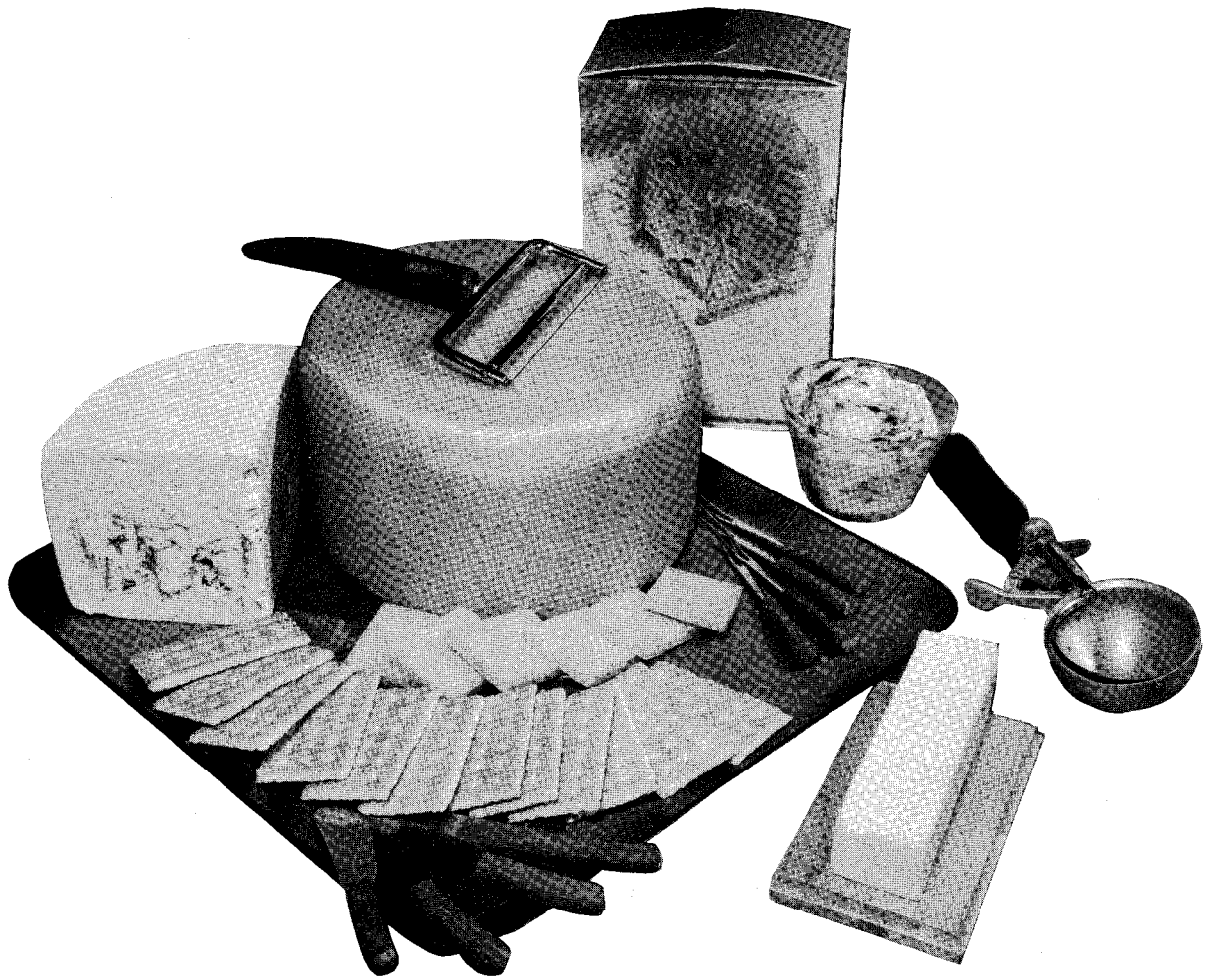
Study of Prices For Milk In Manufacturing Uses



BY JEROME W. HAMMOND AND TRUMAN F. GRAF
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Jerome W. Hammond and Truman Graf*

Preface

Research relating to manufacturing grade milk prices in Wisconsin and Minnesota and various measures of manufacturing milk values, was conducted by the University of Wisconsin and the University of Minnesota. Assistance and cooperation were received from the Consumer and Marketing Service and Statistical Reporting Service of the USDA and the Wisconsin and Minnesota State Departments of Agriculture. Results of this research were originally published by the Department of Agricultural Economics, University of Wisconsin, as Staff Series Paper No. 23, "Analyses of Manufacturing Grade Milk Prices in Minnesota and Wisconsin and Various Measures of Manufacturing Milk Values," July 1968. The Wisconsin publication and this bulletin are similar except for editorial changes and a slight revision of the statistical analysis in Appendix 4.

