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Futures and Options Trading in Milk and Dairy Products

A Guidebook for Dairy Producers

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Contents

Introduction

The opportunity for dairy farmers, dairy processors, and marketing firms to engage in price risk management through futures and options trading is a fairly recent development. The Coffee, Sugar and Cocoa Exchange (CSCE, now part of the New York Board of Trade, or NYBT) offered the first modern dairy forward pricing contracts, for cheddar cheese and nonfat dry milk, in 1993.[1] Despite limited trading of the new dairy contracts, the CSCE introduced a Class III fluid milk contract in 1995. The Chicago Mercantile Exchange (CME) started its own fluid milk contract in the same year.

Dairy farmers and others have an excellent opportunity to manage price risk through the use of futures, options, and futures-based forward pricing contracts.

Both exchanges terminated their (deliverable) fluid milk contracts in 1996 and began trading cash-settled Basic Formula Price (BFP) contracts. During the same year, the CME added a deliverable contract for butter, and, later, cash-settled contracts for cheddar cheese (1997), nonfat dry milk (1998), and dry whey (1998). In 2000, the BFP contracts were converted to Class III milk contracts to conform to federal milk marketing order pricing changes instituted on January 1. Later in 2000, the CME introduced futures contracts for Class IV milk.

The NYBT terminated trading in dairy contracts in June 2000, leaving the CME as the only exchange listing dairy-related futures and options contracts. The CME discontinued trading cheddar cheese futures and options but continues to trade Class III, Class IV, deliverable butter, nonfat dry milk, and dry whey contracts and added a cash-settled butter contract in 2007. That same year, the CME merged with the Chicago Board of Trade and is now referred to as the CME Group.

As price volatility for milk and dairy products has increased in recent years, interest in trading dairy futures and options contracts has increased correspondingly. In late 2000, open interest in the CME Class III contract, the most actively-traded contract within the CME dairy complex, was about 10,000 contracts. Open interest in Class III put and call options totaled about 3,000. In mid-2008, open interest in the Class III futures contract exceeded 25,000 contracts and open interest in Class III put and call options exceeded 16,000. The CME deliverable butter contract has shown minimal trading activity, but the cash-settled butter contract had open interest of nearly 3,000 contracts in mid-2008. Open interest in the dry whey and nonfat dry milk contracts was about 2,000 and 700 contracts, respectively.

While trading in dairy contracts remains small in comparison to major grain and livestock futures contracts,[2] dairy futures markets are clearly here to stay. Hence, dairy farmers, milk buyers, and others have an excellent opportunity to manage price risk through the use of futures, options, and futures-based forward pricing contracts.

In this publication we address some basic questions concerning futures and options markets and the mechanics of trading from the perspective of the dairy farmer. We provide several illustrations showing how dairy farmers might use futures trading—directly and indirectly—to hedge price risk.

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1 The Chicago Mercantile Exchange traded a butter futures contract for many years in the early 1900s. In fact, the CME began in the late 1800s as the Chicago Butter Exchange, a wholesale cash market for butter, and later added cash and futures contracts for butter and several other agricultural commodities. The butter futures contract was terminated in the early 1960s because of limited trading volume.

2 Daily trading volume in corn and soybean futures on the Chicago Board of Trade is typically several times the volume of open interest in dairy contracts.

Part I provides some basic background information on futures contracts, including history, regulatory procedures, and trading mechanics. Then, we illustrate some representative hedges for dairy industry participants using the Class III milk contract. Part II deals with options trading. We show how options markets work in general and demonstrate how dairy farmers might use options to protect pricing objectives. Two appendices provide additional hedging examples and illustrate some advanced price risk management strategies.

Part I: Dairy futures contracts

What is a futures market?

Simply stated, a futures market is an organized auction market for trading futures contracts; that is, contracts for future delivery of a commodity. A futures market can be contrasted with a cash or spot market. A cash or spot market provides for immediate delivery of and payment for the commodity traded. The purpose is to fulfill the immediate needs of buyers and sellers. There are informal and formal cash markets. An example of an informal market is the sale of dry whey through private negotiations between sellers and buyers. The Chicago Mercantile Exchange daily cash market for butter is an example of a formal organized wholesale cash market.

A futures contract involves a *commitment* to either accept or make delivery of a specified quantity and quality of a commodity at a specified time, and often at a specified place of delivery. No actual commodity changes hands unless and until the contract comes due, or matures.

With the exception of the deliverable butter contract, dairy futures contracts are cash-settled rather than settled through delivery of the underlying commodity. With cash settlement, delivery is not even allowed as a means of settling the contract. Rather, the commitment is to make up any difference between the price at the time of sale or purchase of the contract and the price at the time the contract expires. For example, if a November Class III milk contract was sold at $15.00 per hundredweight and the announced Class III price for November turned out to be $16.00, the seller would cash settle by paying $1.00 per hundredweight to the buyer of the contract.[3]

Cash settlement makes it easier to trade contracts because there is no need to have the physical commodity for delivery. For the Class III and Class IV contracts, cash settlement is essential because the "commodity" is really a reference price applied to a physical volume of standardized milk.

In addition to providing a physical location for trading futures contracts, futures markets also establish rules of conduct, fix contract specifications, collect and distribute market information, guarantee settlement of contractual and financial obligations, and arrange for settlement of disputes among traders.

How and why did futures markets develop?

The origin and development of futures markets dates to the mid-19th century with the expansion of market areas for agricultural products, particularly for grain. Market price risk increased due to the long time period between grain production, storage, and final sale. Sellers wanted to protect themselves against a loss in grain inventory value due to price declines between harvest and sale. Initial attempts to avoid this price risk involved establishing a price for grain before it had arrived at its destination through what were termed "to arrive" contracts. This procedure passed price risk from the seller to the buyer, but many grain dealers and processors were unwilling to absorb all the price risk. The development of futures markets alleviated the problem by sharing the risk of unfavorable price movements and thereby increased the flow of risk capital into the marketplace.

The first organized futures market was the Chicago Board of Trade (CBOT). The CBOT was founded in 1848 as a cash grain market; it did not start futures trading in grain until 1865. Today, there are eight futures markets in the United States. Each of these futures markets is operated by one of eight futures organizations, called futures exchanges. Futures markets also exist in many other countries.

[3] This is a simplistic explanation of cash settlement. In reality, the broker account of the seller would be debited and the account of the buyer would be credited.

More than 100 different commodities are traded on U.S. futures markets. Early in their history, futures markets traded only agricultural commodities. Raw farm commodities like corn, wheat, soybeans, cotton, cattle, hogs, sugar, cocoa, and coffee still make up a large portion of futures market trading. But non-farm commodities such as gold, silver, heating oil, and plywood are also actively traded. And financial instruments like Treasury bills, interest rates, and foreign currencies have come to make up a majority share of futures trading.

A major reason for the existence of futures markets is to provide a means for shifting the risk of price change on the cash market for the commodities involved. This is accomplished through a process called hedging, which is explained later. For hedgers, futures markets are not places to buy and sell commodities; they are used to protect price and profit objectives in the cash market.

What are the commitments of buyers and sellers of futures contracts?

If the initial trade on the futures market is the *purchase* of a contract, the buyer is said to be *long* in the market. For a deliverable contract, the buyer has purchased a commitment to receive delivery of a commodity at a specific future date and at a specific price. If the initial trade is the *sale* of a contract, the seller is said to be *short* in the market. The seller of a deliverable contract has sold a commitment to make delivery of a commodity at a specific date and at a specific price.

In nearly all cases, the buyers and sellers of the deliverable contracts will not hold the contracts until they mature. Instead they will *cover* their commitment by offsetting positions on the futures market with opposite transactions prior to contract maturity. Thus, the seller of a futures contract (short) covers by purchasing a futures contract in the same month prior to maturity of the contract. A purchaser of a futures contract (long) would cover through the sale of a futures contract.

As noted above, most dairy futures contracts are cash settled against an announced U.S. Department of Agriculture reference price. If the announced price at contract maturity is higher than the purchase or sale price, longs receive a payment equal to the difference and shorts are obligated to pay the difference. If the announced price is lower than the price at the time the contract was purchased or sold, then longs pay and shorts receive the difference. In terms of accounting, cash settlement is equivalent to offsetting at the time of maturity.

For deliverable futures contracts, commitments are legally enforced by requiring actual delivery (shorts) and acceptance of delivery (longs) of the underlying physical commodity if a contract is allowed to mature. For cash-settled contracts that are allowed to mature, the legal requirement is for either buyers or sellers to make a cash payment equal to the difference between the purchase/sales price and the announced price, depending on the announced settlement price relative to the price at the time the contract was bought or sold. Both deliverable and cash-settlement contracts can be offset prior to maturity, thus removing the legal commitment. When contracts are offset, there is a cash settlement representing the difference between the purchase and sale prices.

Who are the key players in a futures market?

Futures market traders are either *hedgers* or *speculators*. A hedger uses the futures market to protect a cash market price and profit objective. Hedgers deal in both the cash and futures markets, but their interest in the futures market is as a means of shifting price risk. Specifically, hedgers expect that financial losses in one market will be offset by gains in the other market.

Speculators assume the price risk that hedgers try to avoid. The motive of speculators is to make a profit by advantageously trading futures contracts (buy low and sell high or sell high and buy low). This greedy motivation should not be viewed negatively. Speculators provide the futures market with an essential element, liquidity, which enables hedgers to buy or sell contracts when they want to set or lift their hedges. Absent speculators, short or long hedgers would have to rely exclusively on each other to make opposite transactions. Speculators build market liquidity by bridging the gap between the prices bid and offered by other commodity traders.

What is the procedure for trading futures contracts?

In order to trade on the futures market, you need to open an account and sign a customer agreement with a licensed broker knowledgeable about the contracts you will be trading. Since dairy futures contracts were introduced, many brokerage firms have developed considerable expertise in these contracts and how they can best serve customer needs. The customer agreement will specify whether your interest is in speculating or hedging. The broker will carry out your trade orders through a Futures Commission Merchant (FCM), a firm registered to engage in trading on the exchange floor. Many brokers are employees of an FCM.

A *floor broker* is a broker on the exchange trading floor who does the actual trading. The FCM places the customer's order with the floor broker. Floor brokers may also take outside orders from commercial interests, processors, exporters, and even speculators. Floor brokers should be distinguished from *locals*. Locals are also on the exchange floor, but they trade on their own account and speculate on futures price movements.

Since 2007, CME dairy futures and options can be traded electronically 23 hours a day using the GLOBEX system. Trading dairy futures on the CME trading floor continues, but the addition of electronic trading expands the potential trading volume and the number of trading participants. Trading on the CME floor starts at 9:30 a.m. and ends at approximately 1:10 p.m. (Central time). Initial settlement prices are reported at approximately 1:30 p.m. But with the continuation of GLOBEX trading, the final daily settlement prices are reported later—at approximately 7:00 p.m.

What keeps traders from walking away from their contract obligations?

Buyers and sellers of futures contracts are required to post *performance bonds*, often called *margin deposits* or *margin*. Margin represents a financial guarantee that buyers and sellers will fulfill their obligations of the futures contract, providing for contract integrity. Margin requirements for futures contracts usually range between 5 and 15 percent of a contract's face value and are set by the futures exchange where contracts are traded. The size of the margin requirement depends in part on the probability of a price change. A higher margin is required in a volatile (or risky) market than in a less volatile market.

Brokerage firms may require a larger margin than the futures market minimum, but they cannot require a smaller margin. Margin requirements may be different for hedging and speculating accounts. Typically, lower margins are required for hedging accounts because they carry less risk than speculating accounts. Margin may be in the form of cash or government securities.[4]

The performance bond margin posted by traders at the time they place an order to buy or sell a futures contract is called *initial margin*. If prices move in favor of the trader (e.g., rising price for a long position or falling price for a short position), then no additional margin is required. But if prices move unfavorably, then the loss that would be incurred if the contract were liquidated would erode or eliminate the margin balance. If the margin falls below a *maintenance margin* level, which is less than the initial margin, then the trader will be obligated to post additional margin to restore the margin to the initial level. The request for additional margin is referred to as a *margin call*.

Margin calls provide some assurance against trader defaults. For example, if the price of a commodity increases, a seller of a futures contract could possibly gain by defaulting on the contract and forfeiting the initial margin. To prevent this from occurring, the seller is required to post enough additional margin to more than offset any gain from defaulting. Should a customer refuse to come up with additional margin, his/her position will be closed out by the broker and the resulting loss will be deducted from the margin. If the remaining margin is not sufficient to cover the loss, the customer may be sued or subject to other penalties.

Just as every buyer or seller of a futures contract must maintain adequate funds in a margin account with the brokerage firm, so must each brokerage firm maintain adequate funds in its margin account with the futures exchange clearinghouse to cover the positions of its customers.

Margins are returned to the seller and buyer when the contract is offset (covered) by an opposite transaction or when the contract matures and delivery or cash settlement occurs. When futures price movements favor the trader, the margin plus futures gain (profit) are returned. If a trader experiences a loss on the futures contract trade, then the loss is deducted from the margin and the remaining margin is returned.

Who accounts for futures contract transactions and margin requirements?

Essential to each futures exchange is a clearinghouse. Clearinghouses are responsible for day-to-day settlements of thousands of accounts and transactions, collecting and maintaining margin monies, regulating delivery, and reporting trading data. Their operations insure the financial integrity of the marketplace.

Both buyers and sellers of futures contracts are responsible to the clearinghouse through FCMs or brokerage firms that are members of the clearinghouse. Clearinghouses act as third parties to all futures contracts—acting as a buyer to every clearing member seller and a seller to every clearing member buyer. Buyers and sellers of futures contracts do not create financial obligations to one another but rather to the clearinghouse through their clearing member firms. As a third party to every trade, the clearinghouse assumes the responsibility of guarantor of every trade.

