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DAIRY Fact Sheet

Marketing 2.200

THE BUTTERFAT DIFFERENTIAL

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No concept in pricing raw farm milk is quite as misunderstood as the butterfat differential. The butterfat differential is an important factor used to determine the uniform producer price in nearly all the Federal Milk Marketing Orders of the United States. In fact, the butterfat differential is used in the Texas Milk Marketing Order to establish the value of butterfat and skim in the milk marketed by producers and in the milk used by processors.

While producers understand how the price they receive for milk is related to the butterfat content, they do not understand how the butterfat differential pricing is one form of component pricing. It involves changes in the amounts of a single component, butterfat, in a 100-pound unit of milk.

Butterfat differential pricing developed because butterfat used to be a major source of energy in the American diet. Butterfat was also the first component of milk that could be measured easily and accurately. Without an understanding of butterfat differential pricing, it is often difficult to understand the concept of multiple component milk pricing.

This leaflet 1) defines the butterfat differential, 2) illustrates how it is used to derive the price of the butterfat and skim components in producer and processor milk, and 3) illustrates how these prices are applied to determine the value of processor milk and the uniform price received by producers.

Definition of the Butterfat Differential

Currently the butterfat differential is defined as the difference between the price of 1/10 pound of butterfat and the price of 1/10 pound of skim. The value of 100 pounds of milk changes by the amount of the butterfat differential for each 1/10-pound change in butterfat. As the butterfat content changes in 100 pounds of milk, the weight of the milk remains 100 pounds but the composition changes. In 100 pounds of milk testing 3.5 percent butterfat, there are 3.5 pounds of butterfat or thirty-five 1/10-pound units of butterfat.

Figure 1 compares two 100-pound units of milk. Unit A contains 3.5 pounds of butterfat and 96.5 pounds of skim. Unit B contains 3.4 pounds of butterfat and 96.6 pounds of skim. Each 1/10 pound of butterfat is priced at $.177. Each 1/10 pound of skim is priced at $.008.

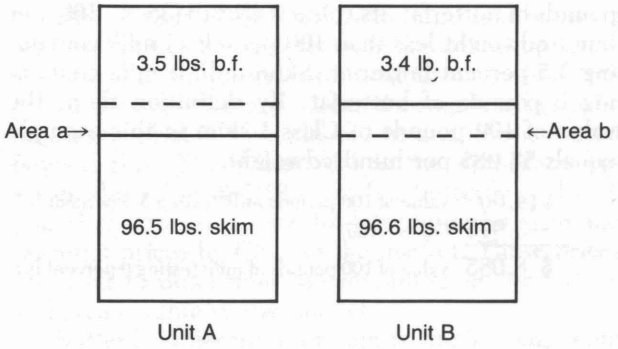

Figure 1. The butterfat differential illustrated.

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The value of B is $.169/cwt.[1] less than A because Area b contains 1/10 pound skim while Area a contains 1/10 pound fat. When the 1/10 pound of skim replaces the 1/10 pound of fat in B, we give $.177 in value of butterfat, but gained $.008 in value of skim. The result is:

$$\begin{array}{r} -\$.177 \\ +.008 \\ \hline -\$.169 \end{array}$$

The $.169 difference is the butterfat differential. By definition, the value of 1/10 pound of butterfat is the sum of the price of 1/10 pound of skim milk and the butterfat differential, that is:

$-\$.008$	price of 1/10 pound of skim
$+ .169$	butterfat differential
$-\$.177$	price of 1/10 lb. of butterfat

One pound of butterfat is equal to 10 times the value of 1/10 pound of butterfat, or $1.77. The prices per pound of butterfat and of skim in milk can be calculated from the price per hundredweight of milk and the butterfat differential.

Calculating Producer Prices for Butterfat and Skim Milk from the Butterfat Differential

To determine the uniform pay price in a federal order, the market administrator must calculate the producer pay prices for the butterfat and skim portions of producer milk in each class of utilization.

The first step is to determine the value of 100 pounds of skim milk. As an example, assume the price of 100 pounds of producer milk used in Class I and testing 3.5 percent butterfat is $14.00. Assume the value of the butterfat differential is $.169 per 1/10 pound. Keep in mind that the value of 100 pounds of milk varies by $.169 for each 1/10 pound change in butterfat up or down from the 3.5 percent level. Therefore, if 100 pounds of Class I milk contain 0 pounds of butterfat, its value is $5.915 (35 × .169) per hundredweight less than 100 pounds of milk containing 3.5 percent butterfat. Skim milk is milk containing 0 pounds of butterfat. By definition then, the value of 100 pounds of Class I skim in this example equals $8.085 per hundredweight.

$14.00	value of 100 pounds milk testing 3.5 percent b.f.
-5.915	(35 × .169)
$ 8.085	value of 100 pounds of milk testing 0 percent b.f.

Using this result, we can compute the prices of one pound of Class I skim and one pound of Class I butterfat. The price of this one pound of skim milk is $8.085 ÷ 100 = $.08085.

