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Price-Protecting Butterfat in High-Testing Herds: Using the CME Deliverable Butter Contract[1]

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Introduction

In September 2005, the Chicago Mercantile Exchange (CME) began trading futures and options contracts for Grade AA butter. While the CME has offered a deliverable butter futures contract and accompanying options for many years, the new contracts are different in several respects. Most important, the new butter contracts are cash-settled against the announced monthly National Agricultural Statistics Service (NASS) Grade AA butter price. The NASS butter price is used by USDA in setting minimum federal order component and class prices. This direct link between futures prices and federal order prices offers hedging opportunities for dairy farmers, particularly those with high-testing herds beyond what is possible using the Class III futures contracts alone.

The purpose of this paper is to demonstrate the mechanics and evaluate the potential for using the new butter contract as a price risk management tool. We begin by providing details of the new butter futures contract, comparing it with the existing deliverable contract. Then, we outline use of the new contract to price-protect butterfat production in excess of the 3.5 pounds per hundredweight embodied in the Class III price. This may be a useful strategy in the six federal order markets (and California) where multiple component pricing is employed. Next, we demonstrate use of the new contract in the four federal order markets that price only the butterfat and skim portions of producer milk.

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[1] This paper summarizes research funded by National All-Jersey. It focuses exclusively on producers' direct or indirect use of the CME deliverable butter contracts to manage price risk. Readers interested in the design and use of dairy plant forward pricing contracts for butterfat can download an electronic copy of the full report at www.aae.wisc.edu/future/publications/Butter_Project_NAJ_Final.pdf .

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New Butter Contract Specifications

Table 1 provides details on the new CME butter contract, comparing them to the deliverable butter contract that has traded since 1996. The biggest difference between the two contracts is in the method of settlement, with the new contract cash-settled against the reported NASS monthly butter price. Using the NASS price as the settlement price is very important for hedging because the NASS butter price determines the monthly federal order butterfat price through a product price formula. So what most dairy farmers are paid for butterfat is precisely linked to the futures contract settlement price.[3]

Table 1. CME Butter Futures Contract Specifications

	Cash-Settled Contract	***Deliverable Contract***
Trading Days	Daily	Daily
Contract Size	20,000 Pounds	40,000 Pounds
Grade	AA	AA
Style	NA	Frozen
Age	NA	Must be produced after Dec. 1
Delivery Area	NA	National. Chicago at par, other locations at fixed discounts
Delivery Facilities	NA	CME approved warehouses
Months Traded	All 12 months	March, May, July, September, October, December
Price Increments	0.025 cents per pound, equiv. to $5.00 per contract	0.025 cents per pound, equiv. to $10.00 per contract
Daily Price Limit	5.0 cents per pound. Can be increased to as high as 20.0 cents. No limit during last 5 trading days in expiring contract months.	5.0 cents per pound. Can be increased to as high as 20.0 cents. No limit in expiring contract month.
Position Limits	500 contracts in any month; 50 contracts in expiring contract month in last 5 trading days	1,000 contracts in all months combined. 900 contracts in any month. 150 contracts in expiring month reduced to 50 contracts in last five trading days
Trading Hours	9:30am - 1:10pm CT. Electronically traded.	9:30am - 1:10pm CT. Pit traded.
Last Trading Day	Business day immediately preceding release date for NASS monthly butter price.	Business day preceding the last seven business days of the contract month.
Date Contract First Traded	September 19, 2005	September 5, 1996

[3] California's state pricing system uses CME butter prices to set butterfat values. The NASS butter price is highly correlated with the CME price, but with a lag. Consequently, hedging butterfat may involve greater basis risk for California dairy producers.

Cash settlement also means that the product specifications such as age and location are immaterial. In reality what is traded is not a commodity but an index tied to a specific volume of a well-defined physical commodity — NASS's product definition for Grade AA butter.

The new butter contract volume is 20,000 pounds, half the size of the deliverable contract, and trades in every month compared to six months for the deliverable contract. Price increments and daily price limits are comparable. If during any day's trading session prices rise or fall by 5 cents per pound compared to the previous day's settlement price, then trading is suspended for the day. But if the price limit for the near contract is reached, then the next day's limit for all contracts is raised to 10 cents. And if the 10-cent limit is reached, the limit is raised to 20 cents the following day. There are no daily price limits in the last five days of trading in order to ensure convergence of the futures price and the upcoming settlement price.

Position limits for the cash-settled contract are 500 contracts in any one month except the expiring month, for which only 50 contracts may be held during the last five trading days. Position limits for the deliverable contract are specified for all months in total as well as individual months.

The new contract is electronically traded, which means that it can be traded outside the CME pits. Bids and offers are posted and can be accepted electronically by brokers located anywhere. This should improve transparency and enhance liquidity.

In this report we will examine two types of producer hedges applicable to dairy herds with relatively high fat contents (e.g., Jersey herds) that employ the new butter contract either directly or through cash forward contracts offered by dairy plants. The first type of hedge applies to producers shipping to plants that pay for milk on a component basis. Later, we examine a second type of hedge that applies to producers shipping to plants that pay for milk on a skim-butterfat basis.