[4] The advantage of using government securities as margin is that they earn interest for the customer at the same time that they serve as a performance bond for the futures market position. Brokers seldom pay interest on cash margins. The disadvantage of using government securities as margin is that the denominations are large and "lumpy," meaning that the performance bond may be much larger than required. Different rules pertaining to margin calls and profit payouts apply to margin deposits in cash and securities.

Clearinghouses settle all accounts to a net gain or loss each trading day and balance their own books to a net zero position, since gains must fully offset losses. Gains are credited to accounts of member firms or, in some cases, are paid out to customers. Losses that erode margin deposits below required levels require prompt posting of additional funds.

How are futures markets regulated?

Futures exchanges in the United States are required by state and federal laws to regulate the conduct of members, member firms, and their employees. The rules and regulations of futures exchanges are extensive and are designed to support competitive, efficient, liquid markets. Exchange rules and regulations cover many areas of futures trading—from contract specifications to trading practices to arbitration procedures. For example, the exchange sets daily trading limits on the maximum price range allowed each trading day for a contract. Position limits are set on the maximum number of futures contracts that may be held by a market participant. FCMs are liable for losses that occur due to error or mishandling a customer's order. Members who default on futures contracts may be suspended.

The obligation of the exchanges to enforce their own rules and regulations was expanded in the late 1900s with the passage of several federal acts. Of most relevance today is the Commodity Futures Trading Commission Act of 1974 and subsequent futures trading acts. Prior to the 1974 act, federal regulation of exchanges was through the Commodity Exchange Authority, which was housed in the U.S. Department of Agriculture and reported to the Secretary of Agriculture. The 1974 act created an independent federal regulatory agency, the Commodity Futures Trading Commission (CFTC). The subsequent futures trading acts re-authorized the continuation of the CFTC and clarified its jurisdiction.

The CFTC has five full-time commissioners appointed by the President with Senate confirmation. The CFTC's regulatory powers extend to exchange actions and to the review and approval of futures contracts proposed by an exchange. The CFTC has regulatory powers over floor brokers, FCMs, and other market participants. Exchanges and their clearinghouses are required by the CFTC to maintain daily trading records. The CFTC is authorized to take emergency steps in the markets under certain conditions, such as actual or threatened market manipulation or some other event that prevents the market from reflecting true supply/demand factors.

In addition to federal and self-regulation, there is industry regulation. The Commodity Futures Trading Commission Act of 1974 authorized the futures industry to create registered futures associations with the CFTC. One such organization is the National Futures Association (NFA). NFA is an industry-wide, industry-supported, self-regulatory organization for the futures industry. NFA enforces ethical standards and customer protection rules, screens futures professionals for membership, and credits and monitors futures professionals for financial and general compliance rules and related activities.

FCMs and brokerage firms provide further regulation. Since they are responsible to the exchange and clearinghouse for their customers' transactions, they do a complete investigation of the financial integrity of the customer prior to opening a trading account.

What criteria does the CFTC use to evaluate new futures contracts?

An exchange that wishes to trade a new futures contract must request approval from the CFTC. Prior to this request, the exchange will have studied the feasibility of the proposed contract and received approval from its board of directors. The CFTC must determine that a futures contract is in the public interest. In making this assessment, the CFTC examines how the proposed contract would be used commercially for pricing and hedging to ensure that it will serve an economic purpose.

The CFTC is concerned about the number of market participants, both buyers and sellers, interested in hedging. Even more critical is the adequacy of speculator interest. As mentioned earlier, hedging will not work without sufficient speculator activity, which is required for market liquidity so a hedger may set or lift a hedging position in a timely fashion.

What do the dairy futures contracts look like?

Futures contracts are standardized contracts. That is, there are no negotiations over contract specifications; the only variable is price. Major contract specifications for the dairy futures contracts trading in June 2000 are shown in table 1.

Table 1 introduces some contract specifications-related terminology that should be explained. The *trading unit* is the size of the contract—if you sell a CME Class III milk contract, for example, you are in effect selling 2,000 hundredweight of milk, and the value of that contract is 2,000 times the contract price per hundredweight. The prices for the Class III contracts are quoted in dollars per hundredweight. The *minimum price fluctuation*, or "tick," is one cent per hundredweight, which translates to $20 per contract. The *daily price limit* is how much the price can move up or down in a trading session before trading is suspended for the day. Price limits are designed to prevent panic trading situations in response to strong upward or downward price pressures. They give traders time to cool off and reassess the supply and demand situation in a less stressful environment.

All contracts except deliverable butter trade in every month. *Position limits* refer to the maximum number of contracts that any one trader can hold. In general, these limits are designed to prevent price manipulation through squeezing or cornering the market (forcing abnormal price movements by holding large proportions of both futures open interest and deliverable supply). Position limits are less important in contracts that are cash settled.

Why the interest in dairy futures contracts?

For the first 40 years following its inception in 1949, the federal milk price support program protected the dairy industry from price volatility. Under the support program, the support level for milk used for manufacturing was set according to legislative rules. The announced support price was maintained by government purchases of cheddar cheese (40-pound blocks and 500-pound barrels), nonfat dry milk, and butter at specified prices through the Commodity Credit Corporation (CCC).

Until the late 1970s, the federal dairy price support program worked much like a buffer stock program. When milk production increased seasonally during the spring, CCC purchases would prevent cheese, nonfat dry milk, and butter prices—and, in turn, manufacturing milk

Table 1. Dairy futures contract specifications

Futures contract	Trading unit	Price quote	Minimum price fluctuation	Daily price limits*	Months	Position limits*	Last trading day	Settle-ment
Class III milk (2,000 X USDA Class III milk price)	2,000 cwt.	$/cwt.	$0.01/cwt.	$0.75/cwt.	All	1,000 contracts in any contract month	Business day preceding Class III price announcement	Cash
Class IV milk (2,000 X USDA Class IV milk price)	2,000 cwt.	$/cwt.	$0.01/cwt.	$0.75/cwt.	All	1,000 contracts in any contract month	Business day preceding Class IV price announcement	Cash
Nonfat dry milk (44,000 X USDA monthly weighted U.S. average price per pound for nonfat dry milk)	44,000 lbs.	$/lb.	$0.00025/lb.	$0.025/lb.	All	1,000 contracts in any contract month	Business day preceding USDA release date for monthly average U.S. nonfat dry milk price	Cash
Dry whey (44,000 X USDA monthly weighted U.S. average price per pound for dry whey)	44,000 lbs.	$/lb.	$0.00025/lb.	$0.040/lb.	All	1,000 contracts in any contract month	Business day preceding USDA release date for monthly average U.S. dry whey price	Cash
Deliverable butter (Grade AA "fresh" or storage butter)	40,000 lbs.	$/lb.	$0.00025/lb.	$0.05/lb.	Mar., May, July, Sept., Oct., Dec.	1,000 contracts in all contract months combined	Business day preceding the last seven business days of the contract month	Delivery
Cash-settled butter (Grade AA "fresh" or storage butter)	20,000 lbs.	$/lb.	$0.00025/lb.	$0.05/lb.	All	1,000 contracts in any contract month	Business day preceding USDA release date for monthly average U.S. butter price	Cash

*Price and position limits can be expanded in the last month of trading.

prices—from falling far from support levels. Then, during late summer and fall, when milk production was normally at its seasonal low and demand was relatively strong, the CCC would sell cheese, nonfat dry milk, and butter back into the commercial market. This added supply kept dairy product prices and manufacturing milk prices from rising sharply during the fall. The CCC purchase and sale activities provided stability and removed much of the market price risk.

From 1949 to 1981, the support level for manufacturing milk was set between 75 and 90 percent of parity. Under the parity formula, the support price moved up slowly for the first 20 years, going from $3.05 per hundredweight in 1950 to $4.60 per hundredweight in 1970. But between 1970 and 1980, the support price increased from $4.60 per hundredweight to $13.10 per hundredweight. Dairy farmers responded with increased milk production. By the late 1970s and early 1980s, the level of milk surpluses and CCC purchase costs were deemed unacceptable by Congress.

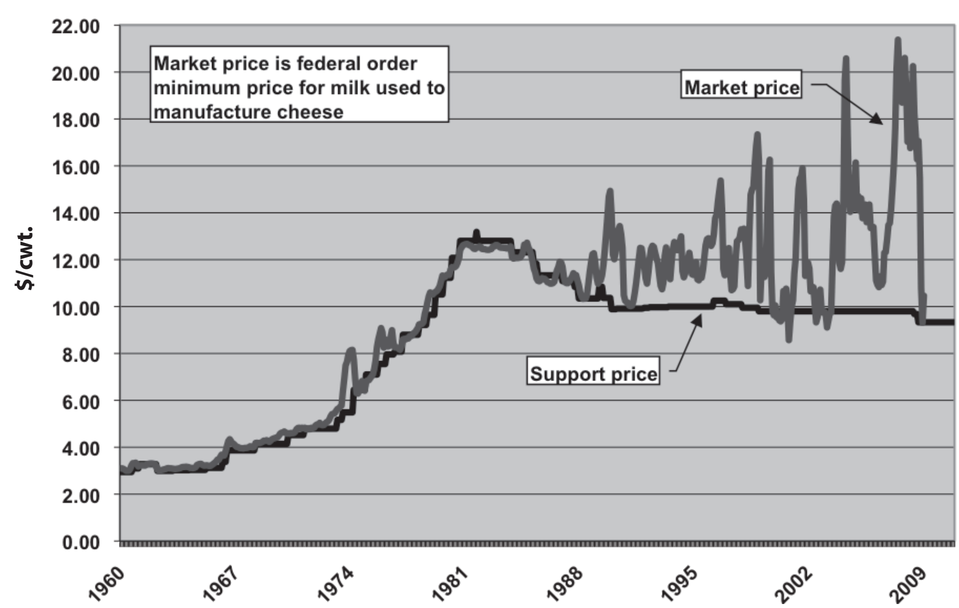
The parity method of setting the support price was abandoned in 1981, and through a series of Congressional actions, the support price was tied to actual or projected CCC purchase costs. From 1981 to 1990, the support price was reduced eight times, to $10.10 per hundredweight. The 1996 Farm Bill elevated the support price to $10.35 in 1996 and then lowered it by 15 cents per hundredweight per year down to its current level of $9.90. The 1996 Farm Bill also called for termination of the support program at the end of 1999, to be replaced by a recourse loan program for manufactured dairy products. Subsequent legislation retained the support program. The 2008 Farm Bill changed the support program from supporting the price of milk to supporting the prices of cheddar cheese ($1.13/lb. for block cheese; $1.10/lb. for barrel), nonfat dry milk ($0.80/lb.), and butter ($1.05/lb.). This effectively reduced the related support price for Class III milk to $9.33/hundredweight based on federal order pricing formulas in effect on October 1, 2008.

The current CCC purchase prices for cheddar cheese, nonfat dry milk, and butter offer only a very low safety net to farm milk prices. Since 1990, product prices and, in turn, manufacturing milk prices have been above support levels most of the time due to market forces. The federal dairy price support program no longer provides for price stability or assumes much of the market price risk.

With the market driving prices instead of the government, price volatility increased markedly (figure 1). From 1965 to 1985, the average annual standard deviation of the principal milk price indicator, the Minnesota-Wisconsin price series, was 30 cents per hundredweight, ranging from 4 cents to 94 cents. In only 4 of the 21 years did the standard deviation exceed 50 cents.

From 1989 through 1999, the average annual standard deviation of the monthly Minnesota-Wisconsin price (replaced by the Basic Formula Price in 1995) was $1.16, ranging from 64 cents to $2.45. Month-to-month milk price changes of $1.00 to $2.00 became commonplace in the 1990s. In 1999, the Basic Formula Price dropped by $6.00 (34 percent) between January and February and $4.77 between September and

Figure 1. Market and support prices for milk



October. Price increases of more than \$2.00 were experienced in two months of 1999.

Milk price volatility increased even more in the first decade of the 21st century. Between 2000 and 2007, the average annual standard deviation of the Class III price was \$1.57, with a range of \$0.45 to \$2.68. Month-to-month price changes ranged from –\$3.29 to \$5.17. The monthly Class III price increased by more than \$2.00 per hundredweight five times and decreased by more than \$2.00 three times.

Sharply increased price volatility creates both opportunities and threats for milk producers and milk buyers. Opportunities come from the higher price peaks that volatility brings. When the federal price support program was active, price increases were held in check by the presence of large government stocks for potential release into commercial markets. Recent history has shown clearly that price rises are no longer constrained.

But volatility requires close attention to financial planning during price troughs. Milk is produced and marketed every day. Dairy farmers do not have the opportunity to hold their milk in hopes of a better price day. Even temporary low price troughs can create cash flow problems and, if low prices continue long enough, the viability of the dairy can be jeopardized.

Milk buyers face similar challenges. Sharp run-ups in cheese prices mean that cheesemakers can benefit from selling high-priced cheese made from low-priced milk. But cheesemakers make cheese nearly every day from the milk shipped to them daily by their patrons. Inventory values can depreciate rapidly with price declines. When milk is procured at a high price to make cheese that is subsequently sold at a bargain basement price, the manufacturer's ability to pay patrons is diminished.

How can futures trading reduce market price risks?