Acknowledgment is given to Robert March and Joel L. Blum, Dairy Division, Consumer and Marketing Service, USDA for their ideas and assistance. Also, the authors thank George Steele, George Otterdahl, and Warren Erickson of the Minnesota State Department of Agriculture and Claire Jackson, Donald Konsoer and Hugh Stewart of the Wisconsin State Department of Agriculture, and Donald Stitts of the University of Minnesota. They collected the data and provided information on regulatory programs. Financial assistance for the study was provided by the Market Order Administrators of the Federal Milk Orders in Minnesota and Wisconsin.

Glossary of Terms

Blend price — Average milk price for a market which is based on the quantities of milk in Class I and Class II uses and the respective prices for milk in each of these uses.

Class I milk — Milk of Grade A quality which is used in fluid products.

Class II milk — Milk of Grade A quality which is used in manufactured dairy products.

Current ratio — Current assets divided by current liabilities.

Equity ratio — Total equity divided by total assets.

Overrun — Amount in percentage terms by which the pounds of butter exceeds the pounds of butterfat received by the plant.

Product price formulas — A formula for determining milk values. It is based on product yields per hundredweight of milk, prices of those products and manufacturing allowances.

"Snubber" — In federal milk orders, this is a maximum price which processing plants will be required to pay for milk used in manufactured products. The price is calculated from butter-powder product price formula.

Summary and Conclusions

This publication describes and evaluates various milk price series used in administered price programs for fluid milk markets. Factors which affect the level of reported prices used in the price series are also evaluated. Major findings of the study include the following:

1. Several measures of manufacturing milk values have been developed by the USDA for federal order pricing. Some are competitive pay price series based on prices reported by dairy plants. Others are based on product prices, product yields, and estimates of processing costs. In recent years there has been a shift from use of product price formulas to competitive pay price formulas in federal milk order pricing provisions. One advantage of competitive price series is its responsiveness to costs of processing inputs other than milk, and to changing technology. The main advantage of using product price formulas is ease of calculating the value; but, keeping cost allowances up to date is a problem. Often product price formulas that have not been updated have tended to provide for a lower price for surplus milk than have competitve pay prices.

   Although product price formulas and competitive pay price series differ in mechanics, both measures have common problems. Both measures are an average — so efficient plants can afford to pay more than the average, while inefficient plants can not. In some instances, pay-in an average "series" price may result in substantial profits for some plants and causes other plants to operate at a loss.
2. The Minnesota-Wisconsin price series is one of the most widely used measures of milk values in the country. It is used in establishing Class I prices in all but the six New England and mid-Atlantic federal order markets. It is likewise a factor in determining surplus Class prices in more than one-half the federal order markets, and the number is continuing to grow.
3. The Minnesota-Wisconsin price series is a good estimate of the final average manufacturing milk prices paid in the two states. For the 77-month period, August 1961 to December 1967, the difference between the announced estimates of the Minnesota-Wisconsin price and the final averages of prices reported paid at all manufacturing plants in the two states averaged 0.6 cents per hundredweight for milk testing 3.5 percent butterfat.
4. Discrepancies between reported and actual milk prices of dairy plants occurred. Overstatement of milk prices oc-

* The authors are, respectively, Associate Professor, Department of Agricultural Economics, University of Minnesota and Professor, Department of Agricultural Economics, University of Wisconsin.

curred because of understating butterfat tests; 4.4 cents per hundredweight in 26 representative Minnesota plants, 3.8 cents per hundredweight in 26 representative Wisconsin plants, and an average of 4.1 cents per hundredweight for the 52 Minnesota and Wisconsin plants, combined. Though exhibiting a wide range of variation, the estimated amount of butterfat actually purchased by plants from the farmers exceeded the amount of butterfat reported to farmers for 50 of the 52 plants. The highly technical nature of determining fat content results in a high potential for error. These errors may be known or unknown.

Hauling subsidies resulted in an understatement of 1.4 cents per hundredweight in reported prices, and cash refunds resulted in an understatement of 2.1 cents per hundredweight in reported prices for the two states combined.

Thus, on the average, reported prices paid by these 52 plants exceeded actual prices paid, by 0.6 cents per hundredweight.

