DAIRY MARKETS
And POLICY
ISSUES AND OPTIONS

O-8

January 1993

ISSUES AND OPTIONS FOR USING MULTIPLE COMPONENT PRICING TO SET PRICING IN FEDERAL MILK MARKETING ORDERS

Robert Cropp, University of Wisconsin
Walter Wasserman, Cornell University

Changes in the Market

Since the introduction of the Babcock test for milkfat, over a century ago, milkfat has been the most valued constituent of milk and the predominant variable in our existing pricing system. Milk has basically been priced on the value of its milkfat and the remaining nonfat or skim milk portion. The skim milk component, however, has been subject to few price adjustments.

During the last several years a number of market developments have fundamentally changed the character of the marketplace. Some are long term trends that have recently accelerated, such as the increasing consumer demand for lowfat milk and dairy products. Others may be more recent, such as the interest in calcium. The current health and nutrition fads have increased consumer dietary concerns and have encouraged a sharp increase in demand for new lowfat and nonfat milk and dairy products (i.e. lowfat frozen yogurt, light ice cream, etc.). This trend is expected to continue, and will further reduce milkfat values relative to nonfat solids.

During the 1970s, both the Dairy Price Support Program (DPSP) and Federal Milk Marketing Order (FMMO) policies tended to increase the price of skim milk and nonfat solids relative to the price of milkfat, but this trend stalled during the massive build-up of U.S. government and world stocks of NDM during the early 1980s. More recently, as a result of European dairy quotas and our own Dairy Termination Program (DTP) these stockpiles have been dramatically reduced. For a period during 1988-1989, tightened international markets for nonfat dry milk strengthened world prices allowing domestic production to again be competitive in overseas markets. The resulting strong export demand contributed greatly to gains in U.S. dairy markets. The world market for nonfat dry milk did weaken, however, during 1990 and 1992. On the other hand, generally weak markets for cream-based products have resulted in a recurring build-up of CCC butter inventories, which prompted USDA decisions tilting CCC purchase prices toward NDM and away from butter.[1]

The continued strong growth of commercial cheese markets has further heightened competition for manufacturing milk supplies, which in turn has resulted in the widespread use of competitive procurement premiums and protein and quality premiums, as well as product yield pricing to improve cheese yields and keep cheese plants competitive.

Over the last 10 to 20 years multiple component pricing systems have been discussed and explored, and they are slowly replacing the longstanding practice of adjusting prices only for the butterfat content of milk. It is estimated today that as much as 80 percent of the U.S. milk supply is marketed to buyers who offer multiple component pricing of one form or another. The State of California, which represents about one-seventh of the nation's milk supply, has required MCP since 1962. Lastly, and of great importance, was the inclusion of the first formal multiple component pricing (MCP) plan under the Great Basin Federal Milk Marketing Order in April 1988. The promulgation hearing for the new Carolina order included a proposal for MCP, but USDA did not recommend it. MCP was introduced in the Middle Atlantic FMMO in April 1991 and is presently being considered for the Eastern Ohio-Western Pennsylvania, Ohio Valley, Indiana, and Southern Michigan orders. This stimulated additional activity toward the inclusion of MCP in other federal milk marketing orders. In a move to address certain market issues and recognizing the benefits of a comprehensive approach, the FACT Act of 1990 instructs USDA to invite MCP proposals in all FMMO areas.

Given these developments, what are the issues and implications of including multiple component pricing within the Federal Milk Marketing Order pricing system?

---

[*]Robert Cropp, Professor and Extension Dairy Marketing and Policy Specialist, University of Wisconsin-Madison. Walter Wasserman, Regional Milk Marketing Specialist, Cornell Cooperative Extension .

[1]See Leaflet 5 for a further discussion of how the DPSP affects the markets for butter, NDM, and cheese.

This paper is part of a series entitled "Dairy Markets and Policy—Issues and Options," a project of Cornell University's Program on Dairy Markets and Policy.

Multiple Component Pricing Defined

Component pricing (CP) may be defined as any payment plan that prices milk on the basis of volume and one major component, most commonly milkfat content. Thus, a price differential based on fat (butterfat differential) is CP. A butterfat differential is still the most commonly used price differential, and, with the exceptions noted above, the only price differential used in pricing milk under federal milk marketing orders.

