracts are traded (Table 2). To hedge effectively, the dairyman needs to match the quantity of his output or input as closely as possible to the size of the futures contract. He also needs to use a contract that matures as close to, but not before, the time he will sell his milk or buy his feed.

Table 1: Futures Contract Specifications and Exchanges Where Traded

Commodity	Exchange	Contract Size	
Corn	CBOT	5,000	bushels
Corn	MidAm	1,000	bushels
Soybeans	CBOT	5,000	bushels
Soybeans	MidAm	1,000	bushels
Soybean Meal	CBOT	100	tons
Soybean Meal	MidAm	50	tons
BFP Milk	CME	200,000	pounds
BFP Milk	CSCE	100,000	pounds
Mini BFP Milk Options	CME	50,000	pounds
Butter	CSCE	10,000	pounds
Butter	CME	40,000	pounds
Cheddar Cheese	CSCE	10,500	pounds
Cheddar Cheese	CME	40,000	pounds

Key: CBOT: Chicago Board of Trade
MidAm: Mid-America Commodity Exchange (Chicago)
CME: Chicago Mercantile Exchange
CSCE: Coca Sugar Coffee Exchange (New York)
Source: Various Exchanges

What Futures Markets Are

Futures markets were originally markets where buyers and sellers met to exchange the actual physical commodity. They arose as the result of a lack of grain storage and extremely volatile supply and demand situations for wheat and corn. The futures market was designed to allow agricultural producers the opportunity to contract their products in advance of harvest. Trade in defined futures contracts emerged as producers started to lock in prices in advance of the dates when formal delivery was required. Futures markets now provide a means of shifting the costs of exposure to price risk to other traders, especially speculators, who are willing to accept that risk in hopes of investment profits.

Table 2: Months When Futures Contracts Are Traded

	----------Month Commodity Traded----------					
Commodity	Jan.	Feb.	Mar.	Apr.	May	June
Corn			X		X	
Soybean Meal	X		X		X	
BFP Milk	X	X	X	X	X	X
Butter		X	X		X	
Cheddar Cheese	X	X	X	X	X	X
Commodity	July	Aug.	Sept.	Oct.	Nov.	Dec.
Corn	X		X			X
Soybean Meal	X	X	X	X		X
BFP Milk	X	X	X	X	X	X
Butter	X		X	X		
Cheddar Cheese	X	X	X	X	X	X

Source: Various Exchanges

A futures contract is a legal contract for the exchange of a commodity with specific characteristics. Corn and soybean meal futures contracts are *physical delivery contracts* which are almost always cancelled through round-turn trades in the futures market. While delivery of the commodity to satisfy contract obligations is often permitted, the exchange of the actual physical goods seldom occurs. The usual procedure is for contracts to be cancelled by the hedger's taking an opposite position in the futures market from his original position. Thus, the hedger buys back the responsibility to deliver that is incurred when a futures contract is sold or he sells the responsibility to accept delivery that is incurred when a futures contract is bought (a round-turn trade).

Many of the new futures contracts, like BFP futures contracts, are *cash settled* to eliminate the sometimes costly and difficult process of physical delivery. Positions for cash settled futures instruments that have not been cancelled by round-turn trades are settled using an identified cash price on the maturity date of the futures contracts. For example, a dairyman sells a January BFP futures contract for $15.00 per hundredweight (/cwt). He does not offset that commitment by buying back the contracts before the last trading day for that contract. The identified cash price used for settlement purposes is $14.00/cwt. His account balance is credited with a gain of $1.00/cwt. If, however, the identified cash price on the last trading day of the contract is $16.00/cwt, his account balance is charged with $1.00/cwt.

BASIS CALCULATIONS AND RELATIONSHIPS

Understanding the concept of *basis* is crucial to effectively using the futures market. Basis is the difference between the local cash price and the quoted futures price:

Basis = Cash - Futures

For example, the local Virginia cash market price for corn on December 1, 1999 is $2.80 per bushel (/bu) and the futures price for December 1, 1999 corn is $2.70/bu. The basis for December 1 is, therefore, +$0.10/bu ($2.80 - $2.70). While basis cannot be controlled, it can be predicted with reasonable accuracy using historical cash and futures prices and the associated risk thereby minimized. Virginia basis tables for corn, soybeans, and wheat are available from local Virginia Cooperative Extension (VCE) agents or from Extension Distribution, Virginia Tech.[3]

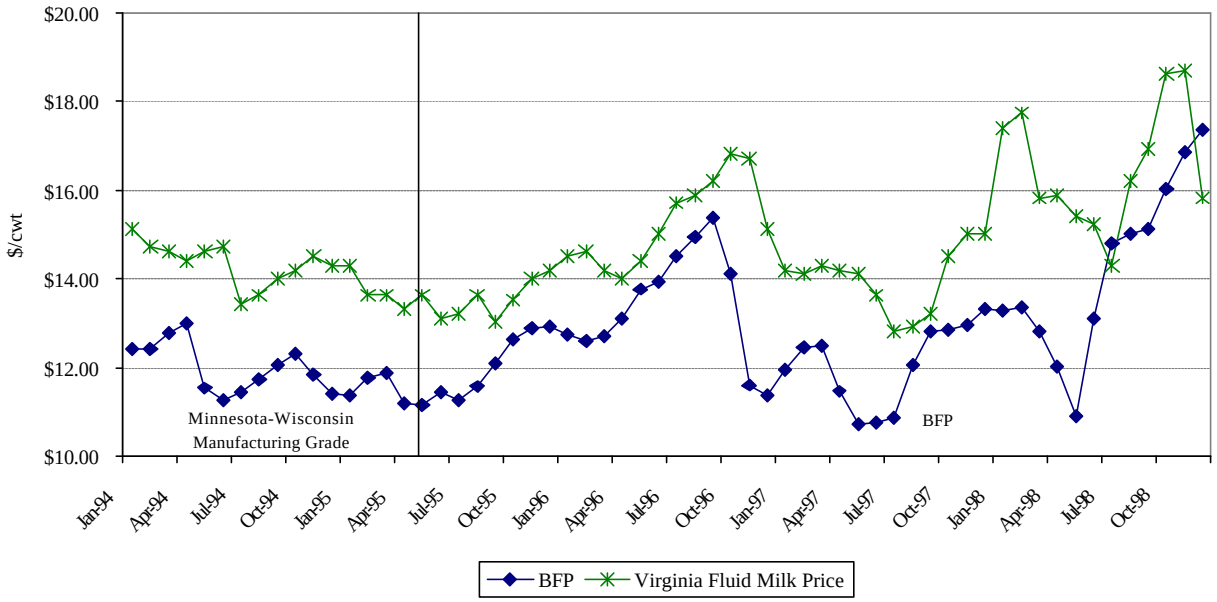
3 Virginia Tech Extension Distribution (0512), Virginia Tech, Blacksburg, VA 24061 or 540-231-6192.

