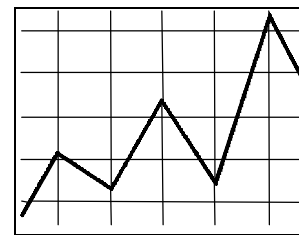


# MARKETING AND POLICY BRIEFING PAPER



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**Paper No. 64**  
**November 1998**

## **Dairy Producer Use of BFP PUT Options to Reduce Price Risk: Application to USDA's Dairy Options Pilot Program**

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The Federal Agricultural Improvement and Reform Act of 1996 authorized the Secretary of Agriculture to operate options pilot programs. The Risk Management Agency (RMA) has been authorized by the Secretary to administer the options program for dairy, called the Dairy Options Pilot Program or DOPP. DOPP is the first options program to be launched under the 1996 ACT. Its purpose is to help dairy producers learn how to manage price risk. The program will offer producers first-hand experience in trading options contracts for a period of six to eight months. Options may be used by dairy producers to establish a floor under their milk price.

Seven states have been selected for the first phase (six to eight months) of the program. The program is scheduled to operate for three years. Additional states may be selected for other phases of the program. The 1996 Act allows for operation in a maximum of 100 counties. Within each of the seven states selected to participate, six counties were selected. Within each selected county, 100 dairy producers will be selected to participate in this first phase. Wisconsin is one of the seven states selected. The other states are California, Minnesota, New York, Pennsylvania, Texas, and Vermont. The six Wisconsin counties selected are Chippewa, Clark, Dane, Grant, Marathon, and Vernon. All dairy producers within each of these six counties will receive an application for participation. Dairy producers eligible to participate in these counties must have produced at least 100,000 pounds of milk over a six consecutive month period during the most recent 12 months. Further, the producer must operate a dairy farm within one of the counties selected.

If more than 100 dairy producers within a county apply for DOPP, 100 will be selected through a lottery. If fewer than 100 apply, the number of unfilled participants will be pooled and redistributed over counties where enrollment exceeds 100. Producers will be required to attend a four-hour training session held in their county. Producers will also need to open an account with an approved broker. The producer will pay to the broker 20 percent of the premium of each put option purchased. RMA will pay the other 80 percent of the premium and up to \$30 of brokerage fees per round turn (the purchase of an option and the exercise of that option). The producer is free to deal with brokers who charge more than \$30 per round turn, but the producer will be responsible for any amount that exceeds \$30.

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**What are options?** There are two types of options, PUTs and CALLs. A PUT option gives the purchaser the right, but not the obligation, to *sell* a futures contract at a specific price (called *strike price* or *exercise price*) within a specified period of time. PUTs are used to protect against *falling* milk prices. A CALL option gives the purchaser the right, but not the obligation to *buy* a futures contract at a specified price within a specified period of time. CALLs are used to protect against *rising* prices.

Options involve both a seller and a buyer. The seller is known as the *writer* or *grantors*. The buyer is the *holder*. Each option is identified as to type, expiration period and strike price. For example, a November \$13.00 BFP PUT gives the holder the right to become a seller of a November BFP futures contract at \$13.00 any time before the options expiration. The BFP is the basic formula price that is announced by USDA each month.

The options buyer pays a *premium* to the seller for the option. Traders of options agree on a premium in an open outcry auction similar to the futures contracts. Since options holders have the write but not the obligation to purchase or sell a futures contract, the most they can lose is the premium. Option holders have three choices, to let the option expire worthless, to exercise the option or to sell the option before expiration at some premium.

The seller of the option receives the premium. In exchange for this premium the seller assumes the risk of being assigned a position *opposite* that of the buyer in the underlying futures market at any time prior to the options expiration. For example, when a buyer exercises a PUT option by acquiring a short position (sells a futures contract) the seller acquires a long position (buys a futures contract) at the option's strike price. Sellers of options keep the premium, if the option is not exercised. But because sellers must be prepared to take a futures position at any time prior to the options expiration, they are required to maintain a margin account similar to that for futures markets.

**Price Insurance:** Dairy producers buy fire insurance on their barn, health insurance, insurance on their livestock, car insurance, crop insurance, insurance on their machinery, and perhaps other insurance. But they haven't had the opportunity to insure against low milk prices. Buying a BFP PUT option is in essence buying price insurance. Dairy producers would buy a BFP PUT option because they are interested in protecting against falling milk prices.