Futures markets may be used to reduce market price risk through hedging. In a simplistic sense, hedging involves using a futures market transaction as a substitute or proxy for a cash market transaction that will occur in the future. The hedger sells or buys futures contracts comparable in volume to anticipated cash market sales or purchases sometime later in time.[5] This futures market sale or purchase is made in an attempt to "lock in" the price of the futures contract as the price for the future cash market sale. In this sense, hedging is an alternative to entering into a cash forward contract with a specified price.

Let's look at some generalized examples. A manufacturer may hedge in an attempt to lock in the cost of a raw material used in the manufacturing process. This calls for a long hedge. On the cash market, the manufacturer expects to purchase a certain volume of raw product sometime in the future. To lock in a price objective, the manufacturer will buy a futures contract for the same or similar raw product prior to the time the cash market purchase will be made. The futures contract month chosen will be as close as possible to the time the purchase will take place. Later, when the raw material is purchased, the long position on the futures market will be covered or offset by the sale of an identical futures contract. Any loss from a price increase for raw material would be offset by a comparable gain on the futures market *as long as the predicted relationship between cash and futures market prices holds*. On the other hand, if cash market prices fall, there would be futures market losses that would offset the cash market gains. In either case, the manufacturer realizes the raw material cost objective that was sought at the time the hedge was placed.

The relationship between cash and futures prices is called *basis*, which is discussed in more detail later, in relation to dairy farmer hedges. Cash and futures market prices for the same commodity do not always move together. But they will *converge*, or come together, as the delivery date for the futures contract approaches. For futures contracts that involve delivery, convergence is assured through *arbitrage* between cash and futures markets.

To illustrate arbitrage, suppose the cash price for a commodity was well below the futures price for exactly the same commodity a few weeks before the delivery date on the futures contract. Arbitragers would buy cheap (the physical commodity) and sell dear (the futures contract). This would bid up the cash price and pull down the futures price, thus causing convergence. If the cash commodity were trading at a premium to the futures contract, opposite arbitrage transactions would similarly pull the prices together.

For cash-settled futures contracts, convergence is not an issue because it is guaranteed by definition. Cash-settled contracts are settled against the actual cash price announced at the expiration of the futures contract.

Holders of inventory stand to incur losses from price declines. The inventory price risk may be reduced by a short hedge, initially taking a short (sell) position on the futures market. Later, when the inventory is actually sold on the cash market, the short position would be covered by a purchase of the same futures contract sold earlier. If prices fell, causing a decline in inventory value, the loss would be offset by a gain in the futures market from selling at a price higher than the purchase price. If prices rose, the cash market gain from higher inventory value would be offset by futures market losses (sale at a price lower than the purchase price).

[5] The futures contract volume and the cash market volume do not have to be identical in a hedging transaction. In fact, hedgers will usually sell or buy futures contracts that total less than their expected cash market sales or purchases. Futures contract volume in excess of expected cash market volume represents speculation in the futures market.

A wholesaler could use hedging to offer a cash forward contract for its product at a specified price. The market risk is that the seller will experience greater acquisition costs than anticipated and losses or reduced profits would occur when the forward-contracted price is received. To protect the seller's profit objective from forward pricing, the seller would hedge by initially taking a long position; that is, buying a futures contract. Later, when the product is acquired and delivered (sold) on the cash market at the forward-contracted price, the seller would offset (sell) the futures contract. If product costs had increased (decreased), the loss (gain) in the cash market by selling at the forward price would be offset by a gain (loss) in the futures market.

Both long and short hedges may be used together to protect manufacturing margins. For example, a food processor could attempt to protect a profit margin objective by locking in both ingredient cost and finished product price. The initial futures transactions would be a long position for ingredients and a short position for finished product. Similarly, a dairy farmer might protect an income over feed cost objective by selling milk futures and buying corn and soybean meal futures.

The above discussion may lead one to believe that losses (gains) in the cash market are exactly offset by gains (losses) on the futures market and that the price objective is exactly realized. More likely, the net price result will be lower or higher than the objective. It all depends upon what happens to the basis. The basis is the difference between the cash price of a commodity and the price of the same or a similar futures contract. For purposes of hedging, basis is *predicted* when the hedge is placed, and the actual basis may be different when the hedge is lifted.

Basis is calculated by subtracting the futures price from the cash price. Therefore, if the cash price is higher than the futures price, then the basis is positive. If the futures price is higher than the cash price, then the basis is negative. Regardless of whether it is positive or negative, basis is said to *strengthen* if the cash price rises relative to the futures price and *weaken* if the cash price falls relative to the futures price.

Knowing basis and understanding what causes it to vary is essential for successful hedging. In hedging transactions, the price or profit objective will differ from its expected value by any difference between the expected basis and the actual basis when the hedge is lifted or (for cash-settled contracts) when the contract expires. For example, suppose that in a short hedge, a butter wholesale seller expects the local cash market price for Grade AA butter will be 5 cents higher than the CME butter futures price (+5-cent basis) when the hedge is lifted. If the basis strengthens by 5 cents (the cash market price is 10 cents per pound higher than the futures price), the net price will be above the price objective by 5 cents. If the basis weakens by 5 cents (cash market price equal to futures market price), the net price will be 5 cents below the price objective. For a long hedge, the opposite effects occur; the net price is exceeded when the basis weakens and is not achieved when the basis strengthens.

Hedging reduces market price risk, but basis risk—the risk that the basis will differ from what was predicted when the hedge was placed—always exists. However, basis is usually easier to forecast than price; hence, basis risk is usually less than price risk.

How can dairy farmers use futures trading to reduce risk?

We have talked generally about how futures trading can be used to shift risk from cash market participants to speculators. Now, let's look at a specific example of how a dairy farmer might hedge to "lock in" a farm milk price. We'll use the CME Class III milk contract in the example.

Dana Dairy produces about 200,000 pounds of Grade A milk per month. Dana ships milk to Bigcheese Coop, which operates a single cheese factory regulated under the Upper Midwest milk marketing order. In May 2008, Dana notes that the November 2008 Class III milk contract is trading at $18.20. Looking back over the past five years of milk checks, Dana sees that for November, the average basis—the difference between Dana's farm "mailbox price" and the Class III price—was $1.30 per hundredweight. So adding this basis to the November Class III price gives a mailbox price of $19.50.

That's high enough to cover basic costs of production and generate a reasonable profit. Dana's study of dairy outlook information for the fall is sobering: It looks to Dana like the Class III price in November will be even lower than the current November futures contract price. So Dana decides to hedge in order to protect the predicted farm milk price of $19.50.

Dana's hedge involves selling one November Class III price contract at $18.20. The contract trading unit of 200,000 pounds matches Dana's expected November milk sales. Dana's broker arranges the sale and charges a $100 commission. Converted to a cost per hundredweight, the commission is a nickel, reducing the price objective to $19.45. Dana also deposits a required performance bond (margin) of $2,000.

Now, let's see what happens when November rolls around. We'll look at two cases. In the first case, let's suppose that Dana's pessimistic forecast about November milk prices materializes. USDA announces the November Class III price at $16.20 per hundredweight, which is $2.00 less than the price at which Dana sold the November CME Class III contract. So in the cash settlement process, Dana's broker account is credited by $4,000 (2,000 cwt. X $2.00/cwt.).

The expected $1.30 basis holds, and Dana sells November milk at $17.50. Adding the $2.00 of futures market gain to the cash market price and subtracting the futures commission yields $19.45. Dana achieved the price objective sought at the time the hedge was placed.

This sounds good, but what if an unanticipated drought causes a milk shortage and a run-up in prices in November? In the second case, the November USDA Class III price is announced at $20.00. Dana sold the November CME Class III price contract at $18.20, meaning that cash settlement of the November futures contract results in a margin account debit of $3,600 [($18.20 – $20.00) X 2,000 cwt.].[6] But, assuming the expected $1.30 basis holds, Dana can sell milk in November for $21.30 per hundredweight. Subtracting the futures loss and the commission from the cash market milk price again yields $19.45, the price objective.

Looking at both cases, Dana Dairy has locked in a November net farm milk price of $19.45 per hundredweight, regardless of which way the market moves. When the market moved lower, futures market gains offset cash market losses. Dana was pleased with the result because not hedging would have resulted in a $0.95 lower price. When prices rose, cash market gains offset futures market losses. Dana was less pleased with that result. Even though the price objective was achieved, not hedging would have yielded a net price $1.85 higher. Locking in a price through hedging means just that. You benefit by protecting yourself from disadvantageous cash market moves, but at the same time, you can't benefit from advantageous cash market price changes.

Perceptive readers may already have noticed that we have stacked the deck in these two examples by assuming that the basis at settlement was the same as what was expected at the time the hedge was placed. If the relationship between cash and futures prices is different from what was expected, then hedgers experience corresponding losses or gains relative to their price objective.

Suppose that in the preceding case, Dana Dairy's basis prediction of $1.30 was too high—that Dana received only $1.00 per hundredweight over the announced USDA Class III price for milk sold in November. In that case, the basis weakened (the cash price was lower relative to the futures price). There is no difference in the futures market gains and losses shown in the example, but the cash market price is $0.30 per hundredweight less. So the net price actually received will be less than the price objective by $0.30, the amount by which the basis weakened. Similarly, if the basis turned out to be $1.50 per hundredweight (i.e., the basis strengthened by $0.20), then the actual net price will be $0.20 higher than the price objective.

What makes up the basis in a dairy farmer hedge?

To answer that, we need a little background on federal milk marketing orders and how they affect farm-level prices for Grade A milk.[7]

Ten federal milk marketing orders regulate Grade A milk plants in most of the United States outside California, which operates its own state milk pricing system. Orders set minimum prices for milk and milk components according to how they are used. This classified pricing system defines Class I milk as milk used for fluid products, Class II as milk used for soft manufactured products, Class III as milk used for hard cheeses, and Class IV as milk used to make nonfat dry milk and butter. Minimum prices for milk and components within these classes are set using product price formulas that relate milk and component values to prices for specified manufactured products: butter, cheddar cheese, nonfat dry milk, and dry whey.

Four of the ten orders price milk to dairy farmers according to a "fat/skim" pricing method. Under fat/skim pricing, farmers receive minimum prices per pound of butterfat and per hundredweight of skim milk calculated as weighted averages of butterfat and skim milk values for the four milk classes. The weights are the percentage utilization of milk by class across all handlers in the market. In three of the four fat/skim markets, the primary use of milk is Class I.

In the other six federal milk marketing orders, dairy farmers are paid minimum prices for pounds of three milk components rather than for milk volume. The components are butterfat, protein, and other nonfat milk solids. The minimum component prices paid to farmers are the same component prices used in deriving the Class III price. The six orders using multiple component

[6] Actually, the loss in futures contract value would have been made up with margin calls between May and November.

[7] Readers seeking a more comprehensive explanation of milk pricing under federal milk marketing can refer to Ed Jesse and Bob Cropp, *Basic Milk Pricing Concepts for Dairy Farmers*, University of Wisconsin-Extension, Cooperative Extension, Bulletin A3379.

pricing (MCP) generally utilize most of their milk in manufacturing classes (Classes III and IV). The Upper Midwest order, which includes most of Wisconsin, Minnesota, North Dakota, South Dakota, and the Upper Peninsula of Michigan, uses MCP.

Producers paid under MCP also receive a producer price differential and, in four of the six MCP orders including the Upper Midwest, a somatic cell adjustment expressed in dollars per hundredweight. The producer price differential represents the (usually) higher value of milk used in Classes I and II and the (usually) lower price of milk used in Class IV relative to Class III milk value. In effect, it is a weighted average value of the differences between the Class I, II, and IV prices and the Class III price with the weights defined as the market utilization of milk in Classes I, II, and IV. The producer price differential is adjusted for the location of the receiving plant within a federal marketing order relative to the major consumption area.

The somatic sell adjustment is a quality differential based on herd somatic cell count (SCC) relative to a base of 350,000. The differential is positive if the SCC is below 350,000; negative if it's above. The differential is fairly small, usually less than 15 cents per hundredweight.

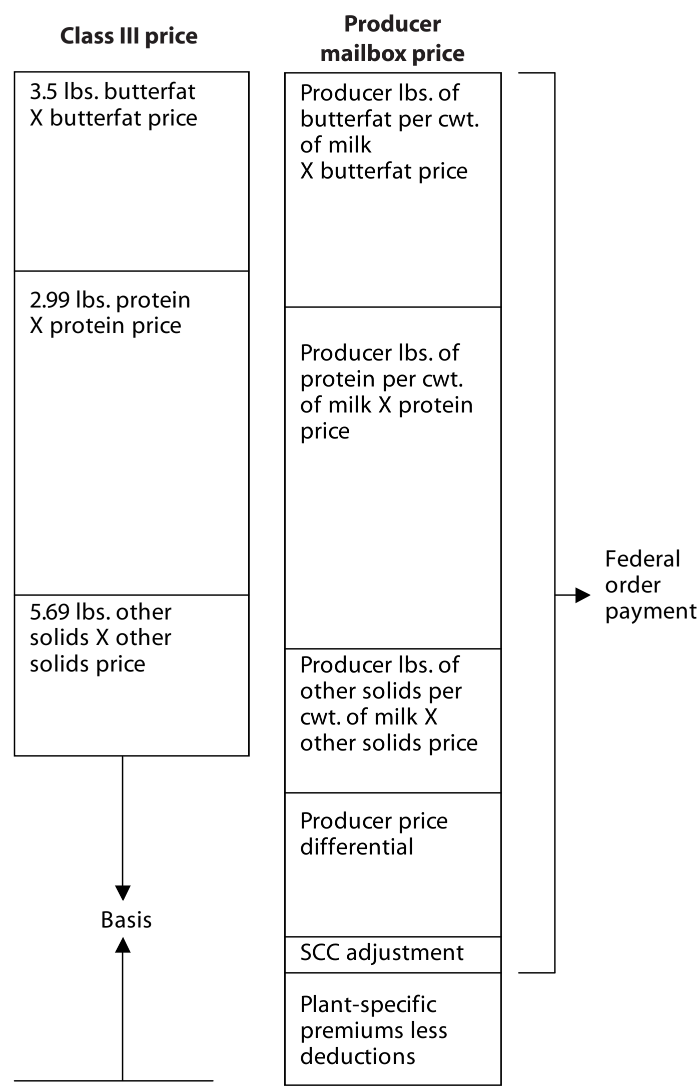
To summarize, federal orders specify minimum farmer payments for butterfat, protein, other solids, the producer price differential, and the somatic cell adjustment. On top of these federal order payments, producers may receive premiums or have certain deductions from their plant that are not related to the order. Premiums may include extra payments for protein and quality (separate from the minimum federal order protein price and the somatic cell adjustment), plant premiums, and volume premiums. Typical deductions are for milk hauling, promotion and cooperative fees, and retains.[8]

The link between the Class III price, which is the traded commodity in futures contracts, and a producer's specific mailbox milk check price is through the component prices for butterfat, protein, and other solids. The component prices used to derive the Class III price are the same as the prices paid to producers.