Basis risk can never be fully controlled, but by monitoring basis and understanding its behavior, the risk can be minimized. *Basis risk occurs when the closing basis at the end of the hedge is not what was expected when the hedge was established.* If the closing basis equals the expected basis, the realized price from combining the outcome from the cash and futures activities will *always* equal the expected forward price, whether prices go up or down. When the basis is not exactly what was expected, basis risk has occurred. Producers will find that basis variation can increase the net realized price so that it is above the expected price, or basis variation can decrease the net realized price so that it is below the expected price. The data show that basis risk is much smaller than the risk associated with being unprotected in volatile cash markets.

Basis for milk must be calculated using mailbox prices, which are tied to the USDA announced BFP price. The mailbox milk price farmers receive for their milk is a blend price based on United States milk utilization as well as all local premiums and discounts for milk quality characteristics such as butterfat content. A $15.00/cwt mailbox price for Class I milk, when the current futures price is $13.00/cwt, means basis is +$2.00/cwt. The $2.00/cwt basis assumes the $15.00/cwt mailbox price has been adjusted for whatever premiums and discounts the dairyman receives.

An identifiable relationship exists between fluctuations in the BFP and the Virginia fluid milk price. A two-month time lag is often seen between the average Virginia fluid milk price and the BFP. For example, the May 1998 BFP dropped sharply from the April BFP, but that decrease did not show up until the July 1998 fluid milk price (Figure 4). The subsequent rise in the fluid milk price came two months after the BFP had increased.

Figure 4. Virginia Fluid Milk Price and BFP, January 1997-October 1998



Source: USDA (b) and VASS

Until more local data are available to develop basis tables for BFP, the easiest way for producers to approximate the expected basis is to calculate the difference between their historical mailbox prices and the historical BFP for the same month. Generating a five-year average for each month will provide a good approximation of the basis, and the strongest (largest positive) and weakest (smallest positive or negative) basis can be recorded for the five-year period. For example, the five-year average January basis is $1.55/cwt (Table 3). Actual BFP futures data will eventually be available to use in calculating the basis.

Table 3. Illustration of Average Historical Calculations Basis for January 1994 - 1998

Year	BFP	January Mailbox Price	Basis
		$/cwt.	
1994	12.41	13.90	1.49
1995	11.35	13.01	1.66
1996	12.73	14.15	1.42
1997	11.94	13.55	1.61
1998	13.25	14.81	1.56
	Average Basis:	1.55	
	Best Basis:	1.66	
	Worst Basis	1.42	

Basis can and does vary. The forward price being offered by the BFP futures is the appropriate futures month price plus basis. For example, the forward price for early April is the April futures price plus the basis for April. Since the basis is variable, a risk exists that the final realized price will not be exactly the same as the forward price that is expected when the hedge is placed. This basis risk is part of the process and cannot be eliminated. The presence of basis risk underscores the importance of collecting and keeping good basis data.

GETTING STARTED

Developing a price-risk management plan involves more than making the decision to hedge. Before trading futures contracts for any commodity, dairymen must open an account with a broker, preferably one who is familiar with the dairy business and dairy markets. Setting up the hedging account takes anywhere from 1 day to 20 days, depending upon the brokerage firm.

The Margin Account

To begin trading a futures contract, hedgers must deposit an *initial margin requirement*.[4] Account balances are "marked to the market," meaning that they are adjusted daily with profits or losses, based on the closing futures prices for the day, against this initial amount. If the account falls below a specified *maintenance margin requirement*, the hedger receives a *margin call*, which requires that the fund be *replenished to the initial level*.[5] If the margin call is not answered within a specified time limit, the brokerage firm can liquidate the hedger's position.

To illustrate the margin account and margin calls, two examples are used. The examples differ only in the price at which the dairyman closes his futures position. The dairyman sets up a hedge fund to sell one February BFP 200,000-pound CME contract at $13.58/cwt. His broker tells him the initial margin is $1,000, and the maintenance margin is $600. The broker's commission is $100 per contract. Based on the contract size of 200,000 pounds, for each $0.01/cwt change in the futures price, the account balance changes by $20 per contract. All the requirements to open an account are met. The $1,000 initial margin, having been placed in an interest-bearing account with the brokerage firm until it is needed either to begin hedging or to meet margin calls, is available to support the sale of the futures contract on November 19. The account will need to be restored to the original margin level by the amount of the margin calls in the event the market moves up after the initial contract is sold to place the hedge.

[4] The Exchanges now refer to "margin" as performance bond.

[5] Hedgers may only be required to restore the account balance to the maintenance level. Farmers should check with their brokers for specific requirements.

In the first example, the dairyman sells a February 200,000-pound BFP contract for $13.58/cwt (Table 4). At the close on November 20, the price has dropped to $13.50/cwt, an *increase* in his account balance of $160. (The market declined $0.08/cwt. Each $0.01/cwt change is valued at $20.00.) The account balance is now $1,160. On November 21, the price rises to $13.80/cwt, an increase of $0.30/cwt ($13.50 - 13.80 = $0.30/cwt). The price increase results in a decrease in the margin account balance of $600, leaving a balance of $560 ($1,160 - 600 = $560) in the account, which is below the $600 minimum required balance. Thus, the dairyman receives a margin call and deposits $440 to restore the account to the $1,000 balance. On November 22, the closing price is $13.90/cwt and a charge of $200 is made to his margin account balance. No margin call is made—the account balance was restored to $1,000 by the $440 margin deposit. The $600 minimum has not been reached ($1,000 - 200 = $800). On November 23, the price is $13.75/cwt, the margin account is credited with $300, and the balance is $1,100. The account is finally closed on February 5 at $13.50/cwt. The dairyman has netted $60 on the futures contract after accounting for the commission. If the market had continued to decline, however, an additional surplus would have accumulated in the account. This surplus can be moved into an interest-bearing account with the brokerage firm, or it can be returned to the dairyman at his request. Very importantly, the surplus in the margin account, however it is managed, is needed to offset the lower than expected cash price.

Table 4. Margin Account, Buy-back Price Below Sell Price

Date	Action	Market Price	Profit/Loss	Equity in Account	Margin Call	Deposits
		$/cwt		$		
Nov 19	Sell	13.58				1,000.00
Nov 20		13.50	160.00	1,160.00		
Nov 21		13.80	(600.00)	560.00	440.00	440.00
Nov 22		13.90	(200.00)	800.00		
Nov 23		13.75	300.00	1,100.00		
.						
.						
.						

	Action	Market Price	Gross Profit/(Loss)	Commission	Profit/(Loss)
			$/cwt		
Feb 5	Buy	13.50	160.00	100.00	60.00

In the second example (Table 5), everything is the same except the closing price is $13.79/cwt, and the dairyman lost $420 on his futures contract, not including the $100 commission he paid. The producer does not get the $440 margin call money back. The final realized price in this example will be made up of a cash market price that was higher than expected and the small losses in the futures account. *The realized price is always the combined result from cash sales and the net from the futures trade*. These two examples deal only with the trade in the futures market and do not show the corresponding gains and losses in the cash market (which are discussed later).