Producer Butterfat Hedge in Multiple Component Pricing Markets

The Class III milk futures contract traded on the Chicago Mercantile Exchange (CME) offers an attractive hedging mechanism for dairy farmers shipping to plants regulated under multiple component pricing (MCP) orders. That is because the Class III price makes up a large percentage of the producer pay price in MCP markets.

Producers under MCP are paid for milk components — butterfat, protein, and other (non-fat, non-protein) solids — rather than solely on milk volume. The component prices paid to producers are the same as what handlers pay for Class III butterfat, protein and other solids. The announced Class III price per hundredweight, against which the CME Class III futures contract is settled, is calculated by weighting these component prices by specific component volumes. Specifically, a hundredweight of skim milk is assumed to contain 3.1 pounds of protein and 5.9 pounds of other solids and a hundredweight of whole milk is assumed to contain 96.5 pounds of skim milk and 3.5 pounds of butterfat. So the standardized Class III milk price contains 3.5 percent butterfat, 2.99 percent protein (0.965 X 3.1), and 5.69 percent other milk solids (0.965 X 5.9).

Basis and Basis Risk

Hedging to reduce milk price risk is accomplished by selling a futures contract or signing a cash forward pricing contract with a dairy plant. Hedgers calculate their expected farm milk price, often called the mailbox price, by adding their expected ***basis*** to the Class III futures price.[4]

Several factors make up basis. The use of standard milk composition in calculating the Class III price is one particularly important factor for Jersey herds. Producers with herds having milk composition different from the standard will receive more or less than the Class III price for a hundredweight of milk; high-testing herds more and low-testing herds less. For example, Jersey herds have butterfat and protein tests that are well in excess of the standards used to calculate the Class III milk price. This yields a relatively large basis, i.e., a large difference between the farm mailbox price per hundredweight and the announced Class III price that is being used to protect the mailbox price.

Other factors making up a producer's basis include:

- ***Producer Price Differential (PPD)***. Federal milk orders that use MCP calculate a marginal value per hundred weight of all milk pooled relative to the Class III value. The difference, which is usually positive, is the PPD. The PPD is the most variable component of basis for most producers. In the Upper Midwest order, the PPD has ranged from as low as -$4.11 per hundredweight to as high as $1.43 between January 2000 and mid-2006, averaging $0.32 (Figure 1).[5] Federal Orders with higher Class I utilization tend to have higher PPD's.

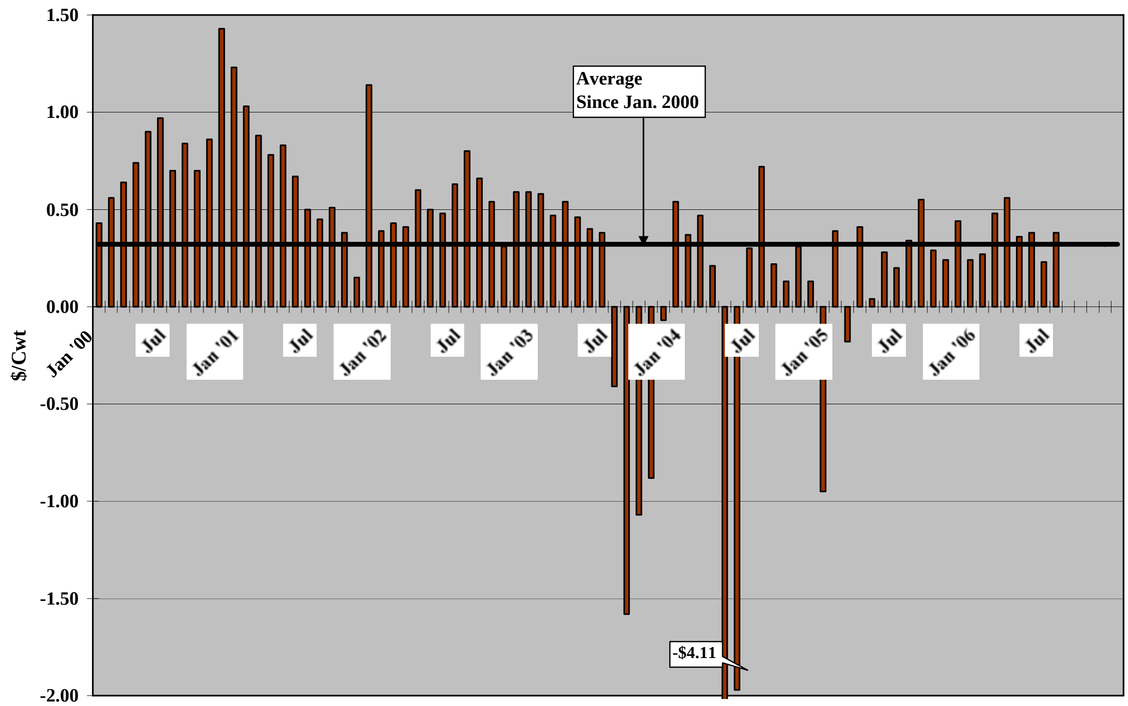
- ***Somatic Cell Count (SCC) adjustment.*** Most MCP orders pay a premium or impose a penalty for producer milk in reference to a 350,000 cells/ml. SCC base. The adjustment rate per 1,000 cells/ml is linked to the National Agricultural Statistics Service (NASS) monthly cheese price. The adjustment per hundredweight is small relative to the PPD and relatively predictable for most herds.