5. Low paying plants in each state understated butterfat tests to a larger extent than did the higher paying plants — 1.94 percent for low paying plants compared to 1.42 percent for the high paying plants, in the two states combined. Accordingly, low paying plants overstated their price more than did the high paying plants — 5 cents per hundredweight for low paying plants compared to 3.9 cents for high paying plants in the two states combined. Thus, upward bias in reported farm milk prices was not due to greater overstatement of price by high paying plants than by low paying plants.
6. Classification of cooperative dividends (patronage refunds) by milk pay price groups for the 52 plants surveyed indicated the lowest pay price group in the two states paid the largest cash and total patronage refunds per hundredweight; 3.7 cents cash dividends and 9.6 cents total dividends respectively. This was more than 1 cent per hundredweight above the high price group.
7. Survey plants with highest pay prices in the two states combined were making a small profit on hauling. As a result of this profit on hauling, high paying plants were paying farmers 0.3 cents per hundredweight *lower* actual prices than were being quoted. Plants with lower prices had losses on hauling and were, therefore subsidizing hauling. As a result of this subsidization of hauling, low paying plants were paying an average of 2.3 cents per hundredweight *higher* actual prices than were being quoted.
8. Proportion of gross income from specific manufactured products was a principal factor influencing the manufacturing milk prices paid by plants. Therefore, an average price reflecting prices at all types of manufacturing plants will not accurately reflect prices that plants manufacturing a particular product can afford to pay.
9. The high and middle pay groups had the highest percentage of capacity utilized — 26 percent, compared to 17 percent for the low paying plants. A relationship existed between plant pay prices and utilization of plant capacity — the higher the percentage of capacity utilized the higher the pay price.
10. High paying plants had lower profits than low paying plants. Specifically, high paying plants in the group of 52 plants surveyed had average plant profits of 3.5 cents per hundredweight, and total profits (including outside income) of 9.6 cents per hundredweight. These profits were about 1 cent lower than those of low paying plants.
11. High paying plants had lower depreciation reserves than lower paying plants. Depreciation set aside for high pay plants was 3.6 cents per hundredweight compared to 5.3 cents per hundredweight for low paying firms. Depreciation set aside as a percentage of fixed assets was 5.9 percent for high paying plants, and 6.2 percent for low paying plants.
12. High-pay plants generally are less financially stable than lower pay plants. For example, the average equity ratio (total equities divided by total assets) was 63.1 for high paying plants, and 75.0 for low paying plants.
13. High-pay butter plants had a 6 cent per hundredweight lower total expense than low-pay butter plants. High-pay butter-powder plants had a 19 cent per hundredweight lower expense than low-pay butter-powder plants. However, high-pay cheese plants had a 7 cent per hundredweight higher cost than low-pay cheese plants. The lack of a normal cost-price relationship in cheese plants may be caused by the many types and styles of cheese, and the resulting differences in costs and returns.
14. In several federal order milk markets with facilities for making only one manufactured product, the competitive price series for surplus milk is modified by using a "snubber" (a formula value based on butter-powder product prices). If the manufacturing series price exceeds the snubber price, the snubber becomes the pricing factor since plants are not required to pay more than that price. Although the snubber provides relief for butter-powder plants when significant differences between the Minnesota-Wisconsin prices and butter-powder product values prevail, there is some question about the snubber carrying out the surplus pricing objective of providing the highest possible returns to producers.
15. More accuracy in calculation of competitive manufacturing milk pay prices, and greater acceptability of these prices in federal order surplus milk pricing could result if:

    a. more detail could be reported for price series which are used for various regulatory programs. Average hauling subsidies, separate can and bulk prices, some estimate of average cash patronage refunds, and average butterfat differentials would be useful.

    b. the "All Manufacturing" U.S. milk price series could be substituted for the 3-product U.S. manufacturing price series. They yield approximately the same price. However, the "All Manufacturing" price series includes more products.

    c. cheese and butter-powder breakdown were included in the Minnesota-Wisconsin series. This would provide the incentive to shift from cheese to butter-powder, or butter-powder to cheese when product prices change. It would overcome the objection that regulated federal order handlers are required to pay more for milk used in manufactured dairy products than non-federal order manufacturing milk plants.

    d. additional resources were devoted to the states' programs to assure accurate weighing, testing, and reporting of milk purchases and sales. The number of plants involved and the highly technical accounting procedures require more resources than the states are able to devote to the programs.

    e. a federal order for manufacturing grade milk were established. Such an order would provide a more comprehensive program of butterfat and weight verification.

Chapter I

Pricing Surplus Milk in Federal Order Markets

Introduction

Federal milk orders encourage an adequate supply of fluid milk to meet market needs and they maintain and promote orderly marketing in the public interest. These functions are partly accomplished by the classified pricing and pooling plans applied under the orders.

In addition to day-to-day and seasonal variations in production, consumer purchases of milk vary from day-to-day and month-to-month. Because of these variations, "daily reserve" and "seasonal reserve" supplies of milk are necessary and inevitable to supply any fluid milk market. The amount of milk in reserve may vary considerably from market-to-market, depending upon differences in milk production and consumption, market organization, size of the marketing area, and how well the available supplies are distributed over the market in accordance with individual plant needs for fluid milk. The presence of these reserves is a basic reason for the application of the classified price plan in fluid milk markets.