Table 5. Margin Account, Buy-back Price Above Sell Price

Date	Action	Market Price	Profit/Loss	Equity in Account	Margin Call	Deposits
		$/cwt	----------	----------	$	----------
Nov 19	Sell	13.58				1,000.00
Nov 20		13.50	160.00	1,160.00		
Nov 21		13.80	(600.00)	560.00	440.00	440.00
Nov 22		13.90	(200.00)	800.00		
Nov 23		13.75	300.00	1,100.00		
.						
.						
.						

	Action	Market Price	Gross Profit/(Loss)	Commission	Profit/(Loss)
		----------	----------	$/cwt	----------
Feb 5	Buy	13.79	(420.00)	100.00	(520.00)

Planning for and Dealing with Margin Calls

The gains received from a profitable hedge will be realized when the contract is settled, but margin calls, which must be covered immediately, can create a cash flow problem. Before setting up a hedge fund for BFP futures, producers should be prepared to cover a price move of at least $1.00/cwt or, even better, be prepared to answer margin calls up to a price level of the life-of-contract high for the month of the particular futures contract. Covering a margin call of $2,000 per futures contract (or $1.00/ cwt) may require a separate line of credit. Not all lenders are familiar with the value of hedging. Those bankers who understand the importance of hedging to a farm business may be willing to set up a line of credit that pays margin calls directly. If the banker is not knowledgeable about and comfortable with hedging, the dairyman needs to consider a cash forward delivery contract from the cooperative, or he needs to consider using options (covered later) which do not have margin calls.

Cooperatives may offer forward delivery cash contracts on milk. Forward pricing with a cooperative is another useful price-risk management tool that some producers may prefer. However, the cooperative that offers forward contracts to its members is using the futures market and exposing itself to basis risk and any interest costs on money used for margin calls. It may, therefore, transfer these risks and costs to the dairyman in the form of slightly lower prices than he would receive if he used futures contracts himself.

FUTURES AND OPTIONS PRICE-RISK MANAGEMENT

Output Price-Risk Management

Farmers can apply several strategies for using futures and options. While all of these strategies have advantages, they can also have pitfalls. Hedging, the first strategy demonstrated, involves selling a futures contract as a temporary substitute for a cash sale to be made later. The advantages to hedging are that contracts can be entered into quickly at highly competitive prices, and the commitment involved can easily be offset. Disadvantages to hedging are margin calls, basis risk, and sometimes, the size of the futures contracts, which may not fit the producer's needs.

Hedging Examples

Four examples are used to illustrate hedging. The first two have no basis risk; the second two show the effects of basis risk. In these examples, the dairyman is establishing a short hedge (selling futures) to protect against lower prices for January 1999 milk production. He would like to receive at least $15.92/cwt for his milk. His January basis is usually $1.00/cwt. On November 1, 1998, January BFP futures are trading for $15.00/cwt. The dairyman establishes a hedge by selling sufficient January BFP futures contracts to cover all or some portion of his expected milk production for January.

The expected price (forward price) is calculated by adding the basis to the January futures price, so that expected price is $16.00/cwt ($15.00 + $1.00 = $16.00). The broker's commission, assumed to be $0.08/cwt, is subtracted from the expected price providing the desired net price of $15.92/cwt. All examples ignore the interest charge that may be incurred on margin funds. In practice, these interest charges must be subtracted from the final price received for the milk. If the futures price declines from the initial hedge price, the gains received may be put in an interest-bearing account with the brokerage firm or withdrawn and deposited in the dairyman's bank to reduce any interest costs.

In the first example, the price for January falls (Table 6). On January 1, 1999, the dairyman buys back his January BFP contract for $13.00/cwt. Thus, he makes $2.00/cwt on the round-turn futures trade: initially sold then bought-back contract. He sold his milk to his cooperative for $14.00/cwt. (The closing basis equals the expected basis: $14.00 - 13.00 = $1.00/cwt, and no basis risk occured). To calculate his net realized price, he adds the $2.00/cwt gain from his futures market trade ($15.00 - $13.00 = $2.00) to the cash price he received ($14.00/cwt), giving him $16.00/cwt. This amount must be further adjusted for brokerage fees ($0.08/cwt), providing him a net realized price of $15.92/cwt.

Table 6. Short Hedge When Price Levels Decline

Date	**Cash**		**Futures**
Nov 1998	$/cwt		$/cwt
	Expected Net Price		
	15.00	Futures	Sell 1 BFP contract @ $15.00
	+1.00	Basis	
	-0.08	Commission	
	15.92	Forward price	
Jan 1999	Sell Milk to local Cooperative		Buy 1 BFP contract @ $13.00
	14.00	Cash	Gain from futures $2.00
	+2.00	Gain from futures	
	16.00		
	-0.08	Commission	
Realized Net Price:	**= $15.92**		

In the second example, the January futures price rises (Table 7). On January 1, 1999, the dairyman buys back his January BFP contract for $17.00/cwt. Thus, he lost $2.00/cwt on the round-turn futures trade. He sold his milk to his cooperative for $18.00/cwt. To calculate his net price, he subtracts his loss from his futures market round-turn trade ($2.00/cwt) from the cash price he received ($18.00/ cwt), leaving him $16.00/cwt. This amount must be further adjusted for brokerage fees ($0.08/cwt), giving him a net price of $15.92/cwt. His expected basis and his actual closing basis were the same.

Table 7. Short Hedge When Price Levels Increase

Date	Cash		Futures
Nov 1998	$/cwt		$/cwt
	Expected Net Price		
	15.00	Futures	Sell 1 Jan BFP contract @ $15.00
	+1.00	Basis	
	-0.08	Commission	
	15.92	Forward price	
Jan 1999	Sell Milk to local Cooperative		Buy 1 Jan BFP contract @ $17.00
	18.00		
	-2.00	Loss from futures	Loss from futures $2.00
	16.00		
	-0.08	Commission	
Realized Net Price:	**= $15.92**		

Dairymen need to be careful not to view the hedge in this example as a mistake because they "lost" money on the futures contract. The direction the market will move is not predictable and an opportunity cost is incurred when the market moves up. Opportunity cost, in this case, is the chance for the dairyman to sell milk at $18.00/cwt that was missed because he hedged. But since prices move up or down, the direction which only 20-20 hindsight can predict, dairymen have far less risk by locking in a price than by speculating on the direction of the cash market. If the dairyman considers $15.92/cwt a profitable price, the profit it allows would have been protected—and this protection may be very good business in today's volatile markets.