- ***Plant premiums.*** Many regulated federal order plants, including nearly all plants in the Upper Midwest, pay premiums over the minimum federal order price. Typical premiums are for volume, quality (in addition to the federal order SCC payment) and protein. Often, plants pay a "plant premium" not tied to either milk volume or composition that is commonly related to participation in cooperative over-order bargaining agencies. Premiums are normally quite predictable from month to month.

[4] Basis is generally positive; that is, the mailbox price is typically higher than the Class III price even after subtracting hauling costs and other deductions. However, a negative producer price differential could result in a negative basis.

[5] Few if any producers in the Upper Midwest order actually experienced the large negative PPDs because plants absorbed them or obtained larger Class I over-order premiums to offset them.

Figure 1. Producer Price Differential, Upper Midwest Federal Order



- ***Plant deductions***. All plants make deductions from producer milk checks. Plants are required to deduct 15 cents per hundredweight to support the National Dairy Research and Promotion Board and eligible state promotion boards. Most plants deduct something for hauling, though often less than full cost. Deductions are very predictable.

As an example of basis calculation in MCP markets, consider a Jersey producer shipping to a federal order pool plant located in the base zone of the Upper Midwest order in March 2006. The herd had butterfat, protein, and other solids tests of 4.6 percent, 3.6 percent, and 6.0 percent, respectively, for March 2006, and a somatic cell count of 350,000 (no price adjustment). The announced producer component prices for March 2006 were: butterfat, $1.2596/lb; protein, $1.8836/lb.; and other solids, $0.1874/lb. The PPD was $0.56 per hundredweight. The announced Class III price was $11.11/cwt.

The producer received a volume premium of $0.30/cwt. in March and was charged $0.20/cwt. for hauling. The plant also deducted $0.15.cwt for the promotion assessment.

With these assumptions, the producer's mailbox price per hundredweight would be calculated as follows:

	Butterfat value (4.6 lbs. X $1.2596/lb):	$ 5.79
+	Protein value (3.6 lbs. X 1.8836/lb):	6.78
+	Other Solids value (6.0 lbs. X $0.1874/lb):	1.12
+	Somatic cell count adjustment:	0.00
+	Producer Price Differential:	0.56
=	Federal order minimum payment	**$14.26**
+	Plant volume premium:	0.30
–	Hauling charge:	(0.20)
–	Promotion assessment:	(0.15)
=	Mailbox price	**$14.21**
–	Class III Price:	($11.11)
=	Farm Basis	**$ 3.10**

Basis risk refers to the uncertainty regarding the difference between the hedger's mailbox price and the Class III price. A hedge is placed (or a forward price contract signed) with the expectation of receiving a mailbox price that is different from (usually higher than) the Class III price. At the time of settlement, that difference may be greater or less than expected. Consequently, the farm milk price outcome of the hedge will be different from what was expected when the hedge was placed by the exact amount that the basis deviated from what was expected. It should be noted that while the basis may change between placing a hedge and final settlement (e.g., basis risk), the potential change in the basis is less than the potential change in the Class III price. Thus, price risk is reduced through hedging.

The actual basis experienced by a producer is affected by changes in the composition of the milk produced by the dairy herd. For example, the basis will be smaller (weaker) for a high butterfat herd during the summer when butterfat contents are depressed due to hot weather.

A Simple Excess Butterfat Hedge

The principal sources of basis risk are the PPD and the payments made for milk components in excess of Class III standards. There is no way of hedging the PPD or the (less variable) plant premiums or deducts. However, at least part of the milk composition difference could be hedged with the new butter contract. Specifically, the value of butterfat in excess of the 3.5 pounds per hundredweight embedded in the Class III price could be price protected. This could be especially advantageous to owners of high-testing herds.

To illustrate, consider the average milk composition by breed from 2005 DHIA averages shown in Table 2. Note that all breeds have both butterfat and protein tests that exceed the standards used to compute the federal order Class III price in MCP markets, but the difference is larger for colored breeds. For Jerseys, excess butterfat averaged 1.1 pounds per hundredweight in 2005. Using the range of announced butterfat values over the January 2005-March 2006 period, this 1.1 pounds is associated with a range of $1.39 - $2.08 per hundredweight that is not price-protected when a Class III hedge is placed.[6] The Brown Swiss and Guernsey herds also possess significantly higher butterfat contents.

Table 2. Breed Average Butterfat and Protein Tests, 2005		
	Butterfat	***Protein***
Federal Order Standard	***3.50***	***2.99***
Ayrshire	3.85	3.15
Brown Swiss	4.04	3.37
Guernsey	4.51	3.37
Holstein	3.64	3.05
Jersey	4.60	3.57
Milking Shorthorn	3.64	3.11
Red & White	3.65	3.02

Source: Agricultural Research Service, USDA summary of Dairy Herd Improvement records (http://www.aipl.arsusda.gov/publish/dhi/current/hax.html)

The following example demonstrates how the new butter contract could be used to hedge the value of excess butterfat. Table 3 provides a summary of the transactions associated with these hedging activities.