The Class III price is calculated for milk of standard composition—3.5 pounds of butterfat per hundredweight and 96.5 pounds of skim milk. The standard composition for skim milk per hundredweight is 3.1 pounds of true protein, 5.9 pounds of other nonfat solids, and 91.0 pounds of water. So the component weights in a hundredweight of standard milk are 3.5 pounds butterfat, 2.99 pounds of true protein (.965 X 3.1), and 5.69 pounds of other solids (.965 X 5.9).

Figure 2 illustrates the relationship between the Class III price and the mailbox price. Note that if a producer ships milk that has the same composition as the standard milk used to derive the Class III price, then the producer's mailbox price will differ from the Class III price by the total of the producer price differential, the somatic cell adjustment, and the net plant-specific payments/deductions. If a producer's milk composition is different from the standard composition used to derive the Class III price (which is the case in figure 2), then the basis will also be affected by the difference. Higher

Figure 2. Basis in Class III milk hedging



[8] Some producers may also have milk check assignments to financial institutions and the cost of dairy supplies and other items deducted from their milk checks. These are business expenses that are not included in calculating the mailbox price.

butterfat and protein tests mean that the sum of the mailbox component values will be higher than the Class III price and vice versa.

Component tests and somatic cell count are usually quite predictable for any given month, and thus, do not contribute much to basis risk. However, there is likely to be a distinct seasonal pattern to tests and cell count. Likewise, plant-specific premiums and deductions typically show a distinct seasonal pattern. In particular, lower cheese yields in summer months for given butterfat and protein tests mean less money for plants to distribute as plant premiums. So it is important to consider the contract month when estimating basis for your hedge.

The most difficult part of the basis to forecast is the producer price differential (PPD). The PPD varies mainly with Class I utilization and the Class I price relative to the Class III price. Market Class I utilization shows a seasonal pattern but changes slowly from year to year. However, the Class I price relative to the Class III price depends on how rapidly manufacturing milk prices change from month to month. This difference is unstable with the kind of price volatility observed in recent years.

Table 2 shows PPD averages by month for the Upper Midwest federal order. From January 2000 through December 2007, the PPD for the Upper Midwest federal order averaged $0.31 per hundredweight. The range was from a low of –$4.11 in April 2004 to a high of +$1.43 in November 2000. The market experienced negative PPDs 12 times in this 84-month period. Because federal orders set Class I milk prices based on manufacturing milk prices 6–7 weeks earlier, negative PPDs can occur with rapid increases in Class III or Class IV milk prices.

Table 2. Upper Midwest producer price differential by month, 2000–2007

Month	Median	Mean	Std. dev.	Minimum	Maximum
	—dollars per hundredweight—				
Jan.	0.41	0.46	0.26	0.19	1.03
Feb.	0.47	0.39	0.32	-0.18	0.88
Mar.	0.55	0.47	0.24	0.05	0.78
Apr.	0.41	-0.14	1.63	-4.11	0.83
May	0.39	0.15	0.89	-1.97	0.90
June	0.34	0.40	0.31	-0.05	0.97
July	0.42	0.41	0.38	-0.41	0.80
Aug.	0.53	0.29	0.78	-1.58	0.84
Sept.	0.34	0.21	0.56	-1.07	0.70
Oct.	0.28	0.26	0.53	-0.88	0.86
Nov.	0.52	0.55	0.52	-0.07	1.43
Dec.	0.32	0.26	0.62	-0.95	1.23

What's the best way to forecast basis in a Class III hedge?

The best information to use in forecasting basis is history. Compare your mailbox prices with the announced Class III price for at least three years, preferably longer, but do not use years prior to 2000, when federal order pricing was fundamentally changed. Calculate average differences by month. Use the relevant month average difference as a rough and ready estimate of basis to establish your mailbox price objective based on futures contract prices. You may have more current information to refine your estimate. For example, if you recently brought some high-testing heifers into your herd and expect herd butterfat and protein tests to be higher in November than the average for the last five Novembers, you can bump your basis estimate from the simple average.

A conservative approach is to use something less than the average difference between mailbox and Class III prices as your basis estimate. Remember that if the basis turns out to be higher than the estimate you used to figure your mailbox price objective (basis strengthened), you will exceed your price objective. It is often better to be pleasantly surprised than to be disappointed.

Can I get out of a futures contract after I've placed a hedge?

The answer is "Yes, but…." You can always lift a hedge once it has been placed by taking the opposite position in the same contract month. For example, if you placed a short hedge by selling a November Class III futures contract, you can lift or remove the hedge by buying a November contract. Your net gain/loss will be the difference between the selling price and the purchase price.

Lifting a hedge is a good strategy if and only if it becomes apparent that the market is unquestionably moving against your futures market position. Suppose you have sold a November Class III contract for $16.00 in May, and it quits raining in June for three months. The November contract hits $17.00 in August, and USDA crop reports indicate corn yields are expected to be down by 30 percent. That's probably a good signal to cut your losses and lift your hedge. You lose a dollar, but hanging on to a short position until November could cost you a lot more. While $16.00 may well have been a very good price at the time you placed your hedge, altered conditions mean that it no longer is.

The "but" part of the answer implies a cautionary note. To repeat, hedges should be lifted only when it becomes *apparent* that prices are *unquestionably* moving against the hedger. Lifting a short hedge only to have prices plummet can be very costly.

Experience from 2004 is illustrative. At the beginning of January 2004, July 2004 Class III futures were trading around $12.80. By early February, July Class III futures traded at $13.79, and by early March, $15.44. Suppose that in early March, a dairy farmer hedged July milk by selling the July Class III contract at $15.44. July Class III futures prices continued to move higher, reaching $16.00 by mid-March. After receiving margin calls, the dairy farmer decides that the July contract will continue to trade higher and decides to offset his hedge, taking a loss of $0.56 per hundredweight ($16.00 – $15.44).

In fact, the July Class III futures price did continue to increase, reaching $17.53 in April. But then, growing milk and cheese production resulted in an announced Class III price for July of only $14.85, $0.59 below the farmer's March short position of $15.44. Relative to keeping the hedge in place, the dairy farmer lost $1.15 per hundredweight ($0.56 + $0.59) by lifting his hedge.

Moral: Don't panic when faced with margin calls if market fundamentals support your hedging decision. By lifting a hedge, you risk ending up with a lower milk price on top of a futures market loss.

When would I want to use a long hedge?

Short hedges protect selling prices while long hedges protect purchase prices. Dairy farmers can lock in part of their feed costs through a long hedge using corn or soybean meal futures. The mechanics of long hedges are the same as for short hedges except that the initial transaction is the purchase of a contract. But grain futures contracts are deliverable contracts, so long hedgers need to offset their contracts prior to maturity. By hedging both milk and feedstuffs, dairy farmers can protect an income above their feed costs objective.

How is hedging used in cash forward contracting?

In the earlier example, Dana Dairy used hedging directly to protect a milk price objective. An alternative to direct hedging is signing a cash forward contract offered by a plant for milk to be delivered at some future date. Accepting a cash forward contract is equivalent to hedging—you're guaranteed the future cash contract price regardless of what happens to milk prices after you sign the contract.

Cash forward contracting is especially useful for producers who do not have enough milk volume to make up a full futures contract (200,000 pounds per month). Another advantage of cash forward contracting over direct hedging is that you don't have to worry about margin calls.

The price offered in forward contracts is a base farm price, usually for milk with specified butterfat, nonfat solids, and quality. Adjustments for milk composition differing from the standard are made when the milk is delivered and premiums and discounts not related to federal order pricing rules are also applied.

A disadvantage of cash forward contracting over direct hedging is that you have less control over your price objective. The price offered is a "take it or leave it" offer and cannot be withdrawn. If you deal in futures yourself, you can place standing offers and offset hedges after they are placed. Another possible disadvantage is that brokerage fees and other hedging expenses are built into the price offers in a cash forward contract. You may be able to get a better deal on your own.

Dairy plants offer a variety of cash forward contracts. Some offer fixed prices for specific months, others offer a single price for several months of production, and still others offer a minimum price for a single month or several months. Let's look at the simplest form, a fixed price offer for one month.

Suppose that in May, Dana Dairy calls Bigcheese Coop and learns that Bigcheese will pay a base price (3.5 percent butterfat, 2.99 percent protein, 5.69 percent other solids, and 350,000 SCC) of $16.10 for milk delivered in November. Milk differing from the base composition will receive an adjusted price based on the federal order component prices announced for November. Dana will also receive the federal order Producer Price Differential and will be eligible for other premiums outside the order that are normally paid by Bigcheese. By forward contracting, Dana projects the base price for milk of standard composition. Dana will still receive all of the premiums or discounts from the milk plant as before. Therefore, as with hedging the actual mailbox price, the price Dana will receive still depends upon premiums and discounts paid, and in essence, there remains a basis risk as with hedging.

Dana decides to go with the offer and signs a contract to deliver 200,000 pounds of November milk to Bigcheese at $16.10. While Bigcheese's price is 10 cents per hundredweight less than the November CME price Dana could get by selling the contract directly ($16.20), Dana doesn't want to put money into a broker account and lose sleep over possible margin calls.

When Bigcheese gets Dana's order, it consolidates the 200,000 contracted pounds with the volume of milk contracted by other producers for November on that day and places a short hedge using the November futures contract. The number of contracts sold will be as close as possible to the consolidated volume. Note that Bigcheese may have to wait a few days to hedge a cash forward contract until there is enough consolidated volume to make up a contract. This would result in a loss to the plant if prices fell and a gain if prices rose between the time the producer contract was signed and the hedge was placed.

The base price in Bigcheese's forward price offer is actually the Class III price. So by placing a hedge, Bigcheese is fully protected from the Class III price falling below the price it offered to Dana Dairy. The Coop doesn't even have to worry about basis risk, because it is hedging exactly the same "commodity" as represented by the futures contract. If Bigcheese did not hedge, it could end up paying higher (contracted) prices for its milk than its competitors.

Suppose the Class III price does fall between May and November, ending up at $15.20. In that case, Bigcheese gets less for its cheese than it would have with a $16.20 price, and thus, it would not have the money to pay the contract price. But having hedged, Bigcheese receives $1.00 per hundredweight from its futures market transaction to offset the loss in cheese revenue.[9] So it has the money to pay the $16.10 contracted base price to Dana Dairy and others who contracted at that price.

If the Class III price rises between May and November, Bigcheese incurs a loss on its futures market transaction equal to the change in price. Because it needs to cover that loss, Bigcheese cannot afford to pay more than the $16.10 contracted price even though cheese prices would indicate a higher price. Just like in the case of direct hedging, Dana Dairy will receive a lower price than dairy farmers who did not contract.

Some dairy plants offer minimum price contracts rather that fixed price contracts. To protect themselves from unfavorable price movements, plants writing minimum price contracts would purchase put options, which are discussed in the following section.

Plants that offer multi-month or annual fixed price contracts would hedge by selling futures contracts equivalent in volume to the volume contracted by producers over the entire time period of the contract. The contract price to producers is based on the average monthly futures prices over the period of the contract. While plants can protect their average price offer by placing hedges in several contract months, there is some risk due to price trends. For example, suppose a plant offers an annual $16.00 cash forward contract. The price is based on the average futures contract price over the next 12 months. These prices range from $14.00 in the first month to $18.00 in the last. In the first month of the annual contract, the plant will likely need to borrow money or draw on its reserves to pay producers the higher average price.

Part II: Options on dairy futures

In many ways, options trading is similar to futures contract trading. The same regulatory procedures generally apply. Trading rules are similar. The same players are involved (hedgers, speculators, brokers, floor traders, locals, etc.). Placing trade orders is the same.

Trading options contracts is somewhat more complicated than trading futures. There are more alternatives, more confusing terms, and a greater need to watch the markets. There are two advantages to using options instead of futures for price risk management: (1) hedgers can preserve the benefits of favorable price movements while protecting themselves against unfavorable movements; and (2) buyers of options don't have to put up margin money or receive margin calls. But there is a cost to gaining these benefits in the form of options premiums.

What are futures contract options?

In a generic sense, the purchase of an option gives the buyer the right to purchase something else. The right does not involve an obligation. Options are common in real estate markets. You buy an option to purchase property at a negotiated price. For example, you might pay $2,000 for the right to purchase a vacant lot in Madison, Wisconsin, for a price of $200,000 anytime before a specified future date. If the real estate market in Madison goes up, you would likely exercise your option and buy the property. If the market falls, you would let your option expire.