Multiple component pricing, in contrast to CP, is the pricing of milk on the basis of two or more of its component parts. The possible components that might be priced include: skim milk, milkfat, total solids, solids-not-fat, protein, lactose, and a fluid carrier (water). Milkfat, protein, and solids-not-fat are the components that are most often separately priced under MCP plans. Quality factors can also be included in MCP.

What Are the Issues?

The average composition of 100 pounds of raw milk is as follows:

Milkfat	3.67	lbs.
Protein	3.20	
Lactose	4.75	
Minerals	.65	
Water	87.73	
Total	100.00	lbs.

However, the composition of milk varies among individual cows and dairy herds, and by season of the year. Both the milkfat and protein content are variable. Lactose and mineral content are fairly constant. Thus, the solids-not-fat content varies primarily with a change in protein content. This is why many dairy producers are demanding that their milk be tested for and paid on the basis of both fat test and protein or solids-not-fat. There is considerable economic justification for doing so. Both the fat and solids-not-fat in milk contribute to its market value. A differential based only on fat test does not adequately reflect both fat and solids-not-fat. On average, for each one percent change in fat test, solids-not-fat changes four tenths of one percent in the same direction. However, there are significant deviations from this average fat to solids-not-fat ratio among individual cows and dairy herds. It is this deviation from the average that raises an equity question for a milk payment plan based solely on a fat test. A simple differential based on the price of fat (butterfat differential) may not adequately reward the producer of milk that is high in protein. Similarly, it may overcompensate a producer with below average milk composition.

The fat and solids-not-fat or protein content particularly affects the market value of milk if it is used for manufacturing purposes—cheese, butter, ice cream or milk powder. The approximate increased yield of manufactured products with an additional one pound of protein in 100 pounds of milk is as follows:

1.75 pounds of cheese
1.00 pound of nonfat dry milk
1.00 pound of ice cream
6.00 pounds of cottage cheese

As a result, manufacturing milk plants, particularly cheese plants, are adopting MCP payment plans. Some cheese plant operators claim it is difficult for them to operate under a pricing system designed for a fluid (beverage) milk market. Producers have bred and fed their cows for volume and not milk composition.

Fluid milk plants, on the other hand, have not been eager to adopt MCP. While higher protein content increases the yield of manufactured dairy products, it does not increase the yield of milk for fluid purposes. Higher solids content does improve the nutritional value of fluid milk and test panels indicate some consumers prefer a higher solids beverage milk product. Present minimum federal standards require 8.25 percent minimum solids-not-fat for all beverage milk. Beyond this level, fluid plants argue they get no higher return to cover their costs of solids-not-fat. Raising the minimum federal standards has been suggested as a means of addressing this problem.

The interest in MCP continues to grow as an increasing share of the milk production is used for manufactured dairy products, particularly cheese. In 1960, 43.1 percent of the milk marketed nationally was utilized for fluid milk and cream, 24.9 percent for butter and associated skim milk products, and only 10.9 percent for cheese, with a total of 56.9 percent for all manufacturing milk products. By 1990, fluid utilization had dropped to 37.4 percent and butter fell to 16.9 percent, but cheese accounted for 32 percent of the milk, and all manufactured dairy products represented 62.6 percent. Cheese is expected to utilize an even larger share of the milk supply during the next decade.

Even with federal milk marketing orders, the trend has been for less milk to be used for class I (beverage) purposes and more to be used for manufactured milk products. The average class I utilization in 1960 for all of the federal milk marketing orders was 64.2 percent. The average class I utilization for 1990 was 42.7 percent. In addition, the trend has been from whole milk to low fat and skim milk. The value of milkfat has declined with this trend towards lower fat milk and milk products. As a result, the fat value in 100 pounds of milk relative to skim value has also declined. In 1960, the average producer blend price for all federal orders was $4.47 per hundredweight. Fat accounted for 55 percent of this value and skim milk 45 percent. The average producer blend price for all orders in 1990 was $13.78 per hundredweight. Milkfat accounted for just 30.5 percent while skim milk accounted for

69.5 percent. The continued trend toward higher proportionate values on the skim milk side of milk argues ever more strongly for testing and pricing of the skim milk components.

Why is MCP an Issue for a National Federal Order Hearing?