Assume the owner of a Jersey herd sells a $12.00 December 2006 Class III futures contract (or signs a $12.00 December 2006 cash forward contract) in March 2006. The farm's December basis over the last five years has averaged $4.00 per hundredweight, so the owner expects a mailbox price of $16.00 per hundredweight on contracted milk. As demonstrated above, close to 80 percent of the $4.00 basis is comprised of butterfat and protein value in excess of the amounts included in the Class III price. Table 3 shows both the cash and futures markets transactions that are associated with using a combination of Class III and Cash Settle Butter futures contracts to hedge the 4.6 lbs. of butterfat.

The butterfat value per hundredweight associated with the $12.00 Class III price is not known. However, based on past records, the owner notes that when announced Class III prices are in the vicinity of $12.00, the monthly average National Agricultural Statistics Service (NASS) butter price used to calculate the federal order butterfat price is usually around $1.30 per

[6] The average butterfat value of this period was $1.6401/lb which yields an average excess butterfat value of $1.804. About 0.6 pounds of excess protein is also not price protected. The average announced protein value over the Jan. 2005-March 2006 period was $2.395/lb. This yields an excess protein value of $1.43/cwt. However, there is no simple way of hedging excess protein.

pound. The federal order formula to convert the NASS butter price to an equivalent butterfat price is:[7]

Butterfat price ($/lb.) = (NASS Butter price/lb. – 0.115) X 1.2

So the $1.30 NASS butter price would yield a butterfat price of $1.422 and the value of the producer's 1.1 pound of excess butterfat would be $1.564 per hundredweight. In other words, of the $4.00 per hundredweight basis, 39 percent represents excess butterfat value.

The owner also does not know for certain what the herd butterfat test will be in September, but it has historically averaged 4.6 percent.

Assume that on January 5, 2007, the December '06 Class III price is announced, at $11.00 per hundredweight and the December NASS butter price is announced at $1.15 per pound. The Jersey owner has locked in a $12.00 Class III price. But the lower butter price means that the owner's excess butterfat value is less than the $1.422 per lb. expected when the hedge was placed. Specifically, the value of excess butterfat per hundredweight associated with the $1.15 per pound announced butter price is $1.3662 [=1.1 X ($1.15 - $0.115) X 1.2], which is 19.8 cents per hundredweight less than the value associated with the expected $1.30 per pound butter price. In other words, the basis is 19.8 cents per hundredweight smaller than expected, and the owner receives less than the expected $16.00 per hundredweight unless increases in other basis components more than offset the lower butterfat value.

Now assume the Jersey owner can sell a butter futures contract (or forward contract butterfat) to protect the price of excess butterfat. The owner simultaneously sells the $12.00 Class III futures contract and a $1.30/lb. butter futures contract. This locks in the butterfat price of $1.422 per pound ($1.30/lb butter X 1.2 lbs. butter/lb butterfat) and the value of $1.564 for the 1.1 lbs of excess butterfat.

The December '06 butter price of $1.15 per pound now means that the producer obtains revenue from the butter futures transaction of 19.8 cents per hundredweight to offset the reduced value of excess butterfat. Specifically, the producer sold 1.32 pounds of butter at $1.30 per pound to protect the 1.1 pounds of excess butterfat per hundredweight (i.e., 1.32=1.1 lbs. of butterfat times 1.2 lbs. of butter/pound of butterfat). The associated revenue is 1.32 X $1.30 = $1.716. The settlement price of $1.15 per pound translates to $1.518 per hundredweight (1.32 X $1.15), yielding the 19.8 cents per hundredweight gain.

As in any hedge, the contract price for butter is locked in whether the actual price ends up lower or higher. If the announced butter price were higher than the $1.30 per pound contract price, the hedge would lose money relative to not hedging, but the net price objective when the hedge was set is realized. That is, we are assuming the producer is interested in controlling price risk versus maximizing revenue from speculative trading of dairy futures.

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[7] Producer butterfat prices in all federal order MCP markets are precisely linked to the NASS butter price using the formula noted here. The term, 0.115, is the butter make allowance, the assumed manufacturing cost per pound of butter, and 1.2 is the yield factor (pounds butter per pound of butterfat).