[9] Bigcheese's futures market gain would be reduced by broker commissions, but these are covered by the 10 cents per hundredweight discount in the contract price relative to the selling price of the futures contract at the time Bigcheese places its hedge.

What you pay for the real estate option depends on two factors: (1) the price of the property listed in the option relative to its current value; and (2) general expectations with respect to real estate market conditions. If the current market value of the property is $200,000 and the price listed in the option is $250,000, then the option value would be much smaller than if the listed option price was $190,000. In a rising real estate market, you would expect to pay more for the option to purchase the property at a pre-negotiated price than you would in a stagnant or falling market.

In any case, you can dispose of your option in one of three ways. You can exercise the option and purchase the property. Or, you can let it expire. The third alternative is to sell the option to someone else, hopefully for a profit.

Futures contract options are similar to real estate options. You can buy a *call*, which is the right—but not the obligation—to purchase a futures market contract at a specified price. You can then exercise the call, which allows you to buy the underlying futures contract at the set price. You can let the call expire. Or, you can sell the call.

If the futures contract price rises above the fixed price in a call you have purchased, you have an incentive to exercise your right to purchase the contract at the lower price. Or, you could sell the call if you were not interested in taking on the commitment to receive delivery of the commodity. It is likely that you could sell the call for more than you paid for it if the price of the futures contract were increasing. If the futures contract price falls *below* the fixed price in your call, you would likely let the call expire; you would not want to buy the contract at more than what it is currently selling for in the futures market.

The second type of futures contract option is a *put*. A put is the right—but not the obligation—to sell a futures contract at a specified price. Like calls, put options are both bought and sold. Put buyers can exercise them, sell them, or allow them to expire. If the futures market price falls *below* the price specified in the put, then it would normally be profitable for the buyer to either exercise or sell the put. If the futures market price rises *above* the price specified in the put, then the buyer would normally allow the put to expire; you would not want to sell the futures contract at less than what it is currently selling for in the futures market.

Both calls and puts have two essential elements: (1) the futures contract delivery or maturity month, and (2) the futures contract price (called the *strike price*[10]). For example, a put option to sell a November 2008 CME Class III milk contract at a price of $16.00 per hundredweight is denoted a November $16.00 put. A call option to buy a February 2010 CME Class III milk contract at a price of $17.00 is a February $17.00 call.

As in all markets, there have to be buyers and sellers on each side of the options transaction. Buyers of puts and calls are called option *holders*. The use of options for hedging purposes typically involves buying calls and puts. Sellers of calls and puts are called option *writers*. Generally, option writers are speculators. They are speculating that the buyer will not exercise the option and that they will gain the premium collected. Call writers assume the obligation to provide a long position in the underlying futures contract if the holder decides to exercise; put writers are obligated to provide a short position if the put is exercised.

What does it cost to buy a futures contract option?

The price of an option is called its *premium*. The premium represents the maximum amount the option holder can lose. Premiums for puts and calls are related to two primary factors. The first is the strike price relative to the current trading value of the underlying futures contract. The difference is known as the *intrinsic value* of the option and is equal to the gross profit per unit that an option holder could earn if the option were exercised. The second factor affecting the value of options is the length of time between the option transaction and the expiration of the option contract. This affects the *time value* of the option.

At any time, there will be trading in several options for the same contract month representing different strike prices. Some strike prices will be above the current contract price, some below. The premium will be related to the economic benefit of being able to buy or sell the contract at the strike price. For example, if in May, the price of a November CME Class III milk contract is $16.20, a November $16.00 call would have a premium of at least 20 cents. The right to buy a futures contract at 20 cents less than its current value would be worth 20 cents or more. The call option has an intrinsic value of 20 cents and will have additional time value.

A November $16.00 put in May would have a smaller premium. The right to sell a November Class III milk futures contract at less than its current value would have no intrinsic value, only time value.

[10] The strike price is sometimes called the *striking price* or the *exercise price*.

Call options with strike prices *below* the current futures price and put options with strike prices *above* the current futures price have intrinsic value. That is, there is a clear economic benefit of being able to purchase the contract at less than its current value (call) or sell it at more than its current value (put). Options that have intrinsic value are called "in the money"; those without intrinsic value are "out of the money"; and those with strike prices roughly equal to the current futures contract price are, not surprisingly, "at the money." The more (deeper) in the money an option, the higher will be the premium.

Out-of-the-money options usually have some time value. We noted above that a November $16.00 put would have limited value if the current November futures price were $16.20. This would be especially true if we were talking about the value of the put in October and the Class III milk futures market was stable. But if the November $16.00 put is purchased in January of the same year, then it could have considerable time value. The buyer is essentially paying for nearly a year to see whether the November futures contract price will fall below $16.00, thereby permitting a profit. In general, the more time between option purchase and expiration, the higher will be the premium.

Time value is also different at different strike prices. For example, at higher strike prices, there is less of a chance that the call option will come into the money during the time prior to option expiring. Therefore, the time value will be less than for a call with a lower strike price and a higher probability of coming into the money.

Volatility in the price of the underlying futures contract also affects the time value of options contracts. If there are rapid and frequent price movements for a futures contract, then there is a greater likelihood that prices will move to a level that will make exercising the option profitable than if futures prices are relatively stable. Therefore, the option writer will want a larger premium for taking a greater risk of having the option exercised. In general, the greater the volatility in futures prices, the greater the premium for the options contract.

Table 3 illustrates quoted options premiums for the CME Class III milk contract for July 2008 as of the end of floor trading on February 13, 2008. On February 13, the July Class III futures contract closed at $16.57, so the $16.50 options are denoted as at the money. These indicated premiums are reported "settle" prices and may not represent what the actual premium would have been if an actual trade had occurred.

Note the symmetry between the put and call premiums. At strike prices below the current futures contract price ($16.50), puts are increasingly out of the money, so premiums fall. But calls are increasingly in the money, so premiums increase. At strike prices above the current futures contract price, puts are increasingly in the money and calls are increasingly out of the money, meaning opposite changes in put and call premiums.

Aren't call and put options just two sides of the same coin?

Isn't buying a put just the opposite of selling a call? Absolutely not. The difference is in both the risk and the potential gain involved. Using the values from table 3, let's say you expect the Class III price to be less than $16.50 by July. So you decide to sell an at-the-money July call option (a $16.50 July call) on February 13 for $0.85 per hundredweight. The buyer of the call is willing to pay $0.85 per hundredweight for the right to buy the futures contract at a price of $16.50 per hundredweight sometime between February 13 and the expiration of the July call option.[11]

Table 3. Decomposition of the July 2008 Class III milk options premiums (based on futures market settlement price of $16.57 on February 13, 2008)

Strike price ($/cwt.)	Puts (cents/cwt.)				Calls (cents/cwt.)			
		Premium	Intrinsic value	Time value		Premium	Intrinsic value	Time value
15.50	Out of the money	42	0	42	In the money	141	107	34
15.75		50	0	50		125	82	39
16.00		60	0	60		110	57	53
16.25		71	0	71		98	32	66
16.50	At the money	83	—	83	At the money	85	—	85
16.75	In the money	97	18	79	Out of the money	74	0	74
17.00		110	43	67		64	0	64
17.25		126	68	58		55	0	55
17.50		131	93	38		48	0	48

[11] Options on cash-settled dairy futures contracts expire on the day before the USDA monthly price announcement, which is the Friday on or before the 5th of the month following the contract month.

Now, let's suppose that June rolls around, and you find out that you were dead wrong. The July Class III milk futures contract is trading at $18.50. The buyer of the call option that you sold decides to exercise and is placed in a long position in the futures market for one July Class III milk futures contract at the $16.50 strike price. As the writer of the call that was exercised, you are placed on the opposite side of the transaction and are now short one July Class III milk futures contract at the $16.50 strike price. To offset your short futures position, you buy one July contract at the current price of $18.50.[12] You lose $2.00 per hundredweight. What looked like a good bet and a profit of $1,700 turned into a loss of $2,300, not including commissions ($4,000 futures market loss minus $1,700 premium collected).

But what if you had bought a put instead of selling a call? By purchasing an at-the-money put, you gain the right to sell the July Class III milk contract at $16.50 per hundredweight. From table 3, the cost of this right to sell, the put premium, is $0.83 per hundredweight. By buying a put, you are banking on a milk price decline, just as you are when you sell a call.

But there's a big difference. Come June, when the July Class III milk futures price has jumped to $18.50, the value of your put option has dropped to zero; nobody is very interested in selling the July futures contract for $16.50 when they can sell it for $18.50 in the futures market. So you're out your $1,660 in premium money. But, unlike the call option case, that's all you've lost. Your put option is worthless, but you have not risked the potentially large losses associated with selling a call.

How would you fare as a call seller and put buyer if your price prediction had been correct? Let's assume that near the expiration of the options, the July Class III milk futures price is $14.00 per hundredweight. The call option—the right to buy the futures contract at $16.50—is worthless, and the buyer lets it expire. The put option is now trading at $2.50 or more—it's worth at least $2.50 per hundredweight to be able to sell the futures contract for $2.50 more than its current value. You can either sell your put and pocket your profit of $3,340 ($5,000 option gain minus $1,660 premium paid), or you can just wait until the option expires.

The same difference applies to buying calls and selling puts if a futures market price increase is expected. The general principle is: Buyers of puts and calls face unlimited gains and limited losses (the option premium). Sellers of puts and calls face limited gains (the option premium) and unlimited losses.

Despite the risks associated with writing calls, there are cases where hedgers can reduce this risk and sell calls as part of a package of price risk management tools. Examples are provided in appendix II.

What do the options on dairy futures look like?

Since puts and calls are options to sell and buy a futures contract, most of the specifications for the options contracts are identical to the specifications for the underlying futures contract. For the dairy options, the price quotation, last trading day, and position limits match the futures. There are no daily price limits specified for option premiums. But since the value of puts and calls changes with the value of the futures contract, the daily price limits for futures contracts effectively establish limits on changes in option premiums.

Contract specifications that are unique to options are shown in table 4.

With the exception of the Midsize Class III milk options, the options contract trading unit is the futures contract trading unit. The Midsize Class III options are one-half the Class III futures contract volume. These options provide better hedging opportunities for producers who market less than 200,000 pounds per month.

The American exercise method allows call and put holders (buyers) to exercise their options at any time. Under the European method, exercise is only permitted on the last day of trading.

Table 4. Dairy options contract specifications

Options contract	Trading unit	Strike price interval (cents)	Exercise method
Class III milk	2,000 cwt.	25	American
Midsize Class III milk	1,000 cwt.	25	European
Class IV milk	2,000 cwt.	25	American
Nonfat dry milk	44,000 lbs.	2/1 in nearest contract month	American
Dry whey	44,000 lbs.	2/1 in nearest contract month	American
Deliverable butter	40,000 lbs.	2	American & European
Cash-settled butter	20,000 lbs.	2	American

[12] If the call is exercised, writers are not obligated to immediately offset their short futures market position. They may hold on to their short position in hopes of a price decline and a resulting lower cost of offsetting.

Options on cash-settled futures contracts are also cash settled against the announced settlement price. That is, if the option is in the money at the time of settlement, then holders (buyers) automatically receive the difference between the announced price and the strike price of their option and writers (sellers) pay the difference. For instance, the buyer of a $16.00 CME Class III milk put who did not exercise prior to expiration would receive a payment at the expiration of the option if the announced Class III price were less than $16.00. The payment per put option contract would be equal to $16.00 minus the announced price times 2,000. Similarly, the buyer of a $16.00 call would receive a payment if the announced Class III price were higher than $16.00.

Because of the cash settlement method for most dairy options, there is usually no benefit to exercising an in-the-money option. Remember that exercising an option means the holder will be placed in a short (put) or long (call) position in futures at the option strike price. The futures position will be cash settled against the announced price at contract maturity. So the return to the option holder who exercises will be exactly the same as the return to the holder who waits until maturity and cash settles the option.

How can options be used for hedging price risk?

Like futures trading, options trading can shift the risk of unfavorable price movements in the cash market to speculators. The difference is that hedgers using options can lock in minimum or maximum price objectives (subject to the same basis risk that applies to futures market hedging) and simultaneously benefit from favorable price movements. However, there is a cost to achieve this asymmetric protection in the form of the options premium. There is no such premium involved in futures market hedging.

Purchasing an option can be viewed as buying price protection insurance for future cash market transactions. The insurance premium is the option premium. If you don't need the insurance (prices move in your favor), you still pay the premium. If you do need the insurance (prices move against you), then the insurance pays off in the form of helping to ensure a price or profit objective by offsetting cash market losses with options market gains.

The insurance analogy can be carried further to look at purchasing options at different strike prices. When you buy automobile insurance, you can select from different deductibles for the collision and comprehensive portions of the package. If you choose a zero or very low deductible, then your cost will be relatively high in comparison to choosing, say, a $1,000 deductible. By choosing a high deductible, you are limiting your risk, but, at the same time, you are self-insuring up to the deductible amount. In other words, you are willing to bear part of the cost of having a wreck but not all of it.

If you buy at-the-money options to provide price protection, then you will pay more than if you buy put or call options that are out of the money. An at-the-money option is the same as a zero deductible insurance policy; it protects the current futures contract price. An out-of-the-money option will cost less. The further out of the money, the smaller the premium. But, at the same time, the out-of-the-money option will protect a price objective that is less than (put) or greater than (call) the current futures contract price. There is a "deductible" representing the willingness of the purchaser to self-insure the difference between the strike price and the current futures contract price.