Current provisions of most federal milk marketing orders do not allow for MCP. Producer prices under orders may only be adjusted for fat tests above or below 3.5 percent milkfat. Federal milk marketing orders require handlers (milk plants) to pay producers at least the established minimum blend price adjusted for fat content. If handlers deducted for below average protein content, they would be in violation of minimum federal order pricing. Thus, federal milk marketing orders need to be amended to allow for a true MCP program.

Although most federal milk marketing orders do not allow for MCP, producers in 29 of the 42 existing federal order markets were eligible for industry-sponsored MCP premium payments during May 1991.[2] Industry-sponsored or voluntary use of MCP programs by federal order plants is the result of competition for producers as well as increased recognition of the different economic values of milk components, particularly in class III uses (cheese, butter, and nonfat dry milk). These plants are paying premiums for above average protein or solids-not-fat content, but deductions for below average content are unusual. Dairy cooperatives are exempt from paying the minimum producer blend prices and could deduct for lower protein. However, in reality, competition prevents cooperatives from doing so. Without both premiums and deducts for milk composition there is not a true MCP program.

Those who advocate that federal milk marketing orders should be amended to allow for MCP pricing do so on the following basis. It would be a more equitable method of paying producers, particularly because over half of federal order milk is utilized for manufactured dairy products. Second, an increasing number of MCP plans are operating outside the federal order program, as industry-sponsored programs. These programs are often quite dissimilar, resulting in confusion, inequity, and even inefficiency in the market place. MCP under federal milk marketing orders would help to create uniformity, stability and equity in fluid milk markets.

Proposals for MCP in Federal Milk Order Markets

A primary objective of a federal milk marketing order is to ensure equal raw product costs on competing milk handlers. On class II and class III (manufactured milk products), testing and pricing for protein or solids-not-fat is economically feasible; handlers receiving higher solids milk will pay more because they can also sell more product from higher testing milk. Handlers receiving lower solids milk will pay less, but they will not have as much product to market. Thus, the equal raw product cost principle is observed.

On class I (beverage) milk, as indicated earlier, where yield differences do not exist, testing and pricing for protein would mean that some handlers would have higher raw product costs on fluid use milk as compared to others. To recover this higher cost, the handler would need to either reduce the solids-not-fat content to the minimum level and use the surplus solids-not-fat in another product or charge a higher price for beverage milk. Neither option is feasible. Therefore, fluid handlers who received milk with higher than average protein or solids-not-fat under MCP would incur higher costs than their competitors with no practical way to recover these additional costs.

Different solutions to the problem of MCP for federal order markets have been suggested. One approach would be to price class I (beverage) milk as is currently done, that is, on the basis of volume plus a butterfat adjustment. Milk utilized as class II and class III would be priced on the basis of the milkfat and protein or solids-not-fat pounds used in each respective class. This procedure was adopted in both the Great Basin and Middle Atlantic FMMOs. The Great Basin order prices class II and class III milk on the basis of milkfat and protein. The Middle Atlantic order prices class II and class III on the basis of milkfat and nonfat solids. The Appendix at the end of the paper illustrates pricing under the Great Basin and Middle Atlantic orders.

Determining protein or nonfat solids values is more difficult than determining fat values. Unlike fat, which can be easily separated out of milk and marketed as butter, protein or nonfat solids are not readily separated. In addition, the value of the protein or nonfat solids in milk varies depending upon what it is used for. It is difficult to obtain from the market additional value for added protein in beverage milk. Its value is not the same for all manufactured dairy products either. The same can be said for fat. Milkfat is worth more in cheese than in butter. Nevertheless, the value of protein varies more than fat depending upon how it is used. Therefore, some flexibility may be needed to incorporate MCP into federal order markets. In order to recognize differences in the way milk is utilized MCP payment plans may not be identical for all regions of the United States.

Importance of Milk Quality

In most instances, milk quality standards are used in conjunction with unregulated MCP programs. While more research is needed in this area, it is commonly known that

---

[2] See Industry-Sponsored Multiple Component Pricing Programs Applicable to Federal Milk Order Producers—May 1991 Update, Market Administrator Task Force, May 1992. Proposals for MCP in federal milk order markets.

milk quality affects dairy product yield. Research indicates that milk high in somatic cells tends to have a lower portion of protein content in the form of casein. Cheese yields are primarily determined by the casein content as well as the fat content of raw milk.