Basis risk can increase or decrease the final realized net price. In these first two examples, the effects of basis risk were not included, and the hedge worked exactly the way it was planned. In the next examples, basis risk is introduced. The futures price at the time the contract is closed is $12.95/cwt, and the cash price remains at $14.00/cwt (Table 8). The net price gain from the futures trade is $2.05/cwt ($15.00 - 12.95 = $2.05/cwt). Adding the $2.05/cwt gain from futures to the cash price gives the dairyman $16.05/cwt. The closing basis is *stronger* (the hedger gets a higher than expected return on his futures trade) than expected: $1.05/cwt ($14.00 - $12.95 = $1.05/cwt). Adjusting the gain for the commission leaves the dairyman with $15.97/cwt. In this example, basis variation helped the dairyman get a higher than expected price.

Table 8. Short Hedge with Strengthening Basis

Date	Cash		Futures
Nov 1998	$/cwt		$/cwt
	Expected Net Price		
	15.00	Futures	Sell 1 Jan BFP contract @ $15.00
	+1.00	Expected basis	
	-0.08	Commission	
	15.92	Forward price	
Jan 1999	Sell Milk to local Cooperative		Buy 1 Jan BFP contract @ $12.95
	14.00		
	+2.05	Gain from futures	Gain from futures $2.05
	16.05		
	-0.08	Commission	
Realized Net Price:	**= $15.97**		

If the closing futures price is $13.15/cwt, the gain from the futures market is $1.85/cwt (Table 9). Combining this gain ($1.85/cwt) with a cash price of $14.00/cwt results in a realized price of $15.85/cwt and a net realized price of $15.77/cwt, after subtracting the commission. The basis is weaker (the hedger gets less than expected on his futures trade): $0.85/cwt ($14.00 - $13.15 = $0.85) or $0.15/cwt less than the expected basis of $1.00/cwt.

Table 9. Short Hedge with Weakening Basis

Date	**Cash**		**Futures**
Nov 1998	$/cwt		$/cwt
	Expected Net Price		
	15.00	Futures	Sell 1 Jan BFP contract @ $15.00
	+1.00	Expected basis	
	-0.08	Commission	
	15.92	Forward price	
Jan 1999	Sell Milk to local Cooperative		Buy 1 Jan BFP contract @ $13.15
	14.00		
	+1.85	Gain from Futures	Gain from futures $1.85
	15.85		
	-0.08	Commission	
Realized Net Price:	**= $15.77**		

Basis movement can increase or decrease the final realized price. The risk associated with a volatile basis is inherent to the hedge and cannot be avoided. *But the magnitude of the basis risk is much smaller than the possible risk in the cash market if no hedge were used.*

Options

Another risk management strategy available to farmers is options. *Options*, like futures contracts, allow dairy farmers to manage their price risk. They can be used to protect against price decreases for output. Options have the added advantage of allowing users to benefit from advantageous price moves. Additionally, they provide both security and price flexibility without margin calls.

An option on a futures contract gives the owner the right, but not the obligation, to enter into a futures contract at a specific price, called the strike price. A premium is paid for this option right. The premium is the "market-determined value of an option for a particular futures contract and . . . [strike] price level" (Purcell and Koontz, p. 395). The option premium is similar to an insurance premium, guaranteeing a specific price level until the option expires. The strike price is a price interval at which the underlying futures contract trades. The exchanges offer a number of intervals or strike prices above and below the futures price at any point in time.

Two types of options are available. A *put option* gives the owner the right to *sell* (be short) the underlying futures contract at a strike price. A put option can be used to set a price floor for milk. Strike prices are offered for milk in $1.00/cwt increments above and below the futures price level. A *call option* gives the owner the right to *buy* (be long) the underlying futures contract at a strike price. A call option can be used to set a cost ceiling on inputs.

Put options allow the dairyman protection against declining milk prices while benefiting from unexpected increases. Protection offered against adverse price moves, while leaving open the potential for higher prices, has a cost.

The drawbacks to options are the premium costs and basis risk. The premium payment is made when the option is placed so that cost is known in the beginning, an advantage to many producers and their bankers. Deciding what he is willing to pay as a premium for an option to assure a floor price can be difficult for a producer. Different levels of price protection require different premiums, much like different levels of deductible on the farm-truck insurance policy.

Four examples illustrate the use of options. In late October 1998, the dairyman decides to protect his price for March 1999 milk production. He finds that on November 1, 1998, March 1999 BFP contracts are trading for $15.00/cwt. He believes that prices could continue to rise; therefore, he does not want to hedge to lock in a specific price. But if he is wrong, the price could decline and bring financial problems. He decides to use a put option to establish a minimum price rather than selling futures directly to establish a specific forward price.

By buying a put option, he is able to set a price floor and still take advantage of any price increases. His broker charges a $0.08/cwt commission. Basis is assumed to be $1.00/cwt. At the time of his trade, the put premium is $0.25/cwt. To calculate his floor price, the dairyman uses the formula

$$P_{FL} = SP + Basis - Prem - Com$$

where: P_{FL} is the price floor
SP is the strike price selected
Basis is cash – futures
Prem is the put option premium for the strike price selected
Com is the broker's commission

P_{FL} = $15.00 + 1.00 – 0.25 – 0.08
P_{FL} = $15.67/cwt

In this first example, when March comes, the cash market is $16.00/cwt, which is higher than expected; therefore, the producer lets the option expire because it is worthless (Table 10). The right to sell a position at $15.00/cwt has no market value when the futures market is above the $15.00/cwt strike price. The final realized price is determined by the cash price received in March, minus the broker commission, minus the put premium. The realized price of $16.67/cwt was higher than expected because cash prices were higher. The protection against price decreases provided by this put option was not needed in this case.

Table 10. Buying a Put To Establish Price Floor: Rising Prices

Date	Cash		Futures
Nov 1998	$/cwt		$/cwt
	Expected Net Floor Selling Price		
	15.00	Strike Price	Buy 1 March BFP put option
	+1.00	Basis	Strike price $15.00
	-0.25	Put Premium	
	-0.08	Commission	Premium = $0.25
	15.67	Price floor	
Mar 1999	Sell Milk to local Cooperative		Futures @ $16.00
	17.00	Cash	
	-0.25	Premium	Option expires worthless
	-0.08	Commission	
Realized Net Price:	**= $16.67**		

In the second example, the cash market is $13.00/cwt, lower than expected. The producer sells the $15.00/cwt put for $3.00/cwt; the futures market is $12.00/cwt (Table 11). The expected basis is the realized closing basis since the cash price is $13.00/cwt and futures price is $12.00/cwt. The final price is determined by the March cash price of $13.00/cwt, plus the gain received from the put option ($3.00 – 0.25 = $2.75), minus the broker's commission. The final price of $15.67/cwt was what the producer expected as a floor price, and the put option was effective. No basis risk has been used in these two examples. The closing basis is +$1.00/cwt in tables 10 and 11.