Table 3. Combined Use of Class III and Butter Futures to Protect Butterfat Value

Assumptions

Herd Butterfat	4.6%
Class III Futures Settle for December '06 Class III in March '06	$12.00
Butter Futures Settle Price for December '06 in March '06	$1.30
Announced Dec. '06 Class III Price	$11.00
Announced Dec. '06 NASS Butter Price	$1.15

Date	Cash Market	Futures Market
	---- Class III Price Hedge Only ----	
03/06	Expect Mailbox Price of $16.00: Class III Price $ 12.000 Excess BF Value (1.1 X 1.422) 1.564 Other Basis Items 2.436 $ 16.000	Sell December Class III Futures @ $12.00
01/07	Sell milk to plant @ $14.802: Class III Price: $ 11.000 Excess BF Value (1.1 X 1.242) 1.366 Other Basis Items 2.436 $ 14.802	Cash Settle December Class III Futures @ $11.00
	Loss =$16.00 - $14.802 = $1.198	Gain = $12.00 - $11.00 = $1.00
	---- Class III and Excess Butterfat Hedge ----	
03/06	Expect Mailbox Price of $16.00: Class III Price $ 12.000 Excess BF Value (1.1 X 1.422) 1.564 Other Basis Items 2.436 $ 16.000	Sell December Class III Futures @ $12.00 Sell 1.32 lbs. (=1.1 lbs of excess butter X 1.2 lbs of butter/lb butterfat) of Dec butter futures ($1.30 butter = $1.422 butterfat value) 1.1 X $1.422 = $1.564 per cwt
01/07	Sell milk to plant @ $14.802 Class III Price: $ 11.000 Excess BF Value (1.1 X 1.242) 1.366 Other Basis Items 2.436 $ 14.802	Cash Settle December Class III Futures @ $11.00 Cash settle 1.32 lbs butter futures @ $1.15 ([(1.15-.115) X 1.2] X 1.1 = 1.366
	Loss =$16.00 - $14.802 = $1.198	Gain = $1.198 (= $12.00-$11.00 + $1.564 – $1.366)

Note: It is unrealistic to show no change in other basis items with a Class III price decrease since the protein price would likely be lower. The intent here is to focus exclusively on how basis is affected by changes in the butter price between the date of contracting and the date of settlement

Butterfat Hedging Issues

There are two technical problems associated with hedging excess butterfat: (1) The size of the butter contract makes selling butter futures a speculative venture for most dairy farmers, and (2) The price of butter and the Class III price are not as highly correlated as might be suggested in the example above, leading to basis risk in a combined Class III-butter price hedge.

Contract Size. The butter contract volume is 20,000 pounds, which is equivalent to 16,667 pounds of butterfat.[8] Using the 2005 DHIA butterfat test of 4.6 percent for Jerseys, 1.1 pounds per hundredweight more than the 3.5 pounds in the federal order standardized milk, this translates to nearly 1.5 million pounds of milk per month, the monthly milk production of more than 1,000 cows. Few U.S. dairy herds produce that much milk.

Selling a futures contract that is larger in volume than anticipated cash market sales volume represents speculation with respect to the difference. Futures market gains will more than offset cash market losses and futures market losses will more than offset cash market gains.

The large size of the butter contract means that most producers will hedge butterfat by forward contracting with their dairy plant. Plants could offer a forward price contract for excess butterfat and consolidate contractual commitments of several producers to sell a 20,000-pound butter futures contract. This is what plants do now in offering cash forward contracts based on the Class III price.

Butter price-Class III price correlation. Working through the equations used under Federal Order minimum pricing regulations, the announced Class III price for any month can be expressed in terms of the NASS monthly prices for butter, cheese, and whey[9]:

Class III Price = 9.64 NASS Cheese + 0.42 NASS Butter + 5.86 NASS Whey – 2.57

When simultaneously placing a Class III and butter price hedge, a producer attempts to lock in a mailbox price and reduce basis risk relative to using only the Class III price hedge. While the individual commodity prices making up the Class III price are positively correlated because of their common raw product, they do not move in tandem. Therefore, the relationship between the butter price and the Class III price is not fixed. The announced Class III price might end up lower than the contract Class III price, but that does not mean that the announced butterfat price will also be lower. In fact, the butter price could rise from the time of contracting while the Class III price falls. This would result in a situation where the Class III hedge was beneficial but the butterfat hedge was not.