To illustrate the use of put options to protect against a price decline, suppose it's June and you expect to sell 200,000 pounds of milk in November. Your reading of dairy outlook information makes you worried about a price collapse between June and November. You think that the June price of $16.00 for the November Class III milk futures contract is not likely to hold. You've estimated your full costs of production at $15.70 per hundredweight and the five-year average basis for your farm is +$1.30 per hundredweight for November. So you need a Class III price of $14.40 to cover your costs.

The $15.00 (out-of-the-money) put option for the November Class III milk contract is trading at $0.50. You decide to buy one November $15.00 put and place the order with your broker. The broker gets the trade at $0.50 and charges you $60.00, or 3 cents per hundredweight, as a commission.

By purchasing the November $15.00 put, you've established a price floor of $15.77 ($15.00 strike price + $1.30 basis – $0.50 premium – $0.03 commission). This is 7 cents above your cost of production. You have paid a premium of $1,000 to ensure your price objective. That is your maximum liability in the options market. If the November Class III price is announced at $15.00 or higher, your put option will expire worthless, in which case you are out $1,000. If the announced Class III price is less than $15.00, you will garner a profit equal to $15.00 minus the announced price, which you can use to supplement your lower cash market milk price. Your hope is that the option will expire worthless, which will mean that your cash market price objective will be exceeded.

Let's use some specific examples. Suppose you were correct in your pessimistic forecast for the November Class III price, and it is announced at $14.30. Your milk plant pays you $15.60 for the milk that you delivered in November, which means your basis forecast was accurate. Your put option expires in the money by $0.70, so you collect $1,400 from your broker account. Your net milk revenue (milk sales plus net options gain) is $15.77 ($15.60 plant pay price + $0.70 options gain – $0.50 put premium – $0.03 commission), which is equal to your price objective.

But suppose your pessimism was unfounded. The November Class III price is announced at $16.00, the price you were looking at in June. Assuming no basis change, your plant pays you $17.30 for your November milk. Your net revenue is $16.77 ($17.30 plant pay price – $0.50 premium – $0.03 commission). You exceeded your price objective by $1.00 per hundredweight. But at the same time, you are $0.53 cents worse off than if you had not purchased price protection that you didn't need.

This example illustrates the difference between futures contract hedges and options hedges. If you had attempted to lock in your cash market price objective using a short futures contract, you would have done better with falling prices than you did using the put option. With a constant basis, the gain from the futures market hedging transaction would have completely offset the cash market loss, except for the broker commission. With the put option, the net revenue is lower by the amount of the premium plus the amount that the put is out of the money.

But with a rising market, the options hedge can be preferable to the futures hedge. Assuming a constant basis, the futures hedge would have meant exactly offsetting gains and losses in the cash and futures markets. You would have achieved your price objective, but you would not have benefited from the higher cash market. In contrast, the options hedge allowed you to garner all of the cash market increase except for the option premium.

How are options used in a floor price cash contract?

The use of futures market hedging to allow dairy plants to offer cash forward contracts was discussed above. Under these fixed price contracts, dairy farmers are locked into the contract price and do not receive any more if prices rise. Some dairy plants offer minimum price contracts that protect a price floor rather than a specific price. The contracting farmer can select among alternative minimum prices and will pay different fees depending on the price floor selected.

Let's look at a hypothetical case. On June 1, the November Class III milk contract closes at $16.50. On the same date, Bigcheese Coop offers floor price contracts for the Class III portion of November milk at minimum prices ranging from $15.50 to $17.50 per hundredweight in 25-cent increments. Bigcheese's charge to contracting farmers ranges from $0.53 per hundredweight for the $15.50 contract to $1.42 for the $17.50 contract. The charge is non-refundable and will be deducted from the farmers' November milk checks. So the net floor price for contracting farmers would be $14.97 for the $15.50 contract and $16.08 for the $17.50 contract.

Bigcheese will compare the announced November Class III price to the minimum price in settling with producers who sign floor price contracts. If the announced price is less than the floor, then Bigcheese will pay the difference. If the announced price is higher than the contracted floor, then the contracting farmers receive no payment.

For example, suppose you think that the November Class III price of $16.50 will likely hold, but you have nagging worries about a price collapse. So you decide to set a price floor on 100,000 pounds of November milk by contracting with Bigcheese at the $15.50 level. With your normal basis of $1.20, you are effectively setting a floor mailbox price of $16.17 ($15.50 contract price + $1.20 basis – $0.53 contracting charge).

Assume that milk prices do, in fact, collapse, and the announced November Class III price is 14.00. If your basis estimate of $1.20 holds, your mailbox price is only $15.20. But you also get a payment from Bigcheese of $1.50 per hundredweight (the amount by which the November Class III price fell short of your floor price) on your 100,000 pounds of contracted milk. Netting out your contracting charge, you have an additional $0.97 to bring your price up to your price objective of $16.17.

If the announced Class III price is higher than $15.50, you exceed your price objective but you receive no payment from Bigcheese, and the floor price charge of $0.53 is deducted from your milk check. You paid Bigcheese to insure a minimum price but ended up receiving more than the minimum.

How is Bigcheese able to offer floor price contracts? If the Class III price were below the minimum price in a producer price floor contract by more than the producer charge, then Bigcheese would have a financial obligation that it could not recover through its cheese sales. So to protect itself, Bigcheese buys put options at strike prices corresponding to the minimum prices selected by contracting farmers. If the November Class III price ends up less than these strike prices, then Bigcheese will use the proceeds from cash-settling the put options to offset its obligation to producers.

For contracts with price floors that are less than the announced Class III price, Bigcheese's associated put options expire worthless. But Bigcheese does not make any payments to producers holding these contracts.

Note that unlike fixed price forward contracts, floor price contracts involve a producer charge, with the amount of the charge tied to the minimum price that a producer selects. That's because the plant offering floor price contracts has to pay the put premium regardless of what happens to the Class III price. The producer covers the full cost of price protection. In effect, Bigcheese is serving as an insurance broker.

However, the floor price contract has an advantage over buying a put option in that the milk plant covers the up-front cost of price protection, which is deducted from the contracting producer's milk check at the time of settlement.

How does Bigcheese set the producer charges for floor price contracts? Bigcheese charges producers more than the premiums for the November put options. It also tacks on a service charge to cover brokerage fees and interest costs on the premiums from June to November.

How do you select a minimum price in a floor price contract? Note that the net price floor (after subtracting the producer charge) in this example increases for higher minimum prices selected. The net floor price for the $15.50 contract is $14.97 while the net price for the $17.50 contract is $16.08. So wouldn't it make sense to pick the contract with the highest price floor?

The answer is, usually not. You need to look at the minimum price you want to protect relative to the current futures price and the cost of purchasing various levels of price protection. The cost of protecting a minimum price that is higher than the current futures price is very high because the contracting plant will be purchasing in-the-money puts. The November Class III price would have to rise by $1.00 per hundredweight between June and November in the previous example to yield a net price equal to the $16.08 floor. A higher Class III price ($16.57) could be protected through a direct hedge by selling the November futures contract—and there would be no contracting charge.

How do I pick the best risk management tool?

Unfortunately, there is no best strategy before the fact. The strategy you select—sell futures, buy puts, sign a fixed price or floor price cash contract—depends on your expectations with respect to future milk prices and how confidently you hold those expectations. Some very general rules follow:

- Hedging with futures or accepting a fixed price cash contract is generally the best strategy if futures prices are historically high or are high relative to your price objective and you think there is a better than 50-50 chance that prices will decline. Going to extremes, if the current November CME Class III price is $5.00 higher than the five-year average November Class III price and if you are 100 percent certain that the current price will fall by November, then hedge. While you could also protect against downside risk by buying a put, that would cost you the put premium. Further, when futures prices are historically high, options premiums are also relatively expensive simply because the probability of prices falling may be greater than prices increasing. And since you are certain there is no upside price potential, there is no potential benefit to protect with a put.
- Buying a put is generally the best strategy when (1) futures prices are at historical lows or are low relative to your price objective; (2) you think there is better than a 50-50 chance that prices will increase; but (3) there is some chance that prices will go even lower. In that case, you benefit from having disaster insurance in place, but you are not locking yourself into what you think is an unfavorable price. If your expectations concerning price are shared by most other traders, put premiums should be fairly low. Buying puts may also be a good strategy with low futures prices even if you expect prices to fall even further. In that case, you don't want to lock in an unprofitable price with a hedge, but neither do you (or your banker) want to risk financial disaster.
- If futures prices are about at your price objective and you have no good idea where they are headed, then the decision is not easy. Whether to hedge with futures or buy a put option may depend on the size of put premiums. Or you may elect to keep all or most of your milk un-priced until you have a stronger sense of market direction.

Above all, remember that the objective of any price risk management strategy is to protect a profit or price objective, not to get the highest possible milk price.

Besides these basic risk management strategies, there are more sophisticated approaches that involve combinations of futures, options, and cash forward contracts. Some of these advanced strategies are outlined in appendix II.

What can I use to help me formulate good price forecasts?

Milk price forecasting is an inexact science that has become even more inexact in recent years. There are no magic formulas or economic models that can accurately forecast prices. In fact, economic models have become more imprecise since recent price movements have often been unrelated to fundamental market factors. Unforeseen or non-market factors can bring about abrupt changes in milk prices. But while it is impossible to accurately forecast milk prices, it is easier to predict the general direction of price changes.

There is an abundance of dairy outlook information available to help you decide how prices are likely to move. Much of this information is available free on the Web or in agricultural newspapers. Some particularly important USDA reports that you should follow are noted below:

- *Milk Production Report.* This important report is issued by NASS (USDA's National Agricultural Statistics Service) mid-month covering the previous month. This report tracks milk cow numbers, milk per cow, and total milk production for 23 selected states representing about 85 percent of U.S. milk production. The report also provides a national estimate of total milk production. Quarterly data are provided for all states.
- *Milk/Feed Price Ratio.* This measures the pounds of a 16 percent protein dairy ration equal in value to one pound of milk[13] and is an indicator of the overall profitability of milk production. High values signal expansion of the national dairy herd while low values signal liquidation. The milk/feed price ratio is published around the first of the month as part of the NASS monthly report, *Agricultural Prices*. With elevated feed and milk prices beginning in 2007, the milk/feed price ratio values historically used as indicators of expansion and contraction have become obsolete. Income above feed costs is a better measure of dairy profitability than the milk/feed price ratio.
- *Dairy Product Stocks.* Commercial and government-held inventories of butter, cheese (by category), and nonfat dry milk are published as part of the NASS monthly *Cold Storage Report*. Stock changes are an important gauge of supply-demand balance for manufactured dairy products.
- *Dairy Product Production* reports monthly factory production of all major dairy products for the U.S. and major states. It is published by NASS around the first of the month for the second preceding month, so it is not a particularly good contemporary indicator of the supply of manufactured dairy products.
- *Dairy Product Prices* is a weekly report issued by NASS each Friday morning covering the week ending the previous Saturday. Weekly prices and weights used to calculate all Federal Order Class prices are reported (butter, block and barrel cheddar cheese, nonfat dry milk, and dry whey).
- *Commercial Disappearance* measures imputed consumption—actual sales as well as "pipeline" stocks of major dairy products. Commercial disappearance is reported quarterly by USDA's Economic Research Service.
- *Retail Dairy Prices* and price indices for major dairy products, both national and regional, are released monthly by the Bureau of Labor Statistics (BLS).

All of these reports and other outlook indicators are published as soon as they are released in Dairy Market News (Agricultural Marketing Service, USDA). Dairy Market News is issued weekly each Friday. The report is no longer available in hard copy by subscription, but it can be accessed free at http://www.ams.usda.gov/dairy/mncs/weekly.htm.

A very useful Web site for obtaining information in all of these reports is "Understanding Dairy Markets," which is maintained by UW–Madison Department of Agricultural and Applied Economics professor Brian Gould. The site address is: http://www.aae.wisc.edu/future/. "Understanding Dairy Markets" provides a wealth of dairy market and price information and allows users to construct tables and charts tracking critical variables over time. The site provides links to all dairy contracts and exchanges. Data covering production, inventories, and prices are updated daily as new information is released by government sources. The site also includes an excellent interactive tutorial on futures and options trading.

[13] The ration used in the milk/feed price ratio consists of 51 pounds of corn, 41 pounds of alfalfa hay, and 8 pounds of soybeans.

Appendix I: Hedging examples

Example 1: Dairy farmer places a short hedge to lock in December milk price

Date	Cash market	Futures market	Basis
July	Expected December milk production is 900,000 pounds. December mailbox price has averaged $1.27 over the Class III price over last three years. Price objective is $16.97	Sell 4 December CME Class III milk contracts @ $15.70	$1.27
Case I: Futures price decline/no basis change			
Dec./Jan.	Class III price announced at $12.55. Delivers 920,000 pounds of milk to plant at price of $13.82	Cash-settles 4 December futures @ $12.55	$1.27
Gain/loss	($3.15)	$3.15	No change
Net gain	($0.41)		
Case II: Futures price increase/basis weakens			
Dec./Jan.	Class III price announced at $16.20. Delivers 780,000 pounds of milk to plant at price of $17.20	Cash-settles 4 December futures @ $16.20	$1.00
Gain/loss	$0.23	($0.50)	($0.27) Change
Net gain	($0.28)		

Note: The hedging examples in the text used identical cash and futures market volumes. Futures contract volume will not usually match anticipated cash market volume. This affects the hedging outcome relative to the price objective. In Case I, the volume of milk sold in the cash market (920,000 pounds) is 120,000 pounds greater than the hedged volume (800,000 pounds). The farmer was un-hedged on 13 percent of cash market sales. So the futures gain was not large enough to offset the cash market loss. This led to a price outcome less than the price objective even when there was no basis change (1,200 cwt. un-hedged X $3.15/cwt. = $3,780/9,200 cwt. total milk sold = $0.41). In Case II, the cash market volume fell short of the futures volume. Since there was a futures market loss, the result was a net price that was below the price objective by even more than the basis change. The farmer ended up as a (losing) speculator on the 20,000 pounds of milk that exceeded cash market sales. This points out the problem of "lumpiness" in the futures contract volumes.