Table 11. Buying a Put To Establish Price Floor: Falling Prices

Date	Cash		Futures
Nov 1998	$/cwt		$/cwt
	Expected Net Floor Selling Price		
			Buy 1 March BFP put
	15.00	Strike Price	strike price $15.00
	+1.00	Basis	
	-0.25	Put premium	Premium for put $0.25
	-0.08	Commission	
	15.67		
Mar 1999	Sell Milk to local Cooperative		
			Sell $15.00 futures put option @
	13.00	Cash	$3.00 with futures @ @12.00
	+3.00	Put option sale	
	-0.25	Premium	
	-0.08	Commission	
Realized Net Price:	**= $15.67**		

When the market moves up, basis risk is not a big concern. The option is worthless as long as futures are above the strike price when the option matures. When prices decline, basis risk is still a potential factor because the level of the basis at the close will determine whether the floor price is realized, and the basis at the close of the strategy will influence the level at which the put option is sold.

In the third example, the put value will not be $3.00/cwt (Table 12) if cash is $13.00/cwt but the futures contract closes at $12.25/cwt. The closing basis is then $0.75/cwt ($13.00 - $12.25 = $0.75). The $12.25/cwt futures means the $15.00/cwt put is only worth $2.75/cwt ($15.00 – 12.25 = $2.75/cwt) (Table 11). The floor price of $15.67/cwt is not realized. The price would be only $15.42/cwt, which is below the desired floor price by the amount of the basis variation.

If the futures price goes down to $11.75/cwt and cash is $13.00/cwt, the option value goes up to $3.25. The desired price floor is exceeded by the amount of the basis improvement, which is $0.25/cwt greater than the $1.00/cwt expected basis ($13.00 – 11.75 = $1.25). In options, as in futures hedges, basis volatility can also help the final realized price (Table 13).

Table 12. Buying a Put Option with Closing Basis Weaker Than Expected

Date	Cash		Futures
Nov 1998	$/cwt		$/cwt
	Expected Net Selling Price		
	15.00	Strike Price	Buy 1 March BFP put strike price $15.00
	+1.00	Expected basis	
	-0.25	Put premium	Premium for put $0.25
	-0.08	Commission	
	15.67		
Mar 1999	Sell Milk to Local Cooperative		
	13.00	Cash	Sell $15.00 futures put option @ $2.75
	+2.75	Put option value	with futures @ $12.25
	-0.25	Premium	
	-0.08	Commission	
Realized Net Price:	**= $15.42**		

Table 13. Buying a Put Option with Closing Basis Stronger Than Expected

Date	Cash		Futures
Nov 1998	$/cwt		$/cwt
	Expected Net Selling Price		
	15.00	Strike Price	Buy 1 March BFP put strike price $15.00
	+1.00	Expected basis	
	-0.25	Put premium	Premium = $0.25
	-0.08	Commission	
	15.67		
Mar 1999	Sell Milk to local Cooperative		
	13.00	Cash	Sell $15.00 futures put option @ $3.25/cwt
	+3.25	Put option sale	with futures @ $11.75
	-0.25	Premium	
	-0.08	Commission	
Realized Net Price:	**$15.92**		

Futures and options are excellent tools for managing price risk. For farmers to successfully use these tools, they need to determine which strategy best fits their operations and what they hope to accomplish by using these strategies.

Table 14 shows some net price comparisons for three strategies, and Figure 5 plots the net prices for closing futures prices from $12.50 to $17.00. Basis is assumed to be $1.00/cwt, brokerage fees are assumed to be $0.08/cwt for futures and options, and the put premium for a $15.00/cwt futures is assumed to be $0.25/cwt. Futures are sold at $15.00/cwt in the short hedge, or a $15.00/cwt put option is purchased. A number of conclusions emerge:

- For the cash-only strategy with a closing basis equal to the expected basis of $1.00/cwt, the cash price will always be $1.00/cwt above the closing futures prices. At futures prices of $12.50/cwt, for example, the cash price will be $13.50/cwt. This cash price is $2.44/cwt below the futures strategy and $2.17/cwt below the options strategy when futures go to $12.50/cwt. Obviously, a strategy relying on the cash market is a poor choice when prices go down.

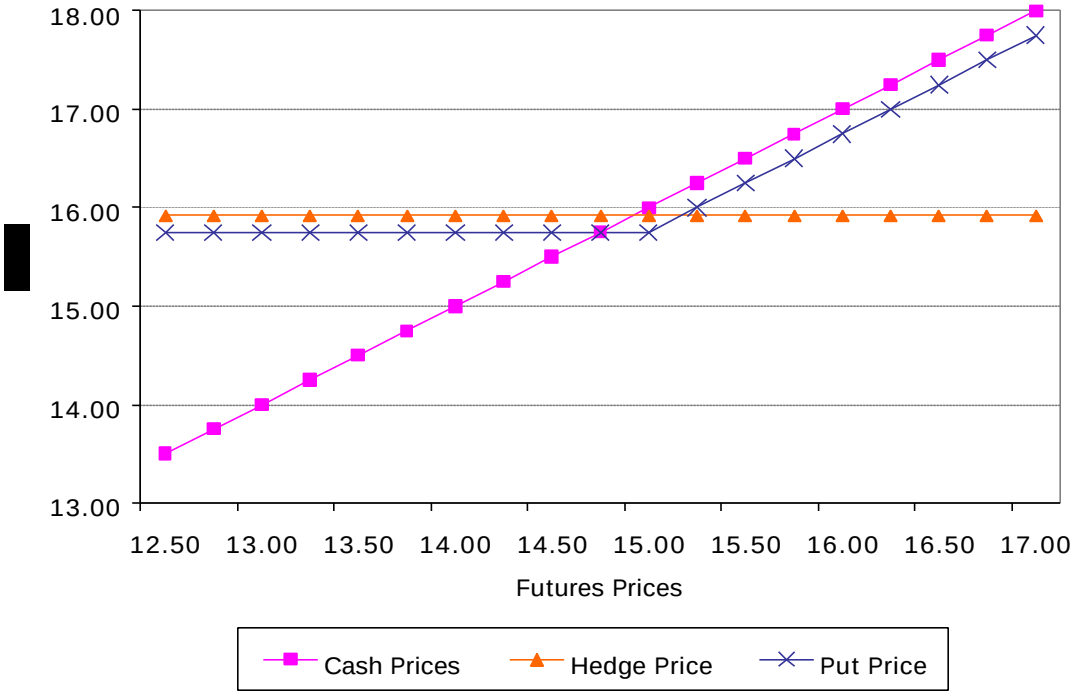
- If futures prices were at $15.00/cwt and prices were expected to decline, the short (sell) hedge is most profitable at all prices below $15.00/cwt. A price of $15.92/cwt is locked in (subject to closing basis being $1.00/cwt) at all futures price levels.
- If futures prices were at $15.00/cwt and prices were expected to rise, the dairyman still needs protection from unexpectedly lower prices. In this case, the put option strategy looks best. With commissions, the price floor is $15.67/cwt for futures prices at $15.00/cwt and below at closing—much better than the cash price strategy at all prices below $15.00/cwt and only $0.25/cwt (the premium cost) below the hedge strategy. For higher prices, the farmer gets part of the benefit. Buying a put will always result in a price $0.33/cwt below cash (the cost of the put premium plus the broker's commission) at futures prices above $15.00/cwt, and the dairyman can benefit from price increases.
- As long as the premium cost is not too high ($0.25/cwt in this example), many producers will prefer options. They provide protection against low prices and benefits from high prices, and they require no margin accounts.