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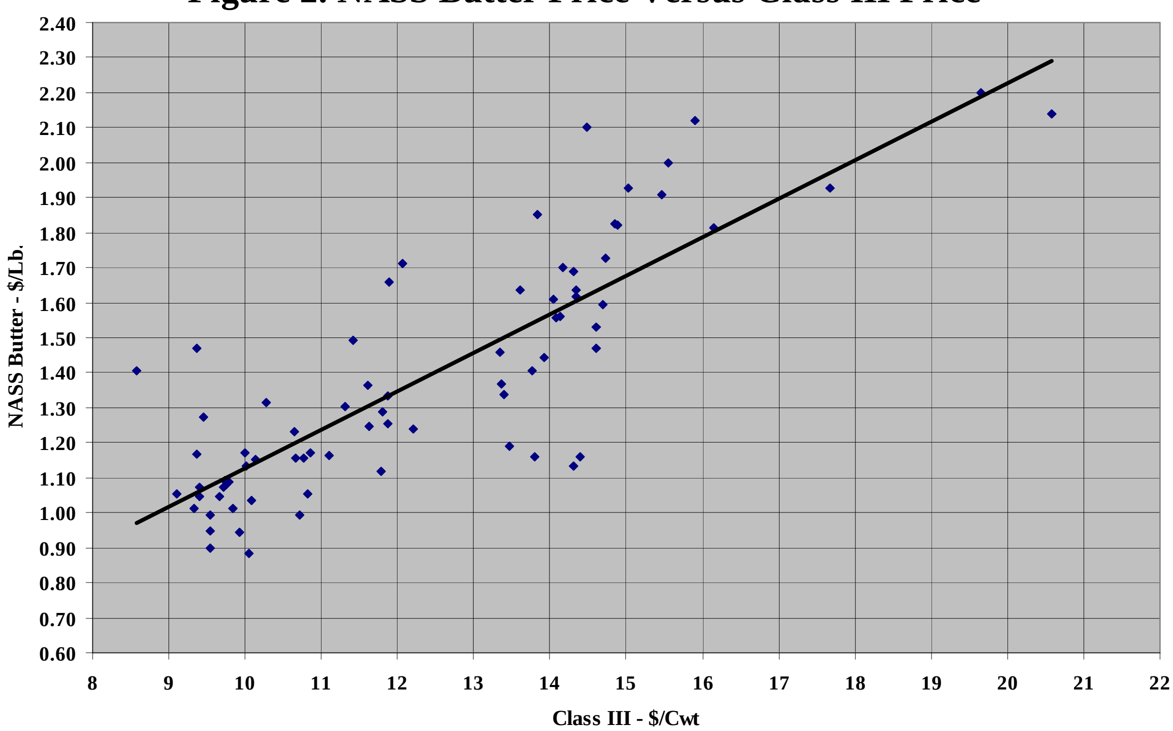
[8] Based on the federal order yield assumption of 1.2 pounds of butter per pound of butterfat; i.e., it takes 0.833 pounds of butterfat to make one pound of butter.
[9] For a detailed discussion of these rules refer *to Basic Milk Pricing Concepts for Dairy Farmers*, Ed Jesse and Bob Cropp, Feb. 2004 (www.aae.wisc.edu/future/publications/milk_pricing.pdf).

The relationship between monthly butter and Class III prices since federal order reform in January 2000 through March 2006 is illustrated in Figure 2. In spite of a statistically significant relationship between Class III and butter prices, there is still considerable variability. For example, Class III prices in the vicinity of $14.00 per hundredweight were associated with butter prices in the range of $1.10 to $2.10 per pound. This implies that locking in a $14.00 per hundredweight Class III price and a $2.00 per pound butter price might be a coup. But locking in a $14.00 Class III price and a $1.20 butter price could result in a loss for the butter hedge even though the Class III price was announced at $12.00.

Figure 2 suggests a possible rule of thumb for butterfat hedgers: If the butter futures price is higher than predicted by the Class III futures price, then hedge butterfat. If the butter futures price is lower than predicted, then don't hedge. Using this rule, a producer locking in a $15.00 per hundredweight Class III price would only hedge butterfat if the butter contract price were higher than $1.70 per pound. Current market abnormalities or contrary outlook information would, of course, alter that strategy.

Figure 2. NASS Butter Price Versus Class III Price



Examples of Alternative Class III/Excess Butterfat Hedging in MCP Orders

Some examples of Class III/excess butterfat combination hedges may be useful for clarification. We will use common starting conditions and look at the results of hedging under different ending conditions. Results are expressed in dollars per hundredweight, which ignores hedging risk associated with the "lumpiness" of the Class III and butter contracts (i.e., we assume that both milk and butter can be forward-priced in any volume). Brokerage and margin interest costs are ignored.

Our starting conditions are as follows: A Jersey herd operator attempts to lock in a September mailbox price early in the calendar year by hedging or forward contracting in Class III milk and butter. At the time the hedges are placed, the September Class III futures is trading at $13.50 per hundredweight and the September cash-settled butter contact is trading at $1.40 per pound. Alternatively, these are the base milk and butter (or equivalent butterfat) prices offered by the operator's plant under the plant's forward pricing program.[10]

The herd's expected fat test in September is 4.6 percent, which means that the producer is hedging the value of an expected 1.1 pounds of excess butterfat per hundredweight of milk over the assumed fat test associated with Class III pricing under the Federal Order system. The expected value of the excess fat can be derived precisely from the Federal Order butterfat price formula: 1.1 lbs X ([$1.40-$0.115] X 1.2) = $1.70 per hundredweight. Over the last few years, the farmer's mailbox/Class III *gross* basis averaged $4.00/cwt. The expected basis net of the value of excess butterfat — we'll call this the *net* basis — is $2.30 per hundredweight (i.e., $4.00 gross basis-$1.70 value of excess butterfat). The net basis reflects the value of excess protein, the PPD, and net plant premiums and deductions.[11]

Given these assumptions, the producer's expected mailbox price is $17.50, calculated as follows:

Class III Price (hedged)	$13.50
Excess Butterfat Value (hedged)	1.70
Net Basis	2.30
Expected Mailbox Price	$17.50

There are two sources of basis risk facing the hedger; that is, two ways that the actual mailbox price can end up different from the expected mailbox price: (1) the net basis may be different, and (2) the butterfat test may be different. If the net basis and the fat test are the same as predicted when the hedge is placed, then the mailbox price will be $17.50 per hundredweight.