Example 2: Dairy plant places a short hedge to protect cash forward contracts

Date	Cash market	Futures market	Basis
December	Dairy plant signs cash forward contracts with producers for March milk totaling 2.4 million pounds. Contracts are for a base Class III milk price for milk testing 3.5% butterfat, 2.99% protein, and 5.69% other solids and with a SCC of 350,000. Producers are eligible for other premiums and milk value will be adjusted for tests different from the base. Contracting producers also receive the federal order PPD. Contract price on milk from farmers contracting for March averages $16.75	Sell 12 March CME Class III milk contracts at average price of $16.90	NA
Case I: Futures price decline/no basis change			
Mar./Apr.	Class III price announced at $16.00. Plant receives 2.4 million pounds of contracted milk from farmers. Plant pays March federal order price plus/minus plant premiums/discounts plus $0.75 per hundredweight bonus on contracted milk.	Cash-settles 12 March futures @ $16.00	NA
Gain/loss	($0.75)	$0.90	
Net gain	$0.15		
Case II: Futures price increase/no basis change			
Dec./Jan.	Class III price announced at $17.50. Plant receives 2.4 million pounds of contracted milk from farmers. Plant pays March federal order price plus/minus plant premiums/discounts less $0.75 per hundredweight discount on contracted milk.	Cash-settles 12 March futures @ $17.50	NA
Gain/loss	$0.75	($0.60)	
Net gain	$0.15		

Note: There is really no "basis" in this example because the plant is merely settling with producers according to the announced Class III price relative to the contracted price. But while the plant experiences no basis risk in its hedge, contracting producers still risk receiving a smaller difference between their mailbox and contract prices than anticipated when they contracted, the same as they do when they hedge directly by selling a futures contract. The difference between the plant's cash forward contract price offer and the futures price used for hedging is really a service charge to cover brokerage fees and risks associated with the plant being obligated to sell futures at less than the cash forward price. This is a common form of cash forward contracting.

Example 3: Dairy farmer places long hedge to lock in January corn price

Date	Cash market	Futures market	Basis
March	Farmer intends to purchase 10,000 bushels of No. 2 yellow corn to replenish commodity bin in January. Local basis in January is normally ($0.25) per bushel. Price objective is $5.15 per bushel.	Buy 2 Chicago Board of Trade (CBT) February corn futures @ $5.40	($0.25)
Case I: Futures price decline/basis weakens			
January	Farmer purchases 10,000 bushels of No. 2 yellow corn from local elevator at $5.00 per bushel.	Sell 2 CBT February corn futures @ $5.35	($0.35)
Gain/loss	$0.15	($0.05)	($0.10)
Net gain	$0.10		
Case II: Futures price increase/basis strengthens			
January	Farmer purchases 10,000 bushels of No. 2 yellow corn from local elevator at $5.50 per bushel.	Sell 2 CBT February corn futures @ $5.50	$0.00
Gain/loss	($0.35)	$0.10	$0.25
Net gain	($0.25)		

Notes:

- Grain futures are deliverable contracts. The farmer in this case would have to accept delivery of corn in Chicago if the contracts were not offset.
- Local market prices for grains are usually lower than their corresponding futures because of the costs to transport grain to the delivery point.
- A long hedger benefits when the basis weakens because the cash commodity can be bought relatively cheap in comparison to the futures, and loses when the basis strengthens.

Example 4: Dairy farmer buys a put to set a minimum price for December milk

Date	Cash market	Futures market	Basis
July	Expected December milk production is 900,000 pounds. December mailbox price has averaged $1.27 over BFP/Class III price over last three years. Price floor is $16.02 ($15.00 strike price + $1.27 basis – $0.25 premium)	Buy 4 December CME $15.00 Class III milk puts @ $0.25 December futures is trading at $15.70	$1.27
Case I: Futures price decline/no basis change			
Dec./Jan.	Class III price announced at $14.55. Delivers 920,000 pounds of milk to plant at price of $15.82	Cash-settles 4 December puts @ $14.55	$1.27
Gain/loss	($0.20)	$0.20	No change
Net gain	($0.03)		
Case II: Futures price increase/basis weakens			
Dec./Jan.	Class III price announced at $16.20. Delivers 780,000 pounds of milk to plant at price of $17.20	Put options expire at zero value.	$1.00
Gain/loss	$1.18	($0.25)	($0.27)
Net gain	$0.92		

Notes:

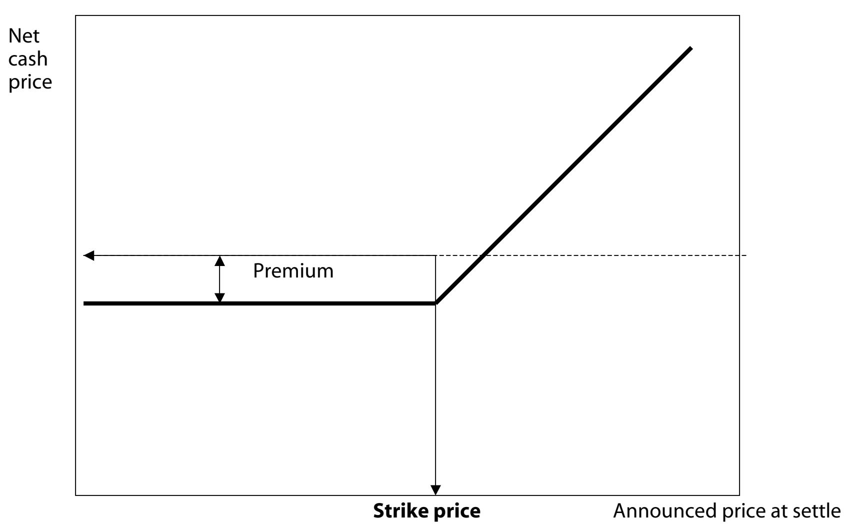
- Using put options establishes a price floor rather than a fixed price. The floor price is the put strike price minus the put premium.
- As in example 1, the volume of milk represented by the put option in this example does not exactly match the volume of milk sold on the cash market. This results in the net gain or loss (relative to the price floor) that is different from the per hundredweight difference between the cash and futures market gains/losses.

Appendix II: Advanced strategies

The basic risk management strategies outlined in the text can be modified or supplemented as market conditions change or as your price expectations change. In this appendix, we discuss some of these advanced risk management strategies.

To help in explaining these strategies, let's introduce a graphical method of demonstrating the effects of futures and options trading and cash forward contracting on net cash prices received (combination of cash and futures or options returns). Refer to appendix figure 1, which demonstrates generally the purchase of a put option to set a price floor. The diagram is also applicable to floor price cash contracting. For simplicity, let's assume a zero basis and ignore broker commissions.

Appendix figure 1. Buy a put option



The price floor is the strike price of the put minus the put premium (the horizontal portion of the heavy solid line). If the announced settlement price is less than the put strike price, then the put expires in the money and cash settlement will yield a return that offsets the difference between the strike price and the announced price.

If the announced price is higher than the put strike price, then the put expires worthless. The cash market return is the announced price minus the put premium. This return is represented by the 45-degree portion of the heavy solid line in figure 1. Note that the announced price must exceed the strike price by more than the put premium for the net cash price to end up higher than the strike price.

Hedging with futures locks in a specific price outcome. In figure 1, this would be illustrated as a horizontal line that crosses the vertical axis at the price of the futures contract sold. The futures price is both a price floor and a price ceiling. Cash forward contracting at a fixed price would be represented in the same fashion.

Roll up to futures

Suppose in November you bought a May $15.50 Class III put option in anticipation of prices weakening by spring. The put premium is $0.25, so you've established a price floor of $15.25. Heavy winter rains in California sharply reduce production, leading to a price rally early in the year. The May Class III futures is trading at $16.00 in February and your May $15.50 put has fallen in value to $0.10. The $0.10 represents time value.

Your reading of dairy outlook information suggests that California will recover quickly. You are convinced that the $16.00 May futures price will not hold. How do you take advantage of that conviction?

One way is to roll up to futures—sell a May futures contract. You can either hold on to your put or sell it to increase your net price. This changes your position from having a price floor at $15.25 to locking in a $15.85 net price if you sell your put for $0.10 ($16.00 futures price less $0.15 option loss) or setting a $15.75 minimum price if you keep your put ($16.00 futures price less $0.25 option premium).

Appendix figure 2 illustrates this strategy. The original transaction is a put purchase which establishes a price floor at the strike price minus the premium (the lower heavy solid line). After a price rally, the second transaction is sale of a futures contract. There are two alternatives shown. In Case I, illustrated by the upper heavy horizontal solid line, the put option is sold for $0.10. This results in a fixed net price equal to the price of the futures contract less the *net* premium for the put ($0.25 purchase price minus $0.10 sales price).

In Case II, illustrated by the heavy dotted line, the put is retained. The minimum price is the futures price minus the put premium. If the announced price is below the put strike price, then the net price will increase by the difference.

Let's look at the net price outcome from rolling up to a $16.00 May futures at different announced Class III prices for May:

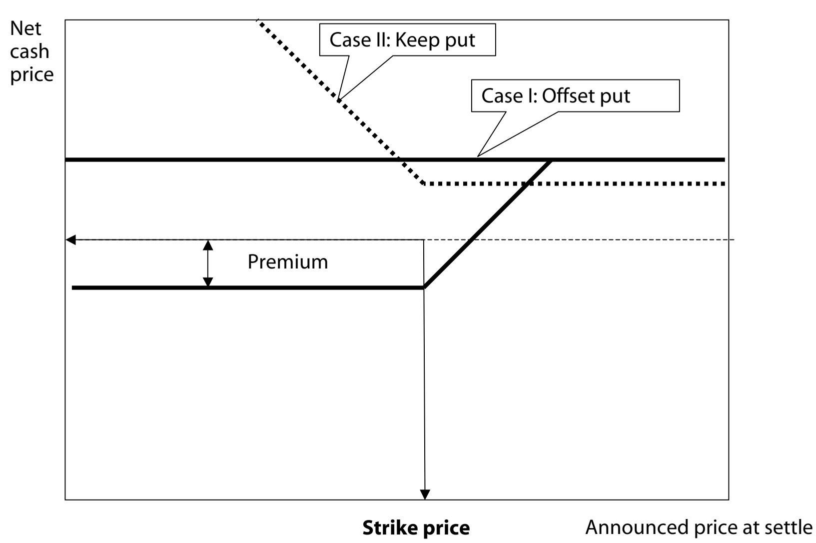
Case I: Sell $15.50 May put @ $0.10

Announced May Class III price ($)	Futures gain/ loss ($)	Put option gain/loss ($)	Net price ($)
18.00	(2.00)	(0.15)	15.85
16.00	0.00	(0.15)	15.85
14.00	2.00	(0.15)	15.85

Case II: Keep $15.50 May put

Announced May Class III price ($)	Futures gain/ loss ($)	Put option gain/loss ($)	Net price ($)
18.00	(2.00)	(0.25)	15.75
16.00	0.00	(0.25)	15.75
14.00	2.00	1.25	17.25

Appendix figure 2. Roll up to futures



Roll up put

Rolling up to futures is a good strategy after a price rally if you are very bearish after the rally. But what if you're less certain about prices falling? Maybe the California rains will continue longer than you expect, meaning there's a good chance that the rally could continue.

If you are somewhat bearish but cautious after a rally, rolling up your put may be a better strategy than rolling up to futures. This involves selling your May $15.50 put and buying a May put at a higher strike price. You retain downside price protection but at a higher floor. And you can take advantage of any time value remaining in your original put.

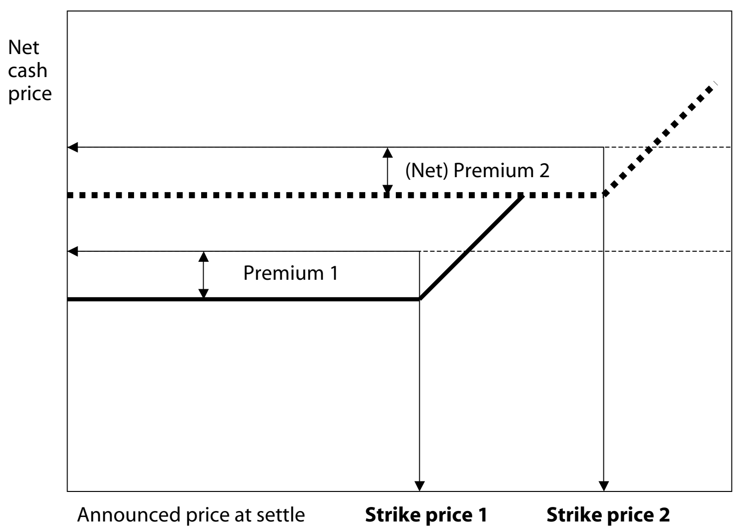
Suppose in February that the May Class III futures price is $16.00, the May $15.50 put is trading at $0.10, and the (at-the-money) May $16.00 put is at $0.50. You sell your May $15.50 put and apply the dime sales proceeds to the premium on the May $16.00 put. By this action, you raise your floor price from $15.25 to $15.35 ($16.00 strike price less first put premium of a net $0.15 less second put premium of $0.50).