Table 14. Net Prices to Producer under Alternative Pricing Strategies

Futures Price	Cash	Short Hedge	Cash – Short Hedge	Buy a Put	Cash - Put
			$/cwt		
12.50	13.50	15.92	-2.42	15.67	-2.17
12.75	13.75	15.92	-2.17	15.67	-1.92
13.00	14.00	15.92	-1.92	15.67	-1.67
13.25	14.25	15.92	-1.67	15.67	-1.42
13.50	14.50	15.92	-1.42	15.67	-1.17
13.75	14.75	15.92	-1.17	15.67	-0.92
14.00	15.00	15.92	-0.92	15.67	-0.67
14.25	15.25	15.92	-0.67	15.67	-0.42
14.50	15.50	15.92	-0.42	15.67	-0.17
14.75	15.75	15.92	-0.17	15.67	0.08
15.00	16.00	15.92	0.08	15.67	0.33
15.25	16.25	15.92	0.33	15.92	0.33
15.50	16.50	15.92	0.58	16.17	0.33
15.75	16.75	15.92	0.83	16.42	0.33
16.00	17.00	15.92	1.08	16.67	0.33
16.25	17.25	15.92	1.33	16.92	0.33
16.50	17.50	15.92	1.58	17.17	0.33
16.75	17.75	15.92	1.83	17.42	0.33
17.00	18.00	15.92	2.08	17.67	0.33

The direction milk prices are expected to move will, obviously, influence the strategy chosen. *The risks of relying only on the cash market are huge*. If solid supply and demand reasons indicate that milk prices might increase, buying the put option provides insurance against unexpected price decreases while leaving open the potential to benefit from increasing prices. But if supply and demand factors indicate that prices will fall, the option premiums can appear to be large, and a hedge or a cash forward contract with the processor might be the best choice. Every producer needs to reflect on his financial position and his tolerance for risk. Based on his reflection, he needs to make an informed decision on which approach to take.

Figure 5. Cash Prices, Hedge Prices, and Put Option Prices for Closing Futures Prices, $12.50 to $17.00/cwt under Alternative Strategies



Input Price-Risk Management

Controlling price risk for feed costs is also important. Corn prices went to record highs in the spring and summer of 1996, forcing some Virginia dairymen out of business. In early 1999, the situation was very different: September 1999 corn futures were trading around $2.40/bu. The 1998 corn crop was large and the 1999 crop estimates projected another large crop. But weather can always alter predictions. Protection against rising corn costs can be placed throughout the year, using a hedging strategy or a call option strategy.

In February 1999, the dairyman sees September 1999 corn futures are $2.40/bu. Basis is $0.10/bu, so he expects his cash price to be $2.50/bu. The call option premium is $0.15/bu for the $2.40/bu contract, and the broker's commission is $0.01/bu ($50.00 for a round-turn trade on a 5,000-bushel futures contract). The dairyman calculates his maximum or ceiling price for corn using the formula

$$P_C = SP + Basis + Prem + Com$$

where: P_C is price ceiling
SP is strike price
Basis is cash – futures
Prem is call option premium
Com is the broker's commission

P_C = $2.40 + 0.10 + 0.15 + 0.01
P_C = $2.66/bu

The call option premium and the broker's fee are additional costs and are, therefore, added to the cost of the corn.

A dairyman buying futures at $2.40/bu anticipates a cash cost of $2.50/bu (cash = futures + basis). Buying a $2.40/bu call option at a premium cost of $0.15/bu and $0.01/bu broker's commission sets a price ceiling at $2.66/bu (Table 15). Above the $2.40/bu, the call takes on value. For example, when futures are at $3.60/bu, cash would be $3.70/bu. The call option would be worth $1.20/bu ($3.60 – 2.40 = $1.20/bu). The $2.40/bu call option is sold at $1.20/bu so that the corn cost is reduced by that amount. The call premium and commission must be added to the cash cost of $2.50/bu. The result is the anticipated ceiling price of $2.66/bu. Expected basis is assumed to equal the closing basis.

Table 15. Buying a Call Option When Price Levels Increase

Date	Cash		Futures
Feb 1998	$/bu		$/bu
	Expected Price Ceiling		
	2.40	Strike price	Buy 1 Sept. $2.40 call
	+0.10	Expected basis	
	+0.15	Call premium	Premium = $0.15
	+0.01	Commission	
	2.66		
Sept 1998	Buy cash corn		
	3.70	Cash	Sell $2.40 futures call option @ $1.20/cwt
	-1.20	Call option sale	with futures @ $3.60
	+0.15	Premium	
	+0.01	Commission	
Realized Net Price:	**= $2.66**		

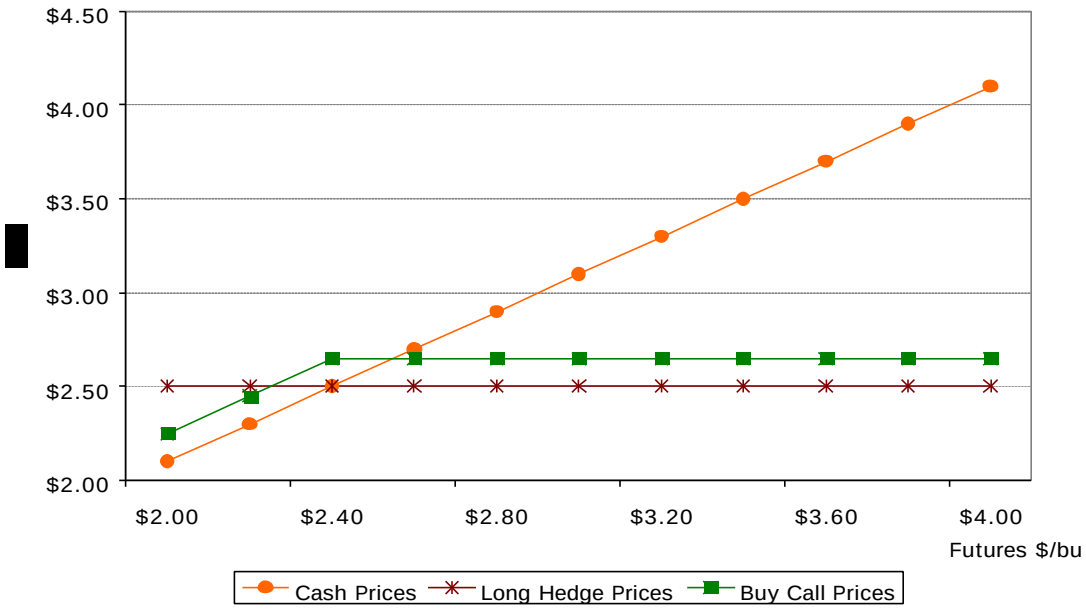
The net corn costs are shown in Table 16 using three strategies: cash, long (buy) hedge, and buying a call option. Expected basis equals actual basis and is $0.10/bu. The call option premium is assumed to be $0.15/bu and the broker's commission is $0.01/bu. Except at the cash corn prices below $2.50/bu, either a long hedge or buying a put is preferable to cash. If, as assumed in this example, basis risk does not exist and a long hedge is placed at $2.40/bu, the long hedge provides lower costs than either the cash or the call option strategy.