Table 4 shows the results of combination hedging under six scenarios. Under scenario I, the net basis is $.30 lower than expected and announced Class III and butter prices are both lower than contracted values. The herd butterfat test is 4.6 percent. Despite cash prices, the overall return per cwt is only $0.30 less than the target $17.50 level, with the difference due to reduced net basis.

[10] With plant-specific administrative costs deducted, the net cash forward contract price is usually a little lower than the above values. We will provide a detailed plant level analysis later in this report which accounts for these administrative costs.

[11] Again, the assumption that the protein value portion of net basis is fixed with changing Class III prices is unrealistic since the Class III price is correlated with the value of protein and an the value of excess protein is an element of net basis. Note that in Table 4, net basis is positively related to the difference between the announced Class III price and the Class III contract value, which reflects differences in the value of excess protein.

Under the scenarios represented by II and III, the September net basis is $2.30 per hundredweight and the herd butterfat test is 4.6 percent; both the same as predicted when the hedge was placed. So the outcome is a $17.50 per hundredweight gross return, even though the announced Class III price is lower in both outcomes and the butter price is lower in outcome II and higher in outcome III. Note that hedging gains (losses) exactly offset market losses (gains) relative to expectations when the hedges were placed.

In outcome IV, the gross return ends up 40 cents per hundredweight higher than expected, and in outcome V, 70 cents higher. These differences are equal to the difference between the actual and predicted net basis. When the basis is larger than expected, the hedge results in a higher return than expected and vice versa. Outcomes VI and VII show the effect of the herd butterfat test deviating from expectations. In outcome VI, the test is two points lower than expected. So market returns are less than expected, even though the butter price ended up the same as when the hedge was placed. In outcome VII, both of the factors contributing to basis risk are different from anticipated. The larger net basis and higher fat test, result in gross 76 cents/cwt higher than predicted.

Table 4: Simulated Results from a Hypothetical Combination of Class III and Butter Hedges

	I	***II***	***III***	***IV***	***V***	***VI***	***VII***
Class III Price/cwt.	$11.00	$12.00	$12.00	$14.50	$16.00	$12.50	$15.00
Butter price/lb.	$1.15	$1.20	$1.50	$1.50	$1.75	$1.40	$1.60
Prod. BF test (%)	4.6%	4.6%	4.6%	4.6%	4.6%	4.4%	4.8%
Net Basis/cwt.	$2.00	$2.30	$2.30	$2.70	$3.00	$2.30	$2.70
Market Returns:							
Class III Value	$11.00	$12.00	$12.00	$14.50	$16.00	$12.50	$15.00
Excess BF Value	$1.33	$1.43	$1.83	$1.83	$2.16	$1.39	$2.32
Net Basis	$2.00	$2.30	$2.30	$2.70	$3.00	$2.30	$2.70
Total	$14.33	$15.73	$16.13	$19.03	$21.16	$16.19	$20.02
Futures Returns:							
Class III Hedge	$2.50	$1.50	$1.50	($1.00)	($2.50)	$1.00	($1.50)
Butter Hedge	$0.37	$0.27	($0.13)	($0.13)	($0.46)	$0.00	($0.26)
Total	$2.87	$1.77	$1.37	($1.13)	($2.96)	$1.00	($1.76)
Total Returns:	$17.20	$17.50	$17.50	$17.90	$18.20	$17.19	$18.26

Producer Butter Hedge in Skim-Butterfat Markets

Four federal order markets with relatively high Class I utilization do not employ MCP: Appalachia, Arizona-Las Vegas, Florida and Southeast. These orders use *skim-butterfat pricing*, which involves pooling the skim milk and butterfat value of milk used in the four federal order classes. Producers receive uniform prices per pound of butterfat and per hundredweight of skim milk. These uniform prices are weighted average pool values where the weights are the relative proportions of butterfat and skim milk used by class and the prices are the associated class butterfat and skim milk prices.

Producers in skim-butterfat markets cannot effectively use the Class III contract or the essentially dormant Class IV contract to forward price their milk because their uniform prices are not consistently tied to either. The skim portion of Class I milk, which comprises the bulk of producer milk usage in three of the four markets, is priced in reference to the "higher of" advanced Class III and Class IV skim milk prices. Producers cannot accurately predict which advanced price will be the mover. So even though advanced prices are highly correlated with lagged monthly prices, potential hedgers are uncertain about which contract to sell.

However, while hedging skim milk remains problematic, the new butter contract offers an effective hedging mechanism for protecting the producer uniform butterfat price in skim-butterfat markets.

Uniform butterfat prices are very highly correlated with monthly average NASS butter prices.[12] The current month's butter price influences Class II, III, and IV butterfat prices and the previous month's butter price influences Class I butterfat prices. A regression analysis of the relationship between producer uniform butterfat prices and current and lagged monthly average NASS butter price yields adjusted R^2 values greater than 0.99 in the four skim-butterfat markets (Table 5).

Table 5 shows that the relative influence of the current and lagged months' NASS butter prices on the current month uniform butter price depends on the market-wide utilization of milk by class. Not surprisingly given advanced pricing for Class I butterfat, the higher the Class I utilization, the greater the influence of lagged month's butter price in determining the current butterfat value. For the Arizona-Las Vegas order (Class I utilization of 33.5 percent), the ratio of the lagged and current month's butter price is 0.254 versus 1.587 for the Florida Order (Class I utilization of 82.5 percent).