Class I prices are designed to encourage an adequate supply of milk. A major objective of surplus pricing is to assure the orderly marketing of the reserves associated with an adequate supply. An equally important objective of surplus pricing is to promote the use of available supplies of milk to provide the highest possible return to producers, consistent with cost-price relationships for manufactured products.

Orderly disposition of surplus milk is a problem in surplus milk pricing. At any given time the price must be low enough so that manufacturing plants can afford to purchase the surplus milk. In the long-run, an attempt should be made to keep prices as high as possible and still provide adequate manufacturing facilities so surpluses can be disposed of for regulated markets.

Reserves are marketed as ice cream or cottage cheese — so-called soft products — or products such as butter-powder and cheese. These products are sold in local or distant markets and sometimes compete with products processed from manufacturing grade milk, especially with respect to butter-powder and cheese. In establishing a price for surplus milk in a fluid milk market, the general level of competitive prices paid to producers by unregulated manufacturing plants indicates an appropriate level, unless these prices appear unreasonable.

The Nourse Committee in its 1962 report on the federal order program summarized the objectives in pricing surplus milk as follows: "While pricing surplus milk to avoid 'homeless' milk, extreme care must be exercised to price such milk so that (a) surplus handling is not so profitable as to encourage bringing more milk into the market in order to increase handler profits, (b) surplus is not withheld from Class I usage when needed, and (c) unstabilizing effects upon the markets of producers of manufacturing milk are avoided."* A surplus milk price which will accomplish these objectives requires a careful appraisal of the factors which influence the market for manufacturing milk and the level of surplus prices in federal orders.

* Report to the Secretary of Agriculture by the Federal Milk Order Study Committee, December 1962, p. 26.

Surplus milk prices should be low enough to encourage the use of available reserve supplies by manufacturers; but they should not be so low that Grade A milk is used only for manufacturing. Too low surplus milk prices over a period of time can disturb the marketing structure, particularly under a marketwide pool. If manufacturing milk prices are so low that more than normal profits are obtained by using market reserves, handlers and producer cooperatives will attempt to develop market milk supplies solely for manufacturing. New plants and new producers will be attracted to the market for this purpose alone.

When Class I prices are higher than necessary to attract an adequate supply of milk to the market they will greatly accelerate the development of manufacturing facilities. In any event, as more manufacturing milk comes to the market and blend prices go down, producers seek even higher Class I prices to maintain the blend price.

Low surplus prices may create other problems. Dairy products manufactured from surplus Grade A milk compete with products from manufacturing grade milk. If order surplus prices in a given market or markets are too low in relation to manufacturing grade prices, regulated handlers are given a competitive advantage.

If surplus milk is priced so high that handlers are unwilling to receive it, the purpose of the market order is defeated. For example, when surplus prices are too high they may cause financial problems for cooperatives located in markets with many nonmember producers. If proprietary handlers reject milk of their producers, it must be handled by the cooperative. If the surplus price is too high, cooperatives must handle surplus milk at a financial loss and the cooperative producers are penalized relative to non-cooperative producers in the market.

Objectives of the Study

This study evaluated various measures of manufacturing milk values used to price milk for manufactured dairy products. Particular attention is devoted to manufacturing milk values in Minnesota and Wisconsin.

Specific objectives of the study were to:

1. Evaluate various measures of manufacturing milk values.
2. Find out if reported pay price series accurately reflect the average of reported prices for the universe they represent.
3. Find and measure differences that may exist between milk prices actually paid by dairy plants for manufacturing grade milk and the prices reported as paid.
4. Determine the relationship between certain market and operating variables for milk plants, and the prices paid by these plants for manufacturing grade milk.
5. Describe and evaluate those aspects of the trade practice programs of the Minnesota and Wisconsin State Departments of Agriculture which concern the accuracy of accounting for milk purchased by plants and reporting plant information.
6. Consider the implications of various measures of manufacturing milk values with respect to establishing surplus class prices in federal order milk markets.

Methods Used to Obtain Values of Manufacturing Milk

Two types of formulas are used to price surplus milk for manufacturing purposes in federal orders. They are: (a) *product price formulas* which are calculated by multiplying prices for the products (such as butter, nonfat dry milk, and cheese) by yield factors, then deducting a manufacturing allowance and (b) formulas based on prices paid at unregulated manufacturing plants — commonly called *competitive pay price series* (such as the "Midwest Condensery" price, "local plant" averages, "U.S. average 3-product manufacturing grade milk" price, and the "Minnesota-Wisconsin" price).

Both types of formulas are used to price surplus milk in federal order markets but there has been a shift in emphasis from product price formulas to competitive pay price formulas — especially to the Minnesota-Wisconsin price. The Midwestern Condensery price and local plant averages have also declined in importance. Table 1 lists the pricing factors used for surplus class pricing in federal order markets in December 1956 and October 1967. A competitive pay price series was used as a factor in pricing surplus milk in 81 percent of the federal order markets in 1967.