A 1991 Cornell study sheds further light on the relationships between somatic cell count and cheese yield.[3] It was concluded that any increase in milk somatic cell count above 100,000 cells/ml will have a negative impact on cheese yield efficiency for milk from groups of cows with similar milk somatic cell count. However, the change in cheese yield efficiency for commingled milk would not show this same trend. Herd milk will represent a weighted average of the milk characteristics from individual cows.

Further, high somatic cell count is associated with increased rennet coagulation time and a slower rate of curd firming during cheese making. Cheese manufacturers experience economic losses from reduced cheese yields and increased incidence of cheese quality defects from high somatic cell count milk. Without a quality standard to establish eligibility for protein premiums, a cheese plant could be paying some producers a premium when their high somatic cell count resulted in reduced cheese yields per hundred pounds of milk.

While authorizing legislation under the Agricultural Marketing Agreement Act of 1937 does permit the inclusion of milk quality standards under federal orders, their implementation involves substantially greater regulatory problems, thus complicating the quality issue.

Impact of MCP on Producers and the Industry

Implementing an MCP plan will not affect the total amount of money a dairy plant has available to pay its producers, at least in the short run. This is because product yields for the plant are unchanged. Thus, in the short run, the size of the revenue pie stays the same—only how it is divided up among the producers changes. Some producers will receive a higher price than currently and others will receive a lower price depending upon their fat and solids-not-fat composition.

In the long run, plant yields (cheese) and plant efficiency may increase with MCP plans, resulting in more money to be paid out to producers. This may come about for any of several reasons. First, producers may be able to enhance the solids content of their milk through feeding and cattle selection practices. Second, because there are considerable differences in milk composition across herds already, MCP could encourage high solids milk to gravitate to cheese and other manufacturing plants. Third, increased revenue could occur through improved consumer image of milk and milk products because of stressing components other than fat, thereby increasing demand and paying relatively higher prices.

In summary, MCP if properly incorporated into a federal milk marketing order, could result in more equitable milk pricing than both to producers and to milk plants.

[3] Barbano, D.M.; Rasmussen, R.R.; and Lynch, J.M., "Influence of Milk Somatic Cell Count and Milk Age on Cheese Yield." 1991 J. Dairy Sci. 74:369-388.

APPENDIX

Multiple Component Pricing Under the Great Basin Federal Milk Marketing Order (fat and protein).

Assume: M-W price for the month of $11.46; 7.3 cent butterfat differential; class I differential = $1.90; class II differential = 10 cents; protein test for previous month = 3.28 percent; 500,000,000 pounds of producer milk; 42 percent class I; 10 percent class II; 48 percent class III.

I. Component Values

(a) 7.3 cents
x 35 points
$2.555

(b) $11.46
- 2.555
$8.905 = value of 100# skim or
8.905¢ per pound of skim

(c) .965 x $8.905 = $8.593 value of 96.5 # skim
$11.46 - $8.593 = $2.867 BF value

$2.867÷ 3.5 # **$0.819 per pound BF**

(d) One pound of protein =

$$\frac{\text{96.5 \# skim x 8.905¢ per pound}}{\text{3.28 percent protein}} = \boxed{\text{\$2.62 per pound protein}}$$

II. Producer Protein Price

(a) 500,000,000 # producer milk x 42 percent class I = 210,000,000 pounds class I
210,000,000 # x 96.5 % skim = 202,650,000 pounds of skim in class I
202,650,000 # x 8.905¢ per pound = $18,045,982
PLUS

(b) 500,000,000 # -210,000,000 # = 290,000,000 pounds of milk in class II and class III
290,000,000 # x 3.28 percent protein = 9,512,000 pounds of protein
9,512,000 # x $2.62 per pound protein = $24,921,440
$18,045,982 + $24,921,440 = $42,967,422

(c) $42,967,422÷ 16,400,000 pounds protein in producer milk = **$2.62 producer protein price**

III. Weighted Average Differential Value (market has 500,000,000 pounds of producer milk).

210,000,000 pounds of class I x $1.90/cwt. = $3,990,000
PLUS
50,000,000 pounds of class II x $.10/cwt. = $ 50,000
Total $4,040,000

$4,040,000 ÷ 500,000,000 pounds = $0.808 Weighted Average Differential

<u>Monthly Pool Comparison</u>

I. Current System of BF/Cwt. Pricing:

Processor Pays In -------------> ($50 Million) --------> Pay Out To Producers

Blend: Cost of Milk at BF Test

II. Great Basin Plan:

Processor Pays In		$50 Million		Pay Out to Producers	
- Pounds of BF - Pounds of protein in class II and III - Class I skim milk computed at class III skim milk price - Class I and class II differentials on amounts of class I and class II milk	---------->		--->		- Pounds of BF - Producer protein price - Marketwide weighted average of class I and class II differentials per cwt.