To calculate the price of one pound of butterfat, use the price per pound of skim milk to calculate the value of 96.5 pounds of skim in 100 pounds of milk testing 3.5 percent butterfat. Multiplying 96.5 pounds of skim by the price per pound of skim gives a value of $7.80 to the skim portion of the milk (.08085 × 96.5 = $7.80). By subtracting the value of 96.5 pounds of skim from the total value of 100 pounds of milk, the value of the fat portion of the milk can be determined:

$$\begin{array}{r} \$14.00 \\ -\ 7.80 \\ \hline \$\ 6.20 \end{array}$$

The value of 3.5 pounds of butterfat is $6.20. Therefore, one pound of butterfat is worth $1.77/pound: ($6.20 ÷ 3.5 pounds = $1.77 per pound). The same procedure is used to calculate the fat and skim prices for each class of utilization.

Applying the Fat and Skim Prices

The market administrator in the Texas Milk Marketing Order uses the method just described to determine uniform price. The uniform price is the minimum blend price paid to producers supplying the market and qualifying to share the total market pool (see Dairy Fact Sheet L-2053, Marketing 2.0200, November, 1982).

Assume the market administrator calculates the following prices[2] for each class using the method just outlined, and assume the average butterfat test for all milk in the market is 3.67 percent butterfat:

> $.08085/pound for Class I skim; $.06285/pound for Class II skim; $.06185/pound for Class III skim; $1.771/pound for Class I butterfat price; $1.753/pound for Class II butterfat price; and $1.705/pound for Class III butterfat.

Also, assume the milk handlers in the market report the total utilization for the month shown on the following chart. Dividing the total pool by the total pounds of milk used in the market results in the blend price.

The uniform price for 300 million pounds of milk testing 3.67 percent butterfat in the market is $13.653/cwt. of milk ($40,959,650 ÷ 300 million pounds × 100 = $13.653).

Since the milk in the example tested 3.67 percent

[1]The value of the butterfat differential for any given month in the Texas Milk Marketing Order is the monthly average of wholesale selling prices per pound of Grade A bulk butter at Chicago as reported by the USDA for that month, times 0.115. For example, if the average price of butter at Chicago was $1.47 per pound, the value of the butterfat differential is $.169 (1.47 x .115).

[2]Using a butterfat differential of $.169 (see footnote 1).

Class	Skim	Butterfat	Total Milk
		Million Lbs.	
I	197	3	200
II	53	7	60
III	39	1	40
Total	289	11	300

Combining prices and utilization results in the total market pool.

Million Lbs.		Price/Lb.		Total Dollars
197	×	.08085	=	$15,927,450
53	×	.06285	=	3,331,050
39	×	.06185	=	2,412,150
3	×	1.771	=	5,313,000
7	×	1.753	=	12,271,000
1	×	1.705	=	1,705,000
300				$40,959,650

butterfat, the uniform price adjusted to 3.5 percent butterfat milk is calculated as follows:

36.7 points of fat in 3.67 percent butterfat
−35.0 points of fat in 3.5 percent butterfat
1.7 points

1.7 × .169 (the value of the butterfat differential) = $.2873 (the value of 1.7 points butterfat).

$13.653
− .287
$13.366 is the uniform blend price of produce milk testing 3.5 percent butterfat.

Fat and Skim Prices and the Value of Cream

Often cream prices are quoted as the price per pound of butterfat in the cream. Normally, cream is 38 percent butterfat and 62 percent skim milk. If the cream is to be used for ice cream, then Class II prices are used to calculate the values of cream.

The value of cream testing 38 percent butterfat is calculated as follows:

38 lbs. × $1.753[3] = $66.614
62 lbs. × $0.06285[4] = $ 3.897
$70.51 = value of 100 pounds of cream (testing 38 percent b.f.) at Class II prices

[3]The Class II butterfat price.

[4]The Class II skim price.

The minimum order price per pound of cream with 38 percent butterfat would be $.705. To determine the minimum order price per pound of this 38 percent cream (based on butterfat content) the value of 100 pounds of cream must be divided by 38 pounds of fat (70.51 ÷ 38 = $1.856). The $1.856 is the price per pound of cream. The value of cream would increase as the percentage of butterfat increased and vice versa. For example, if cream tested 40 percent butterfat, then the value of 100 pounds of cream for Class II usage would be:

40 × 1.753 = 70.12
60 × 0.06285 = 3.771
73.891

Then the price per pound of cream (based on a butterfat content of 40 percent) would be:

$$\frac{73.891}{40} = \$1.8617 \text{ per pound}$$

The butterfat differential is an important but little understood factor in determining the uniform price in the market. Producers are familiar with how the prices they receive are adjusted using the butterfat differential, but few people understand how it is used beyond this. The differential is the difference between the value of 1/10 pound of butterfat and 1/10 pound of skim. It is used to determine the skim and butterfat prices by Class in the market. These prices are used to determine the minimum uniform price and cream value in the market.

Butterfat differential pricing is single component pricing. Understanding single component pricing is essential to understanding multiple component pricing. If the butterfat differential is misunderstood or used incorrectly, it can lead to erroneous conclusions about the values of skim and butterfat in producer milk.

Other Information Sources

Federal Milk Marketing Order 126, Market Administrator's Office, 11117 Shady Trail, P.O. Box 29529, Dallas, Texas 75229-0529

Jacobson, Robert E., and Francis E. Walker, "Efficiency Considerations in Butterfat Differential and Component Pricing of Milk," *American Journal of Agricultural Economics*, Vol. 55; No. 2: pp 214-216, May, 1973.

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