Table 1. Pricing factors used for surplus class pricing in federal order markets December 1956 to October 31, 1967

Price factors	Number of markets		Number of markets as percent of total	
	1956	1967	1956	1967
Minnesota-Wisconsin price only	0	31	0	42
3-Product (U S. mfg.) price only	0	8	0	11
Local plant price only	11	0	16	0
Product price:				
One	16	10	24	14
More than one	4	4	6	5
Minnesota-Wisconsin price in conjunction with:				
Another competitive pay price	0	2	0	3
Product price	0	15	0	20
Other competitive pay price(s) and product price(s)	37*	4	54	5
Total number of federal order markets	68	74	100	100

* The Midwestern condensery price was used as the competitive pay price factor in 10 orders. It was used as one of the competitive pay price factors in another 8 orders.

Competitive Pay Price Series

Midwestern Condensery Price Series

The "18 Condensery" or "Midwestern Condensery" price series was the first competitive pay price series used to price manufacturing milk in federal order markets. The amended Chicago order, effective July 1, 1940, provided for pricing Class III milk (evaporated and condensed milk) on the basis of the average prices reported paid by 18 specific evaporated milk plants in the Chicago market supply area. Thirteen of these plants were in Wisconsin and five in Michigan. Effective September 6, 1940, the Chicago order was further amended to add the Midwestern Condensery price as an alternative basic formula for establishing Class I and surplus class prices.

In December, 1956, the Midwestern Condensery price was directly or indirectly used as an element in Class I pricing in 51 of 68 markets. It was the factor or one of several alternatives used in pricing surplus milk in 18 markets. However, by October 31, 1967, no markets were using the Midwestern Condensery average as an element in Class I pricing and only two orders were using it as a factor in pricing surplus milk.*

Part of the reason this series is no longer a major pricing factor is that only five plants are now available to report prices. As a result, it is not a satisfactory indicator of manufacturing milk values. Another reason was the wide and fluctuating disparity between prices paid at Michigan and Wisconsin plants.

Local Plant Averages

Another method establishes surplus milk prices based on prices paid at milk manufacturing plants in or near the supply area of the regulated market. This procedure relates order surplus prices to the local competitive value of manufacturing grade milk. Local plant averages have been used largely in markets with enough manufacturing grade plants to provide an adequate measure of value. However, extensive and often complete conversion to Grade A has reduced the number of plants processing manufacturing grade milk until it is difficult to find enough plants to include in a local plant series in most markets. In October 1967 only five orders included a local plant average as an alternative surplus pricing factor.

*U. S. 3-Product Manufacturing Grade Milk Price***

The so-called U. S. 3-product price was developed in 1949 by the Statistical Reporting Service of the USDA. This price is derived by weighting together the U. S. average price paid to farmers for manufacturing grade milk used for butter and by-products, American cheese, and canning (evaporated milk) according to the quantity of milk used for each product each month. Weighted average butterfat tests of such milk are also calculated.

This price was used in determining the parity equivalent of U. S. manufacturing grade milk for about 13 years — until November 1962. Since then the U. S. manufacturing grade milk price has been used. In 1951 the New England federal order markets adopted the 3-product price as an alternative factor in pricing Class II milk. On October 31, 1967, this series, subject to seasonal adjustments, was the sole pricing factor for surplus milk in six Northeastern and Mid-Atlantic orders, the Oklahoma Metropolitan and Red River Valley orders, and it was an alternative factor in the Neosho Valley market.

*U. S. Manufacturing Grade Milk Price**

This series is quite similar to the 3-product price. Both were developed by the Statistical Reporting Service of the USDA from similar basic data obtained from plants on simi-

* The Midwestern Condensery price has been deleted in both of these markets.

** This series is officially designated the U. S. Average Price Received by Farmers for Manufacturing Grade Milk Used for American Cheese, Evaporated Milk, and Butter and By-Products. It will be referred to in the remainder of the report as the U. S. 3-product price.

lar questionnaires. However, the values of manufacturing grade milk in *all* manufactured dairy products are reflected in the U. S. manufacturing milk price series.

The U. S. 3-product price and U. S. manufacturing grade milk price generate closely related prices. During the last 6 years, the annual average price of each series was the same during 3 years, differed by 1 cent in 2 years, and differed by 3 cents in 1 year. (See table 2).