Within the uniform butterfat-butter price regressions, the regression coefficients for the current and lagged month butter prices approximately sum to 1.20 (+/- 0.025), which is the yield factor (pounds of butter per pound of butterfat) used in the federal order butterfat pricing formula. The regressions are replicating the formula, distributing the weights between the relevant month's butter prices in accordance with butterfat usage by class.

The results shown in Table 5 provide insight to how Jersey producers located in fat-skim FMMO could use the new butter contract to protect their butter price. To directly hedge a given month's uniform butter price in skim-butterfat markets, producers would sell butter

[12] As noted above Monthly Class I butterfat values are based on NASS *advanced* butter prices, which are weighted average weekly prices for the first two weeks of the previous month. While the NASS *monthly* butter price averages four or five weekly prices for the month and are announced no later than the 5th of the month *following* production. The lagged monthly butter price is very highly correlated with the advanced price. Since inception of product formula pricing in January 2000, the correlation coefficient for the advanced and lagged monthly NASS butter prices is 0.99.

futures in both the given month and the previous month. For example, a producer locking in the September uniform butter price would sell both August and September butter contracts.

Table 5. Relationship Between Uniform Butterfat Price and Average Monthly NASS Butter Prices (January 2000-March 2006)						
Market	***Estimated Coefficients***			$\bar{R}^2$	***Lagged/ Current Coefficient Ratio***	***Class I % (2005)***
	Intercept	***NASSS Butter Price***				
		Current Month	***Lagged Month***			
Florida	-0.0700 (0.0157)	0.4540 (0.0270)	0.7205 (0.0264)	.994	1.587	82.3
Southeast	-0.0905 (0.0123)	0.6755 (0.0209)	0.5062 (0.0206)	.996	0.749	61.7
Appalachia	-0.0793 (0.0132)	0.6328 (0.0224)	0.5428 (0.0222)	.995	0.858	65.5
Arizona-Las Vegas	-0.1073 (0.0080)	0.9484 (0.0135)	0.2413 (0.0134)	.998	0.254	33.5

Note: Coefficient standard errors are in parentheses. All coefficients are statistically significant.

The estimated NASS Butter Price coefficients shown in Table 5 can be used to determine relative contract volumes in the current and lagged months' butter contracts. Consider a producer shipping to a plant regulated under the Florida order who wants to lock in the September uniform butterfat price. For each pound of butterfat that the producer anticipated marketing in September, the producer would sell about 0.45 pounds of September butter and 0.72 pounds of August butter. If this Florida herd has an expected September butterfat production of 10,000 pounds this would mean that the producer would sell 4,500 pounds of August butter and 7,200 pounds of September butter.

For a producer in the Arizona-Las Vegas order, the comparable contract volume per pound of expected butterfat production would be about 0.95 pounds of September butter and 0.24 pounds of August butter. The differences in the relative hedging volume of current and lagged month butter contracts reflect the proportion of the producer uniform butterfat price that depends on the Class I butterfat price (linked to the previous month's butter price) compared to Classes II, III, and IV butterfat prices (linked to the current month's butter price).

As in the case of a butter hedge in MCP markets, the butter contract volume is large relative to the monthly butterfat production of most herds. Plus direct hedgers would sell butter contracts in two months to hedge a single month's production of butterfat. On the other hand, producers in skim-butterfat markets would be hedging their entire month's butterfat production, not just the amount in excess of 3.5 percent. Assuming 60 pounds of butterfat production per cow per month, two butter contracts would be equivalent to the combined production of 555 cows. This large herd size along with the complexity of selling in two contract months means that the primary producer use of the butter contract will likely be though forward contracts offered by plants.

The very tight relationship between NASS butter prices and uniform butterfat prices in skim-butterfat markets means basis risk is very small as measured per pound of butterfat. About the only risk are large swings in Class I utilization from historical levels, in which case the current and lagged month weights applied to butter contracts would correspondingly change. It should be noted that unlike MCP markets with high Class III milk utilization rates and periodic depooling, utilization percentages have been relatively constant in skim-butterfat markets.

Hedging risk is principally in matching volume with contract size, and that is not a concern if forward contracting is used rather than direct hedging. Jersey producers would be advised to limit the amount of butterfat forward contracted to something less than anticipated butterfat production in order to prevent taking on a speculative position in the event that production fell short of contract volume.

Summary

This report demonstrates the use of a new tool that may assist dairy farm operators in managing milk price risk. The new cash-settled butter futures contracts can serve as an adjunct to the current Class III futures and options contracts.

Hedging butterfat can reduce milk price volatility, especially for owners of dairy herds with relatively high butterfat tests. But given the size of the butter contract compared to butterfat production of most herds, the primary hedging use may be through butterfat forward pricing programs offered by dairy plants. The full report from which this publication was derived contains a description of how a dairy plant may operationalize a butterfat forward pricing contract using the cash settle butter futures contract.