It may be useful to look at buying a PUT option in the same light as buying car insurance. A person buys car insurance to protect against a loss if he/she should incur a car accident. Naturally, a one hopes never to have a car accident. They don't want an accident so they can collect against the premium paid for car insurance. But without paying this insurance premium, and an accident did occur, the financial losses suffered may be quite detrimental. The buyer of this car insurance decides how much risk to retain by deciding upon the amount of deductible insurance. They will pay a smaller premium, if willing to assume a \$500 deductible policy rather than a \$200 deductible policy. They may decide that they could bear the risk of a \$500 loss in damages to their car due to an accident, but a loss greater than this is more than they want to bear. Similarly, a dairy producer can buy a BFP PUT option and pay a premium to establish a *floor price* for future milk production. The floor price is the *strike price* of the option purchased minus the premium paid for the option and brokerage fees. This floor price is a price he/she feels is necessary to meet certain dairy business financial requirements or objectives. Producers don't care if milk prices turn out to be better than this floor price; that is, they don't have an accident with milk prices. But, producers sure don't want milk prices to fall below this floor, that is, have an accident with milk prices which would prevent their business objectives from being met. Similar to buying car insurance, a producer needs to decide on the amount of deductible insurance, that is, how low of a floor price to establish. This will depend upon how much price risk the producer wishes to bear. Naturally the higher the floor price established the higher the premium the producer will have to pay simply because there is greater likelihood that milk prices could be below the floor price and the producer will exercise the option. Like car insurance, the producer hopes he/she never has to exercise the PUT option, that is have an accident from falling milk prices. Producers prefer that milk prices go higher and the PUT option purchased expires worthless and the premium paid is lost.

**Illustration of using BFP PUT option:** A buyer of a PUT option has the right but not the obligation to sell a futures contract at a strike price at any time prior to its expiration. Let's assume in July Mr. Smith wants to protect a floor mailbox price on 400,000 pounds of October milk. Mr. Smith would buy two October BFP PUT options (CME BFP futures contracts are 200,000 pounds). Buying a PUT option to establish a floor price is a good price risk management strategy. Mr. Smith will know that his October mailbox price will not fall below this floor. He also knows that if the October milk prices do strengthen, he will not forgo all of the price increase.

Mr. Smith figures his cost of production to be \$13.25 per hundredweight. On July 10<sup>th</sup> Mr. Smith sees that October BFP PUTs are trading at the following strike prices and premiums.

<u>Strike Price:</u>	<u>Premium:</u>
\$13.25	\$0.48
\$13.00	\$0.38
\$12.75	\$0.21
\$12.50	\$0.18
\$12.25	\$0.14

Mr. Smith decides to buy an October BFP PUT with a strike price of \$12.75 at a premium of \$0.21. Based on the past, Mr. Smith receives an October mailbox price from the milk plant of about \$1.20 above the announced BFP. This \$1.20 is referred to as the *basis*, the difference between the cash milk price and the futures price<sup>2</sup>. So by buying an October BFP PUT Mr. Smith has established a floor under his October mailbox price of:

$$\begin{array}{r}
 \$12.75 \text{ Oct. BFP PUT} \\
 - \quad \underline{\$ \quad .21} \text{ Premium} \\
 \$12.54 \\
 + \quad \underline{\$ \quad 1.20} \text{ Basis} \\
 \hline
 \mathbf{\$13.74 \text{ OCT FLOOR MAILBOX PRICE}}
 \end{array}$$

Mr. Smith could establish an even higher floor price by buying an October BFP PUT with a higher strike price. An October BFP PUT with a strike price of \$13.00 had a premium of \$0.38. The established floor price would be \$0.25 higher (\$13.00 - \$12.75) at a cost of \$0.17 more (\$0.38 - \$0.21). This may seem like a good decision, and may be it would be. But, the announced final October BFP would also have to increase by \$0.38 to recapture that premium. Based on dairy situation and outlook reports, Mr. Smith realizes that the probability of October milk prices increasing by \$0.21 and recapturing the premium is greater than increasing by \$0.38. Besides Mr. Smith is satisfied with protecting a profit of \$0.49 (\$13.74 Oct floor price - \$13.25 cost of production). So Mr. Smith is comfortable with a \$0.25 lower floor price.