Table 2. Annual average U.S. manufacturing milk prices, 1962-67*

Year	U.S. 3-product price	U.S. Manufacturing grade milk price
	— dollars per cwt. of 3.5 percent milk —	
1962	3.02	3.03
1963	3.05	3.04
1964	3.12	3.12
1965	3.20	3.20
1966	3.79	3.79
1967	3.88	3.91

* Preliminary

* This series is officially designated the U. S. Average Price Received by Farmers for Manufacturing Grade Milk. It will be referred to in the remainder of the report as the U. S. manufacturing grade milk price.

The U. S. manufacturing grade milk price is used to calculate the parity equivalent for manufacturing milk; but it is not used in federal orders. Since this price series is more comprehensive than the U. S. 3-product series it is recommended for use in federal order pricing formulas. Existence of two nearly identical price series is confusing and serves no useful purpose.

*Minnesota-Wisconsin Price**

This series was developed to replace the Midwestern Condensery price. It was first adopted in the Chicago order in September 1961. Now one of the most widely used measures of milk values, it reflects the prices paid to farmers for about half of the manufactured grade milk sold in the United States. It is used in establishing Class I prices in all but the six New England and Mid-Atlantic markets. This series was included in the surplus class pricing formula in 48 of the 74 orders in effect on October 31, 1967, and the number is growing. The industry uses it as a basic indicator of changes in milk values. (A description of the series, prepared by the Statistical Reporting Service [SRS], appears in Appendix 1, and a discussion of the procedures for converting price at average test to price at 3.5 percent appears in Appendix 2).

A comparison of the 3-product price, the All U. S. manufacturing milk price series and the Minnesota-Wisconsin price series by months for 1960 through 1967 is presented in figure 1. It shows that the Minnesota-Wisconsin series is consistent-

* This series is officially designated Prices Received by Farmers for Manufacturing Grade Milk in Minnesota and Wisconsin and will be referred to in the remainder of the report as the Minnesota-Wisconsin price.