Rolling up a put is illustrated in appendix figure 3. The initial put purchase establishes a floor price at the put strike price minus the put premium (lower heavy solid line). Rolling up the put establishes a higher floor price (upper heavy dotted line) at the new higher strike price minus the net premium for the new put. The net premium is the new put premium plus the old put premium less the remaining value of the old put premium when it is sold.

The net price results under alternative announced May Class III prices are:

Announced May Class III price ($)	$15.50 Put loss (net) ($)	$16.00 Put gain/loss ($)	Net price ($)
18.00	(0.15)	(0.50)	17.35
16.00	(0.15)	(0.50)	15.35
14.00	(0.15)	1.50	15.35

Appendix figure 3. Roll up to a put



Synthetic put

Many dairy farmers resist signing cash forward price contracts because they are irrevocable. They worry that prices will skyrocket after they are locked in to a fixed price. Even though the contract price may exceed their price objective, they would lose bragging rights in the coffee shop if others benefited from higher market prices.

A synthetic put does not alter the irrevocability of cash forward contracts, but it can allow contractors to take advantage of price rallies. A synthetic put involves buying a call after entering into a fixed price forward contract. The name, *synthetic put,* comes from the similarity of the net cash price results of this strategy to purchasing a put.

Suppose you sign a contract with your milk plant in June to deliver December milk at $16.00 per hundredweight. The contract price meets your price objective and looks attractive based on your sense of where the market is heading in the fall.

Your bearish outlook proves accurate for a time, and the December futures falls to $15.00 by late August. But in mid-September, widespread hail severely cuts corn and soybean yield estimates. The December Class III price hits $15.75 and looks like it may keep heading north.

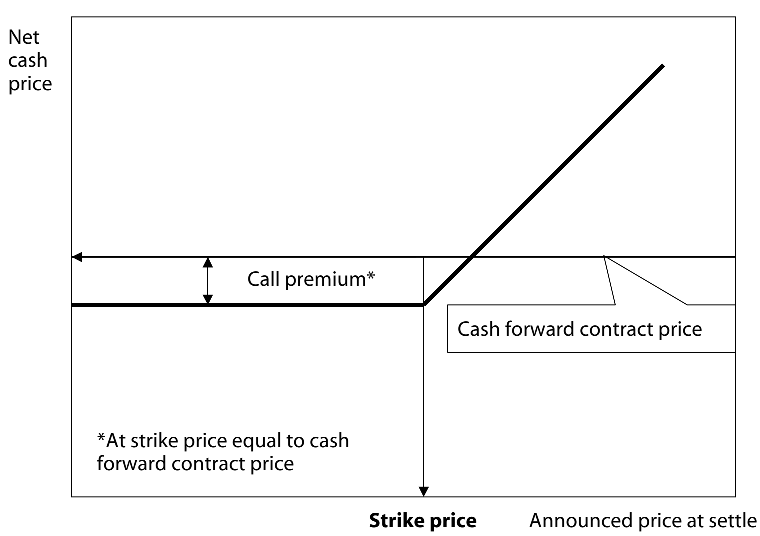
You can't benefit from higher milk prices in the cash market because you're locked into your $16.00 contract. But you can take advantage of the likely price rally by buying a call. Suppose the premium in September for a December $16.00 Class III call is $0.50. You buy the call, which, in combination with your forward contract, establishes a new lower price floor at $15.50. But at the expense of reducing your price floor, you have gained the opportunity for upside price gains. If the announced December Class III price is higher than $16.00, your call will be in the money, and you'll receive any positive difference between the announced price and your $16.00 strike price.

Appendix figure 4 illustrates this strategy. Buying the call sets a floor price equal to the call strike price less the call premium (the heavy solid line). At announced prices greater than the call strike price, the net cash price increases dollar for dollar. Note that the form of the net cash price line for the synthetic put is identical to the put example in appendix figure 1.

Specific net cash results for alternative announced December Class III prices are:

Announced Dec. Class III price ($)	Contract price ($)	$16.00 Call gain/loss ($)	Net price ($)
18.00	16.00	1.50	17.50
16.00	16.00	(0.50)	15.50
14.00	16.00	(0.50)	15.50

Appendix figure 4. Cash forward contract/buy a call (synthetic put)



Sell a call option

In the text, we noted that hedging with options involves buying puts or calls. However, there may be cases where selling a call makes sense as a price risk management strategy. Selling calls is not a strategy for new or conservative hedgers. Margin deposits are required and there may be considerable financial risk from falling prices—you are not protected in the cash market from a price free fall.

Selling a call would represent a possible strategy if: (1) Class III futures price movements were expected to be "sideways"; that is, there is no clear direction, up or down; and (2) call premiums are fairly high. Under these circumstances, selling a call may involve an acceptably small risk and the opportunity to raise net cash prices. But use caution with this strategy: theoretically, there is no limit to your cash market losses if prices nosedive.

Suppose in January the April Class III futures price is $15.00 and the April $15.00 call premium is offered at $0.80. All of the outlook information you've been able to get your hands on suggests a normal seasonal price pattern. April is too early for any planting surprises and nothing else on the horizon indicates much chance for a swing of more than about $0.50 from the current April price. So you sell an April $15.00 call, hoping to add the $0.80 per hundredweight premium to your April milk check.

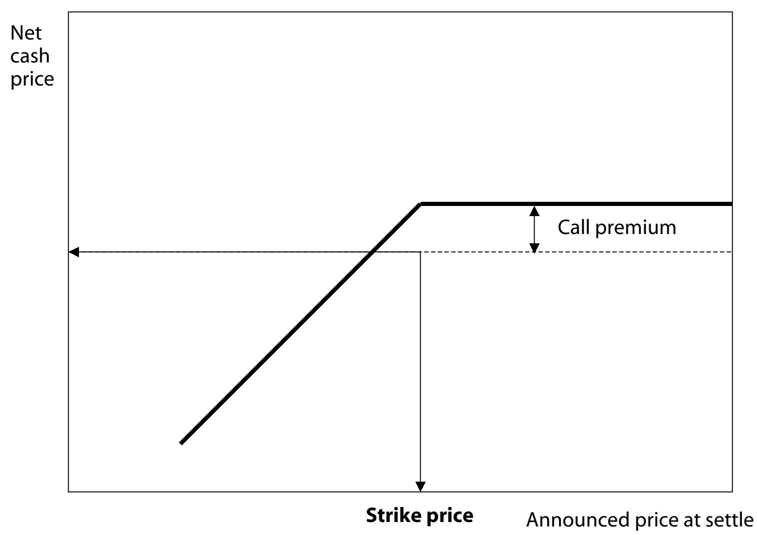
As long as the announced April Class III price is higher than $14.20, you've made a good decision because your net price will be higher than if you had not sold the call. But your net price will be no higher than $15.80. If the April price is announced at more than your $15.00 strike price, you'll be responsible for making up any difference at settlement, which prevents you from benefiting from the higher cash market price.

Appendix figure 5 illustrates this strategy. The net cash price line is higher than the announced price by the amount of the call premium at all announced prices less than the call strike price. At announced prices higher than the call strike price, the difference will be paid to settle the call option. So selling a call sets a ceiling on net cash prices but not a floor.

Numerical results at alternative announced April Class III prices are:

Announced Apr. Class III price ($)	$15.00 Call gain/loss ($)	Net price ($)
17.00	(1.20)	15.80
15.00	0.80	15.80
13.00	0.80	13.80

Appendix figure 5. Sell a call option



Short fence

Another strategy to consider when no major price moves are expected and premiums are relatively high is called a short fence or split-strike synthetic futures. This strategy involves simultaneously buying an out-of-the-money put and selling an out-of-the-money call. It is a good alternative to selling a call if you are slightly bearish—you are concerned that there may be a better chance of prices moving down than up. It also reduces the cost of buying downside price protection, but at the same time, it limits upside price gains.

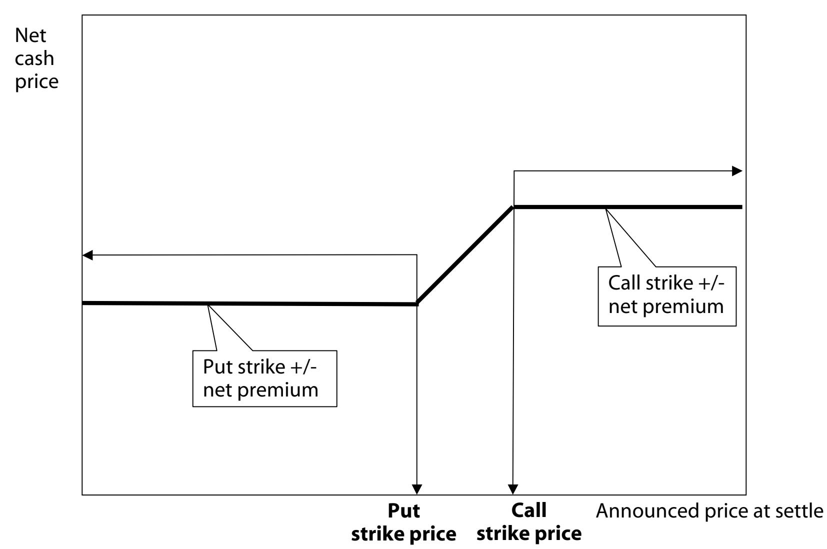
Assume the same conditions used in the sell a call option example—the April Class III futures is trading at $15.00 in January, and you don't see anything happening to move that price much one way or another. You sell an April $16.00 call at a premium of $0.55 and buy an April $14.00 put at $0.60. At this point, your net cost is a nickel and you have set a floor price of $13.95 and a ceiling price of $15.95. At any announced April Class III price between the floor and the ceiling, your net price is five cents less than the announced price.

Appendix figure 6 shows the general case. The net cash price line is below the put strike price by the net put-call premiums at any announced price less than the put strike price. The net cash price line is below the call strike price by the net premiums at announced prices greater than the call strike price. The result is a "fence" around net cash prices. Note that in the special case of buying an at-the-money call and selling an at-the-money put with the same premiums, the net cash price line would be horizontal at the current futures price. In other words, the result would be identical to selling futures.

Numerical results of this strategy at alternative announced April Class III prices:

Announced Apr. Class III price ($)	$14.00 Put gain/loss ($)	$16.00 Call gain/loss ($)	Net price ($)
17.00	(0.60)	(0.45)	15.95
15.00	(0.60)	0.55	14.95
13.00	0.40	0.55	13.95

Appendix figure 6. Short fence (split-strike synthetic futures)



Roll down futures to put

A final strategy would apply in cases where you have sold futures in anticipation of a price decline, the decline happens, and you then expect a rally. You'd like to garner your futures market gains, benefit from the expected price increase, and still maintain downside protection. This can be accomplished by rolling down futures to a put.

In May, you sold an October Class III futures contract at $17.50, feeling that the October contract was overpriced as a result of a weather-related delay in planting. As you expected, the October futures declined in value to $16.50 in July, when USDA's crop report indicated normal corn and soybean yields. But now you are convinced that the market has overreacted. Eroding cheese stocks suggest a rally in the Class III price by early fall, perhaps to more than $17.50. On the other hand, continued good summer weather could spur milk yields and cause prices to dip even further.

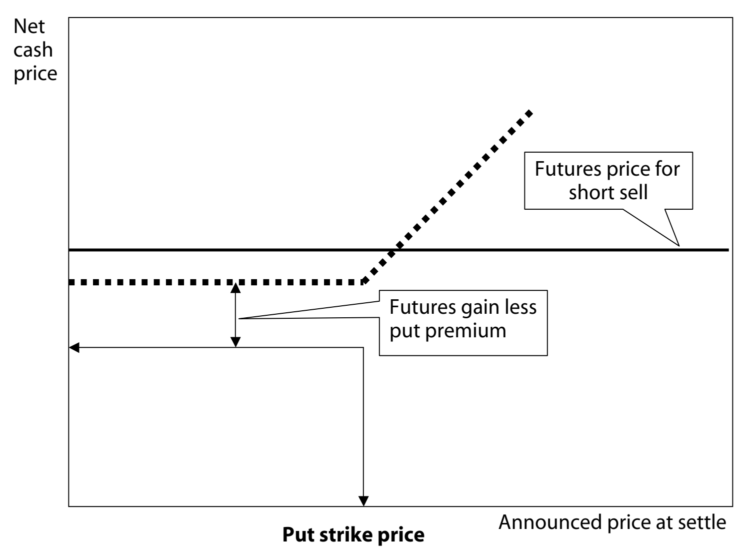
These conditions indicate closing out your short futures position and buying a put to maintain a price floor. So in July you buy an October Class III contract at $16.50 to offset your short position and net $1.00 per hundredweight. You then buy an October $16.50 put at a premium of $0.70. You have now replaced a fixed price position at $17.50 with a floor price of $15.80. But adding your futures profits to the new floor price yields a minimum price of $16.80, and you are now in a position to benefit from any price increase in the October Class III over $16.50, your put strike price.

Appendix figure 7 illustrates rolling down futures to put. The initial short futures hedge establishes a fixed price at the futures price (the horizontal heavy solid line). Offsetting the futures position and buying a put sets a price floor equal to the put strike price plus the difference between the futures gain and the put premium. The net cash price will exceed the floor price at announced settlement prices higher than the put strike price.

Results of this strategy for different announced October Class III prices:

Announced Oct. Class III price ($)	Futures gain ($)	$16.50 Put gain/loss ($)	Net price ($)
18.00	1.00	(0.70)	18.30
16.00	1.00	(0.20)	16.80
14.00	1.00	1.80	16.80

Appendix figure 7. Roll down futures to put



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