Let's now consider how Mr. Smith comes out if the announced October BFP is at \$12.75, the same as the strike price; at \$12.00, \$0.75 lower than the strike price; and at \$13.50, \$0.75 higher than the strike price. The BFP futures contract, unlike many futures contracts, do not involve the actual delivery of milk, but rather are *cash settled* against the announced BFP. The BFP PUT option, if exercised, involves the selling of a BFP futures contract at the strike price and then cash settling against the announced BFP price.

If the announced October BFP is \$12.75, Mr. Smith will not exercise the PUT option because there would be no gain in doing so. Mr. Smith's October mailbox price will be \$13.74, the same as the established floor price, as illustrated below.

\$12.75 announced Oct BFP

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<sup>2</sup> In the following examples, we assume the producer knows with certainty his mailbox/BFP basis. In reality, there is some uncertainty to the basis actually received. The risk associated with this basis uncertainty is much less than the uncertainty of the cash price, BFP. For more information, refer to Fortenberry, T. R., *Hedging with the BFP Futures and Options Contracts: A Guide for Price Risk Management in the Dairy Sector*, Department of Agricultural and Applied Economics, University of Wisconsin-Madison.

$$\begin{array}{r}
+ \text{ \$ } \underline{1.20} \text{ Basis} \\
\text{ \$ } 13.95 \\
- \text{ \$ } \underline{.21} \text{ Premium} \\
\text{ \$ } 13.74 \text{ October mailbox price}
\end{array}$$

If the announced October BFP is \$12.00, Mr. Smith will exercise the PUT option. By doing so, his October mailbox price is again \$13.74, as illustrated below. The gain on the futures market by exercising the PUT option offsets the loss in the cash milk price. Of course the cost of the premium is subtracted.

$$\begin{array}{r}
\text{ \$ } 12.75 \text{ PUT is exercised by buying an Oct BFP futures @ } \text{ \$ } 12.75 \\
\text{ BFP futures contracts are cash settled against the} \\
\text{ announced BFP; for October this is} \qquad \qquad \qquad \underline{\text{ \$ } 12.00} \\
\text{ *Gain on the futures market*} \qquad \qquad \qquad = \text{ \$ } \underline{.75} \\
\text{ Minus the premium paid} \qquad \qquad \qquad \underline{\text{ \$ } \underline{.21}} \\
\text{ *Net futures gain*} \qquad \qquad \qquad = \text{ \$ } \underline{.54}
\end{array}$$

***Net October mailbox price:***

$$\begin{array}{r}
\text{ \$ } 12.00 \text{ announced Oct BFP} \\
+ \text{ \$ } \underline{1.20} \text{ Basis} \\
\text{ \$ } 13.20 \\
+ \text{ \$ } \underline{.54} \text{ Net futures gain} \\
\text{ \$ } 13.74 \text{ *Net October mailbox price*}
\end{array}$$

Mr. Smith's price insurance worked. By collecting against the PUT option the established \$13.74 October floor mailbox price was realized. Mr. Smith achieved a minimum profit of \$0.49 per hundredweight. But if Mr. Smith had not purchased a BFP PUT (price insurance), his October mailbox price would have been \$13.20 (\$12.00 announced Oct. BFP plus \$1.20 basis). Mr. Smith would not have experienced any profit. In fact, he would have suffered a \$0.05 loss (\$13.20 - \$13.25 cost). The \$0.21 premium paid for the October BFP Put was well worth it.

Note: If a BFP PUT option is held until expiration, and the announced BFP is below the strike price, the PUT option will be automatically exercised for the producer. The producer does not need to call his/her broker to request that the option be exercised.