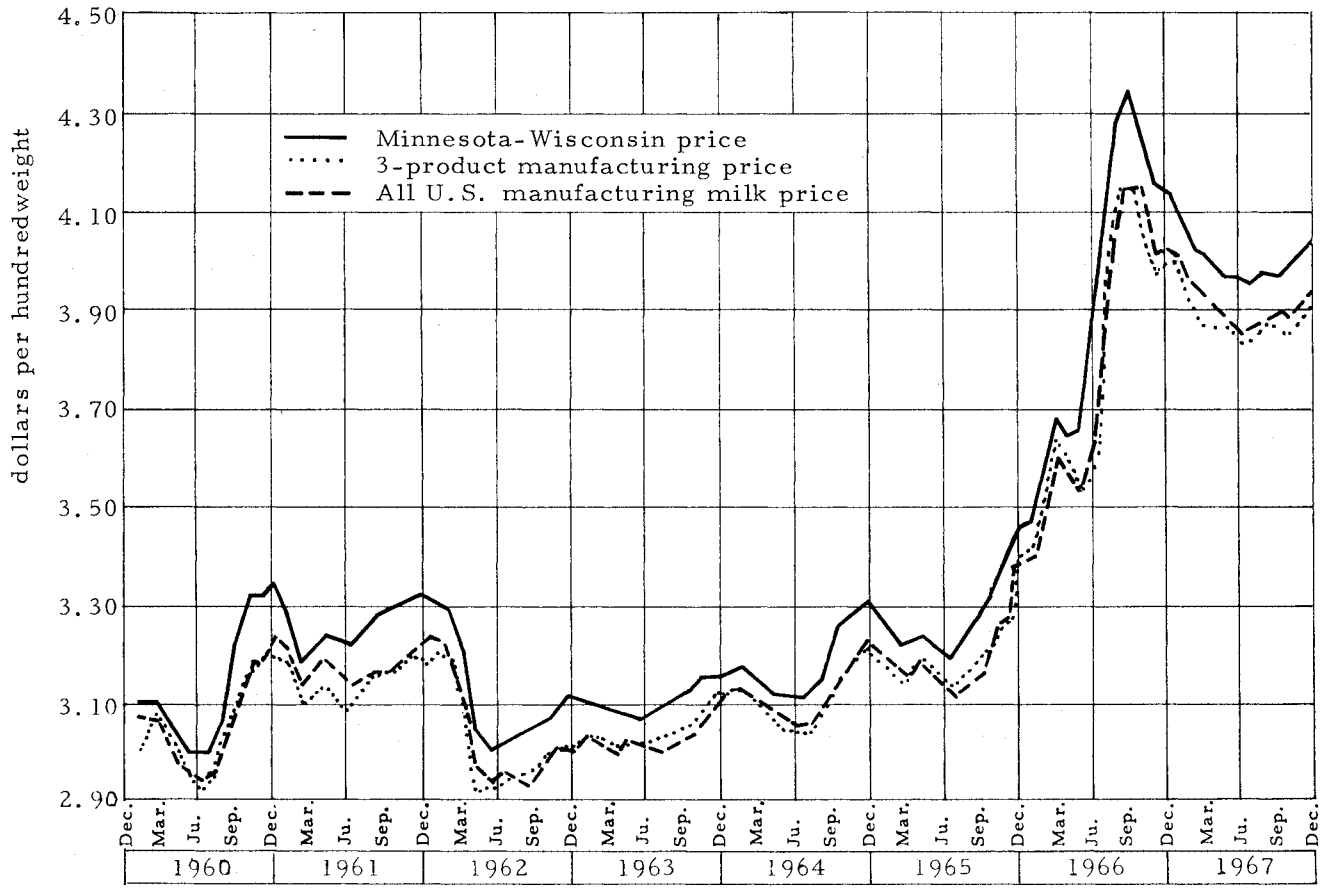

Figure 1. Monthly milk prices: 3-product price, all U.S. manufacturing price, and Minnesota-Wisconsin price, 1960-1966 (3.5 percent butterfat basis).

ly above the two series, and that it averaged 8.1 cents per month above all the U. S. manufacturing milk price series.

Monthly movements in the three price series are similar because all are heavily weighted by data from Minnesota and Wisconsin plants. These two states account for more than half of the manufacturing grade milk in the country.

Product Price Formulas

All milk orders have at one time or another used, at least as an alternative, a product formula in pricing surplus milk. On December 1, 1956, 84 percent of the federal milk orders used a product price formula. On October 31, 1967, 19 percent of the markets used one or more product formulas and 25 percent used a product price formula in conjunction with a competitive pay price. Present product price formulas are based primarily on butter-powder values. Four orders use a Cheddar cheese formula.

Product formulas use market prices for one or more products multiplied by product yields, less operating costs to estimate the value of 100 pounds of milk of a specified butterfat test. For example, the butter-powder formula used in the Kansas City, northern Louisiana, Puget Sound, and Wichita markets is as follows: The price per pound of Chicago 92-score butter multiplied by a yield factor of 4.2, plus the price per pound of Chicago area spray powder multiplied by a yield factor of 8.2, minus a handling allowance of 48 cents.* Assuming a butter price of 66.5 cents per pound and a powder price of 19.6 cents per pound (the CCC purchase prices in effect from June 30, 1966 to March 31, 1968) a surplus milk price based on this formula would equal $3.92 .

(66.5 cents × 4.2) + (19.6 cents × 8.2) − 48 cents = $3.92.

Yield factors and handling allowances in surplus pricing formulas vary from market to market.** However, handling allowances do not vary as much as is suggested in the various formulas. For example, the butter-powder formula for the Fort Wayne, Indianapolis, Miami Valley, and southern Michigan markets is as follows: The price per pound of Chicago 92-score butter, minus a handling allowance of 3 cents, multiplied by a yield factor of 4.2, plus the price per pound of Chicago area spray powder, minus a handling allowance of 5.5 cents, and multiplied by a yield factor of 8.2, plus 10 cents. Using the same butter price of 66.5 cents per pound and a powder price of 19.6 cents per pound as in the Kansas City, etc. markets, results in a formula value of $3.92, the same as that obtained from the Kansas City type formula.

(66.5 cents − 3 cents) × 4.2 + (19.6 cents −5.5 cents) × 8.2 + 10 cents = $3.92. Confusion would be avoided if the USDA expressed formulas more uniformly.

* The respective yields are from 100 pounds of 3.5 percent milk.

** See tables in USDA publication, "Summary of Major Provisions in Federal Milk Marketing Orders," January 1, 1967, pp. 72 and 73.

Chapter II

Considerations Involved in Selecting a Formula to Measure Manufacturing Milk Values

Several items should be considered when selecting the type of formula for pricing surplus milk. Both competitive pay prices and formulas have distinctive advantages and disadvantages.

Following is a discussion of considerations for selecting a surplus pricing formula.

Product Price Formulas

Pros and cons of product price formulas:

1. If realistically set up they are easily understood. They use the same factors a plant operator considers when calculating what he can pay for milk before making adjustment for the general competitive situation. The various factors may be discussed at federal order public hearings on the basis of day to day operating experience.

2. Product price formulas allow plant managers to determine quickly the cost of manufacturing milk. Yield factors and handling allowances are not changed unless they are amended after a hearing. Thus, product prices are the only variables, and they can be readily obtained from published daily, weekly, or monthly quotations.

3. Product price formulas can be designed which will tend to reflect average competitive pay prices over a period of time. However, continual updating of cost factors in formulas is required to achieve this.

4. Publicly quoted weekly or daily product prices provide relatively inexpensive estimates of manufacturing milk values.

5. Product price formulas reflect values of manufacturing milk in a particular use, such as butter-powder. Such values are independent of short-time competitve forces which may result when prices for major manufactured products are not in normal relationship to one another.