Figure 6 shows a plot of the three strategies—cash only, long hedge, and buying a $2.40/bu call option. How the long hedge compares to the call option strategy is obvious. Paying the option premium is logical if there is reason to expect corn costs to go down. If corn costs are expected to go up from a futures level of $2.40/bu, the long hedge will lower net costs compared to the option strategy. With margin calls to cover, some dairymen and their bankers may prefer options, with all costs known up-front.

Table 16. Costs to Dairymen under Alternative Input Cost Strategies

Closing Futures	Cash	Long Hedge	Long Hedge – Cash	Buy $2.40/bu Call	Buy Call – Cash
			$/bu		
2.00	2.10	2.51	0.41	2.26	0.16
2.20	2.30	2.51	0.21	2.46	0.16
2.40	2.50	2.51	0.01	2.66	0.16
2.60	2.70	2.51	-0.19	2.66	-0.04
2.80	2.90	2.51	-0.39	2.66	-0.24
3.00	3.10	2.51	-0.59	2.66	-0.44
3.20	3.30	2.51	-0.79	2.66	-0.64
3.40	3.50	2.51	-0.99	2.66	-0.84
3.60	3.70	2.51	-1.19	2.66	-1.04
3.80	3.90	2.51	-1.39	2.66	-1.24
4.00	4.10	2.51	-1.59	2.66	-1.44

Figure 6. Comparison of Strategies to Manage Volatile Corn Costs



TYPES AND USE OF FUTURES ORDERS

A variety of orders can be used with commodity futures. The constraints placed on orders allow hedgers control over the price at which they enter or leave the market. This control helps them follow a coordinated marketing plan. Understanding these different orders is essential in communicating specific instructions to a broker. Dairymen, having selected brokers knowledgeable about the dairy industry, need to use their brokers as resources for potentially beneficial types of orders.

Communicating clear instructions to the broker about the prices, sizes, and number of contracts is imperative. Producers should ask their brokers to explain how they understand the instructions they have been given before the brokers execute those instructions.

A *market order* is an order to take a position, short (sell) or long (buy), on a futures contract at the prevailing market price. Over the course of a trading day, the price fluctuates. Placing a market order instructs the broker to make a trade at the first available price. This type of order does not give the trader precise control over the entry price.

A *limit-price order* instructs the broker to trade a contract at a specified price level or better. For example, a dairyman could place a sell order for March BFP futures at $15.50/cwt. This information tells the broker to sell March BFP futures at $15.50/cwt or higher. The quantity to be sold is specified as part of the order. Limit-price orders can be placed with a broker on a *good 'til cancelled* (GTC) basis. The order will then be in the market for some brokerage firm-designated maximum period, such as 30 days, or until the hedger cancels it. If the price does not reach a specified level, $15.50/cwt in this example, no action is taken and no protection is in place. A limit-price order to sell at $15.50/cwt will not always be filled. If the high price for the day is $15.50/cwt, and enough buy orders at that level are not available to offset all sell orders, the order may not be filled.

If the *market if touched* (MIT) constraint is placed on a limit order, it becomes a market order when price reaches the specified level. For example, if the dairyman wants $15.00/cwt, he may place a $15.00/cwt MIT condition on a limit order to sell. If the top price for a day reaches $15.00/cwt, the order becomes a market order and is filled as close to $15.00/cwt as possible. The MIT provision protects against an order not being filled at $15.00/cwt when $15.00/cwt is the high for the day but only limited trading occurs at that price. The MIT provision may be useful in markets like BFP futures where trading volume is expected to be limited at any particular price. However, when trading is limited, the order may be filled well below the $15.00/cwt the producer wants. To reduce the downside risk, a limit can be placed on how much below $15.00/cwt is acceptable. For example, a $14.90/cwt minimum can be established by using a limit on how much below $15.00/cwt the price will be allowed to fall before the MIT order will be exercised. (Producers should talk to their brokers about setting these limits.)

A *sell-stop order* becomes a market order if the futures price touches the specified level from above. The order would be written as "sell X January BFP futures at $13.00/cwt stop." Using this type of order allows the hedger to protect against falling prices. For example, a dairyman may feel prices will move up toward $13.50/cwt if the market is currently $13.30/cwt, but he wants to ensure himself of at least $13.00/cwt. If prices suddenly drop to $13.00/cwt, the sell-stop order at $13.00/cwt becomes a market order and contracts are sold at or near $13.00/cwt.

A *buy-stop order* becomes a market order if the futures price touches the specified level from below. In the case of rising feed prices, a dairyman may want to place a buy-stop order to fix a maximum price. If corn is currently trading at $2.75/bu, but prices are rising, the producer may want to place a buy-stop order at $2.82/bu. This action guarantees that the hedger will be in the market at or near $2.82/bu if the market goes up to $2.82/bu. The advantage of using stop orders in hedging programs is that the price level at the time of market entry is controlled. Protection against rapid price rises may be in place while the dairyman is trying to buy corn futures at $2.69/bu.

A hedger could place two orders for January BFP milk with the stipulation that *one cancels the other* (OCO). For example, he would tell the broker, "Sell X January BFP at $15.20/cwt and sell Jan BFP at $14.80/cwt, stop." When one of the two orders is activated, the other is automatically cancelled. This technique allows the producer to sell in a market that rises to $15.20/cwt, but protects him from a falling market by filling a sell order at $14.80/cwt when the $15.20/cwt level is not realized. Thus, the producer locks in a price range at which he enters the market.

PRACTICING BEFORE SPENDING MONEY

Trading on paper is the standard way to gain insight into price-risk management. Trading is done on futures and options with a comparison of the outcomes. Records of these paper trades need to be kept. By looking at what the outcome would have been for various past hedging strategies, dairymen can gain insight into the limitations of the process and to determine which strategies would have been the most useful in managing price risk.

Producers need to develop and adhere to a plan for their risk management strategies, at least until they become experienced. If they do not, they will find themselves exposed to unexpected risks.