If the announced October BFP is \$13.50, Mr. Smith will not exercise the October BFP PUT, but let it expire. By doing so, his net October mailbox price is

$$\begin{array}{r}
\text{ \$ } 13.50 \text{ announced Oct BFP} \\
+ \text{ \$ } \underline{1.20} \text{ Basis} \\
\text{ \$ } 14.70 \\
- \text{ \$ } \underline{.21} \text{ Premium} \\
\text{ \$ } 14.49 \text{ *Net October mailbox price*}
\end{array}$$

Mr. Smith exceeds his price objectives and receives a profit of \$1.29 per hundredweight (\$14.49 - \$13.20 cost). Of course, if Mr. Smith would not have bought the October BFP PUT, he would have experienced \$0.21 more profit, the cost of the premium. But Mr. Smith didn't know that October milk prices would be stronger back in July. The \$13.74 October floor price established back in July allowed Mr. Smith to farm with more ease knowing that he would make at least a \$0.49 profit. It turns out that he now does much better even by giving up the \$0.21 premium. The trade-off between the uncertainty of future milk prices and the price floor that could be established is known as the ***risk-return tradeoff***. It is up to the producer to determine the degree of risk versus return willing to be accepted when determining the farm's marketing plan.

Note: In the above examples, we did not show any transaction costs paid to the broker for buying an option or exercising the option. These costs need to be subtracted from the net mailbox prices. These costs will vary some by broker, but are normally in the range of \$0.05 to \$0.07 per hundredweight. A

producer needs to ask the broker whether the brokerage fee charged is for the initial purchase of the option only, or does it cover a round trip, that is, also the right to exercise the option. Many brokers charge an initial brokerage fee to purchase the option, and then another fee to exercise the option.

We haven't discussed hedging in futures. When using a hedging strategy, a specific milk price is realized regardless of whether milk prices end up higher or lower. This is because hedging involves taking equal and opposite positions in the cash **and** futures markets. Losses on the cash milk price are offset by gains on the futures market. But gains on the cash market are also offset by losses on the futures market. Therefore, with hedging, the specific price protected is both a floor price and a ceiling price. The real advantage of using BFP PUT options, as illustrated above, is that if milk prices turn out higher, the dairy producer can realize that gain minus the premium paid. With PUT options there is no ceiling milk price; just a floor milk price<sup>3</sup>.

#### **What actually determines the range of strike prices and premiums paid for options?**

There is a range of strike prices for each options contract month. These ranges change as the BFP futures contract settle prices change.<sup>4</sup> For the BFP options the range in strike prices will be above and below the existing settle price. The strike prices change in increments of \$0.25. For example, if the November BFP futures contract settles at \$13.00 the range in strike prices may be as follows:

\$14.00  
\$13.75  
\$13.50  
\$13.25  
\$13.00  
\$12.75  
\$12.50  
\$12.25  
\$12.00

The premiums as previously mentioned are determined by competitive auction in a manner similar to that for futures contracts. Premium levels are determined by what someone is willing to pay for an option and what someone is willing to sell the option. There are different factors that go into determining this willingness to pay for and sell an option. First is the difference between the strike price and the futures contract settle price. For example, if the November BFP futures is \$13.00 a November PUT with a strike price of 13.25 is already worth something. It could be purchased and immediately exercised at a profit of \$0.25 (sell a November BFP futures contract at \$13.25 and buy back a November BFP futures contract \$13.00). An option already worth something, if it was exercised, is known as an *in-the-money* option. Writers of an option obviously would not sell the November PUT option for anything less than its value. In this example, \$0.25. The difference between the strike price and the futures contract settle price is referred to as the *intrinsic value*.

Options with strike prices at the futures contract settle price are said to be *at-the-money*. Options with strike prices that do not make them immediately valuable to exercise (with a PUT option this is when the strike price is below the futures contract price) are referred to as *out-of-the money* options. While both at-the-money and out-of-the money options would not have any intrinsic value, they may still be worth something and the premium would be greater than zero. The premiums here are a function of **time** and **volatility**. The longer the time remaining until the options expires, the greater the statistical probability that it becomes valuable, that is, in-the-money. Volatility measures price movements. If a market is more prone to sudden move, sharp movements, it also has a greater chance of coming in-the-money than if prices are not volatile. Thus, options of commodities that have more volatile prices will have higher premiums than

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<sup>3</sup> For more detail refer to Fortenbery, op. Cit. Also refer to Plourd, P. *From Price Taker to Price Maker: A Guide to Dairy Risk Management Using Futures and Options*, Coffee, Sugar & Cocoa Exchange, New York, 1997.