<u>Producer Pay Price Example under Great Basin</u>

Assume: 75,000 pounds of milk; 3.8% fat test; 3.2% protein test

75,000 # x 3.8% fat = 2,850 # fat x $0.819/lb.	=	$2,334.15
75,000 # x 3.2% protein = 2,400 # protein x $2.62/lb.	=	$6,288.00
75,000 # x $0.808/cwt. weighted differential	=	$ 606.00
Total Producer Milk Check	=	$9,228.15

APPENDIX (continued)

Multiple Component Pricing Under the Middle Atlantic Federal Milk Marketing Order (fat and nonfat solids).

Assume: M-W price for the month of $11.46; 7.3 cent butterfat differential; class I differential = $1.90; class II differential = 10 cents; nonfat solids test for current month = 8.68 percent; 500,000,000 pounds of producer milk; 48 percent class I; 10 percent class II; 42 percent class III.

I. Component Values

(a) 7.3 cents
x 35 points
$2.555

(b) $11.46
- 2.555
$8.905 = value of 100# skim or
8.905¢ per pound of skim

(c) .965 x $8.905 = $8.593 value of 96.5 # skim
$11.46 - $8.593 = $2.867 BF value

$2.867÷ 3.5 # **$0.819 per pound BF**

(d) One pound of nonfat solids =

$$\frac{\text{96.5 \# skim x 8.905¢ per pound}}{\text{8.68 percent nonfat solids}} = \text{\$0.99 per pound nonfat solids}$$

II. Producer Nonfat Solids Price

(a) 500,000,000 # producer milk x 48 percent class I = 240,000,000 pounds class I
240,000,000 # x 96.5 % skim = 231,600,000 pounds of skim in class I
231,600,000 # x 8.905¢ per pound = $20,623,980
PLUS

(b) 500,000,000 # -240,000,000 # = 260,000,000 pounds of milk in class II and class III
260,000,000 # x 8.68 percent nonfat solids = 22,568,000 pounds of nonfat solids
22,568,000 # x $0.99 per pound nonfat solids = $22,342,320
$20,623,980 + $22,342,320 = $42,966,300

(c) $42,966,300÷ 43,400,000 pounds nonfat solids in producer milk = **$0.99 producer nonfat solids price**

III. Weighted Average Differential Value (market has 500,000,000 pounds of producer milk).

240,000,000 pounds of class I x $3.03/cwt. = $7,272,000
PLUS
50,000,000 pounds of class II x $.10/cwt. = $ 50,000
Total $7,322,000

$7,322,000 ÷ 500,000,000 pounds = $1.464 Weighted Average Differential

<u>Monthly Pool Comparison</u>

I. Current System of BF/Cwt. Pricing:

Processor Pays In -------------> ($50 Million) --------> Pay Out To Producers — Blend: Cost of Milk at BF Test

II. Middle Atlantic Plan:

Processor Pays In	---------->	$50 Million	--->	Pay Out to Producers	
- Pounds of BF - Pounds of nonfat solids in class II and III - Class I skim milk computed at class III skim milk price - Class I and class II differentials on amounts of class I and class II milk					- Pounds of BF - Producer nonfat solids price - Marketwide weighted average of class I and class II differentials per cwt.

<u>Producer Pay Price Example under Middle Atlantic</u>

Assume: 75,000 pounds of milk; 3.8% fat test; 8.68% nonfat solids test

75,000 # x 3.8% fat = 2,850 # fat x $0.819/lb.	=	$2,334.15
75,000 # x 8.68% nonfat solids = 6,510 # nonfat solids x $0.99/lb.	=	$6,444.90
75,000 # x $1.464/cwt. weighted differential	=	$1,098.00
Total Producer Milk Check	=	$9,877.05