Dairy marketing clubs are being organized around the state so that dairymen can share what they have learned from their paper trades as well as from actual trades. These clubs often include the local county agricultural and natural resources extension agent, who acts as a resource person for the group. Dairymen are encouraged to talk to their local extension agents about farming clubs. Research and education programs at Virginia Tech support the Virginia Cooperative Extension (VCE) field staff. Extension Marketing Economists Wayne Purcell and David Kenyon can be contacted through local extension agents. Wayne Purcell has a weekly market advisory on the VCE internet site (*www.ext.vt.edu*) under Timely Topics. This newsletter covers advice on input hedging and may be expanded to cover milk if futures trading grows and information is more widely available.

Dairymen will need to develop sources of and access to futures and options prices. Typically, the type of information monitored would be dairy product prices, situation and outlook for the dairy industry, and futures and options markets. Available resources differ in form, price, and frequency of distribution. A number of dairy newsletters, like *USDA Dairy Market News* and *Hoards Dairyman*, provide dairy product prices, analyses of the situation in the dairy industry, futures and options prices, and recommended price-risk strategies. The *Wall Street Journal* provides cash, futures, and options information daily on corn and soybean meal. Extension specialists, brokerage firms, consulting companies, and cooperatives typically produce newsletters. Websites for the futures exchanges are available (see "References" for the web addresses).

FUTURE OF DAIRY PRICE-RISK MANAGEMENT

Dairy farmers face new risks, new challenges. They are not used to dealing with price volatility when selling their milk. Historically, few dairymen have bothered to manage exposure to feed cost volatility because the support price was typically sufficient to ensure profitability. With changes in the 1996 Farm Bill that removed price supports, price volatility increased and doing nothing about price risk has become a poor management decision. Failure to manage exposure to milk price risk and feed cost risk can mean major financial problems and can ruin the business.

Several strategies for price-risk management are available. Some of these strategies shift the risk from the dairyman to the cooperative or the feed dealer. Cooperatives that process milk might offer cash contracts tied to futures and minimum price contracts tied to put options. Feed suppliers might offer forward cost contracts tied to long positions in futures, or they could provide cost ceiling contracts tied to call options. Dairymen need to work with their milk outlets and their input suppliers to develop ways to cope with risk exposure.

Producers can manage their own futures and options positions, which usually takes an understanding and knowledgeable banker. Producers and their bankers would both benefit from discussing a price-risk management plan and from writing it down. The interest on margin money is then correctly seen as a normal business cost and "margin phobia" goes away.

In the past, dairymen have worked to increase their profits by increasing their milk production and reducing their costs. Being efficient and cost effective will always be important, but the challenges are now much broader. In today's markets, Virginia dairymen will have to be good managers of the risks associated with volatile feed costs and volatile milk prices as well as good producers.

GLOSSARY

Basic Formula Price (BFP): USDA-calculated price based on a monthly survey of prices for unregulated, manufacturing grade milk (Grade B) in Minnesota and Wisconsin.

Basis: The historical difference between local cash price and futures price at the time the actual commodity is sold or purchased: Basis = Cash – Futures, where cash is the cash price at a local market and futures is the futures contract price closest to, but not before the time of sale or purchase.

Buy-Stop-Close-Only Order: An order that will be filled only if the market *closes* above a specified price level.

Call Option: Gives the owner the right to buy a commodity, security, or futures contract at a specific price anytime from the date of purchase until the expiration date of the option.

Forward Price: The price offered in a particular market area that is determined by adjusting futures prices for basis.

Fundamental Analysis: Analysis of supply and demand factors that affect commodity markets.

Hedge: Temporary substitute for cash market transaction involving being in opposite positions in two different but related markets: futures and cash.

Initial Margin (Initial Performance Bond or Margin Requirement): Money deposited with the brokerage firm for each contract before a hedger can trade futures contracts.

Long: to buy a futures contract or to buy or own the actual commodity.

Mailbox Price: Price received by the farmer in his cash milk transaction with the local cooperative.

Maintenance Margin (Performance Bond): Minimum amount required to be kept in a margin account. If a futures price move causes the maintenance margin to fall below the required level, money must be deposited to return the account to its original margin requirement level or the maintenance margin level. Which level depends upon brokerage firm rules.

Margin Call (Performance Bond Call): Monies required to replenish an account as the market moves against a hedger's position.

Market Order: Order to buy or sell that will be executed at the first available price.

Mark-to-Market: Posting of gains or losses on an account at the close of each trading day. Calculations are based on the contract price at the close of the market.

Open Position: Having a position in the futures market.

Premium: Price of the option when the option is bought or sold.

Put Option: Gives the owner the right to sell a commodity, security, or futures contract at a specific price at any time between the purchase of the option and its expiration date.

Round-turn Trade: Initial purchase (sale) of a contract offset by the sale (purchase) of the contract.

Sell-Stop-Close-Only Order: Sell order that will be filled only if the market *closes* below a certain specified price level.

Short: Sell a futures contract or to sell the commodity in the cash market.

Strike Price (Exercise Price): Designated price levels at which the underlying commodities, securities, or futures contracts can be bought or sold.

Technical Analysis: Analysis of markets through graphical interpretation of past price performance for a particular commodity.

REFERENCES

Chicago Mercantile Exchange. *The Exchange of Ideas: Chicago Mercantile Exchange. http://www.cme.com.* Accessed July 27, 1999.[6]

Chicago Board of Trade. *Welcome to the Chicago Board of Trade. http://www.cbot.com.* Accessed July 29, 1999.

Coffee, Sugar and Cocoa Exchange, Inc. *Coffee, Sugar & Cocoa Exchange, Inc. http://www.csce.com.* Accessed July 27, 1999

Dairy Futures Homepage. Dept. of Ag. & Applied Econ. & Center for Dairy Research. U of Wisc-Madison. *http://www.aae.wisc.edu/future/dairy1.htm.* Accessed July 29, 1999.

Kenyon, David E. *Virginia Basis Tables for Corn, Soybeans, Wheat, and Soybeans*, Va. Coop. Ext. Pub. No. 448-016. March 1999.

Purcell, Wayne D., and Stephen R. Koontz. *Agricultural Futures and Options: Principles and Strategies*. Upper Saddle River, NJ.: Prentice Hall, 1999.

USDA (a). *Dairy Market News*. USDA. AMS. at *www.ams.usda.gov/dairy/mncs/summary.htm*. Accessed July 29, 1999.

_____ (b). *Dairy Situation and Outlook Report and Yearbook*. USDA, ERS. Various years.

_____ (c). *Dairy Yearbook.* USDA. ERS. SB No. 924. Dec. 1995.

_____ (d). *Feed Situation and Outlook Yearbook.* USDA. ERS. FDS 1998. April 1998.

_____ (e). "What is the Basic Formula Price(1996)," adopted from June 1996 *Dairy Outlook*. Found at *http://www.aae.wisc.edu/future/dairy10.htm.* Accessed June 28,1999.

Virginia Agricultural Statistics Service. *Virginia Agicultural Statistics Bulletin.* VASS. various years.

[6] All web addresses were valid as of the date accessed. Web addresses can be changed. If the sites are not found at the addresses given, a search of the web may provide the new address.