<sup>4</sup> The price established by the futures exchange and used by the clearing house at the close of each trading session as the official price to be used in determining net gains and losses, margin requirements, and the next day's price limits.

those with less volatile prices. In summary, the premium level is a function of intrinsic value, time value and history of price volatility.

One strategy not discussed in the above illustrations on using BFP PUT options was selling the PUT option before the expiration date. When it appeared that the announced October BFP was going to be higher than the \$12.75 strike price, Mr. Smith could probably have sold the October BFP PUT option for something and recaptured some of the premium paid. But, one word of caution. If Mr. Smith's price forecast is incorrect and if prices in fact decrease, Mr. Smith not only risks ending up with a lower October mailbox price, he also lost the portion of premium that was not recaptured. It would be like letting your car insurance expire and then having a car accident.

Since PUT options protect against a price decline, the intrinsic value and premium increases with higher strike prices (higher floor price protection). CALLS are used to protect against rising prices. So for CALLS the premiums would increase with lower strike prices (lower ceiling price protection). For example, the premiums for November PUTs and CALLS with an existing November BFP futures settle price at \$13.00 may look like this:

Strike Price	PUT Option Premiums	CALL Options Premiums
\$13.50	\$0.55	\$0.02
\$13.25	\$0.28	\$0.04
\$13.00	\$0.05	\$0.06
\$12.75	\$0.03	\$0.30
\$12.50	\$0.02	\$0.57

**How will the DOPP program operate?** Dairy producers who apply for the DOPP program and are selected to participate agree to the following provisions:

- 1) They will attend one four hour training session conducted by the Risk Management Agency (RMA).
- 2) They will buy BFP PUT options of a minimum of 100,000 pounds, and a maximum of 600,000 pounds of milk, through an eligible broker, within two months the producer attends the four hour training session.
- 3) Put options on no more than 200,000 pounds of milk be purchased in any one strike month. For example, PUTs purchased for the month of October can only total 200,000 pounds of milk. The BFP options on the NY Board of Trade are 100,000 pounds and the CME 200,000 pounds. The CME also has 50,000 pound mini BFP options<sup>56</sup>.
- 4) The dairy producer shall not purchase a BFP PUT option that expires on a date that is less than two months after the date the PUT options was purchased. For example, assume a producer wants to establish a floor price on September milk. The latest date he/she could purchase a September BFP PUT is August 4,1999 because the September BFP PUT expires the day before the September BFP is announced, October 4,1999, two months from August 4<sup>th</sup>. On August 5<sup>th</sup>, the earliest BFP PUT option that could be purchased is the October contract.

<sup>5</sup> For more detail concerning these contracts, refer to the following:

Dairy Futures Website, Department of Agricultural and Applied Economics, University of Wisconsin-Madison: <http://www.aae.wisc.edu/future>

Chicago Mercantile Exchange Website: <http://www.cme.com> .

New York Board of Trade Website: <http://www.csce.com> .

- 5) The BFP PUT options be purchased at a strike price that is at least \$0.10 “*out-of-the-money*”.
- 6) No BFP PUT option purchases may be exercised or sold before four weeks prior to the expiration date. The November 1999 BFP PUT option expires on December 3<sup>rd</sup>. So the purchaser would have to hold this November BFP PUT until at least November 5<sup>th</sup>, four weeks prior to December 3.
- 7) All BFP PUT options purchased shall expire during the month that is not more than six months after the month of purchase. For example, a producer is trained on February 24,1999. and makes all purchases of BFP PUT options during March and April. The latest BFP PUT option the producer could purchase is a September BFP PUT because it expires on October 5,1999. October is six months from April.
- 8) Producers need to open an account with an eligible broker. A list of eligible brokers will be provided by the RMA.
- 9) To assist in the evaluation of the DOPP, producers may be asked to complete a survey of their option activities to the RMA.

### **Summary**

The BFP PUT option offers dairy producers the opportunity to insure the milk price. Purchasing a BFP PUT option allows a dairy producer to establish a floor under their mailbox price without forgoing the opportunity of taking advantage of rising prices. The DOPP is a means for dairy producers to learn first hand how the BFP options work. The cost of learning is minimal since the federal government is subsidizing 80 percent of the premium cost of the option and paying \$30 towards the brokerage transaction fees.