6. Product price formulas are based on the assumption that production and sales are simultaneous. However, there is a short lag between product manufacture and marketing. Therefore, when prices change rapidly, product formulas may yield prices which slightly understate or overstate the value of milk utilized. Over time, however, these differences tend to be offsetting.

7. Determination of proper yield factors, processing allowances, and product prices may be difficult. It has been difficult to get evidence regarding manufacturing costs at public hearings, partly because of wide variations in plant costs. This is the biggest shortcoming of the product formula approach. (For an example of variations in plant costs see table 18.)

Various methods of allocating costs, varied product mixes in plants, and variations in costs because of differences in plant efficiencies, all result in different estimates of processing costs. This makes it difficult to arrive at a formula that results in a price that a plant of average efficiency can afford to pay. Also, there are some differences in yields and prices received for products manufactured f.o.b. the plant.

8. Product price formulas do not automatically reflect changes in processing technology. In the past, changes in processing cost have been incorporated into the processing allowance only through hearings. Experience indicates that product formulas may get seriously out of line because of changes in manufacturing technology. For example, in 1950 the Chicago Class IV (butter-powder) formula accurately reflected prices paid at Wisconsin plants for butter-powder. By 1955, it was running about 5 cents lower than the Wisconsin creamery pay price, and by 1960 it was 21 cents lower. The formula was not changed to reflect reduction in manufacturing costs during this period. A similar situation has developed in the butter-powder formula which is now used as a snubber to the Minnesota-Wisconsin price (see Chapter V).

9. The value of minor by-products is not included in product formulas in federal milk orders. By-products sometimes return a profit, and at other times cause a loss. Buttermilk and dry buttermilk in a butter-powder operation, and whey in a cheese operation are such by-products. At times these products can make the difference between a profit or loss on the entire operation. Cheese factories can frequently net several cents per hundredweight on the sale of whey, at other times a loss can be incurred. Value of by-products, particularly in the case of cheese, should be considered when product formulas are constructed.

10. Product formulas generally reflect the value of milk in a single manufacturing use, i.e. butter-powder or cheese. Thus, when cheese prices are out of line with butter-powder prices, a butter-powder or cheese milk formula will not reflect accurately the average value of milk for manufacturing.

Competitive Pay Price Formulas

Pros and cons of competitive pay price formulas:

1. In the highly competitive dairy industry, the average prices paid in areas with substantial competition for manufacturing milk provide a good measure of average value. Such prices can be defended since they reflect competitive values and are an average of prices actually reported paid.

2. Increasing labor and other costs may tend to reduce prices paid to farmers for milk. On the other hand, the use of new assembling, processing, packaging, and marketing techniques which reduce plant operating costs, will tend to increase prices paid to producers. These changes in processing costs are directly and automatically reflected in surplus milk prices when based on average competitive pay prices. Similarly, changes in product values and yields are also automatically reflected. Thus, at any given time, competitive pay prices reflect the full value of milk for basic manufacturing uses.

3. The competitive price series tends to reflect the return from all products manufactured from milk, including the minor by-products.

4. The competitive price series eliminates the need to calculatate processing margins. Since adjustments in handling margins are automatically reflected, they do not cause controversy at public hearings.

5. The competitive pay price series tends to reflect overall manufacturing milk values rather than values for any particular use. Federal order markets with facilities to manufacture alternative dairy products find this series provides the incentive for needed resource adjustment. This is illustrated by the Chicago market which used the Minnesota-Wisconsin price series for pricing surplus milk. In late 1965 and early 1966, cheese prices rose relative to butter and nonfat dry milk prices. As a result, utilization of surplus milk shifted from butter to cheese during these changes in relative prices (see table 3). The percentage of surplus milk used in cheese in the Chicago market about doubled from 16.5 percent in February 1965 to 32.6 percent in February 1966.

6. The competitive price series tends to put regulated plants on an equal basis with non-regulated plants as far as the cost of milk for mannufacturing is concerned. This is in contrast to an often voiced criticism that product formula prices allow regulated plants to buy manufacturing milk at lower prices than non-regulated plants which must pay a competitive price. Both regulated and non-regulated plants sell their manufactured dairy products on the nationwide market at the same price. Thus, lower raw material prices can provide an advantage to regulated plants over non-regulated plants.

7. Reported plant prices used to compute competitive pay price series may not always represent the actual prices paid for milk. A number of reasons account for this type of discrepancy.

Table 3. Proportion of butterfat in surplus milk utilized by Chicago order handlers for use in butter, cheese, and other manufactured products, 1964, 1965, and 1966*

Year and month	Butter	Cheese	Other
	Percent of total	Percent of total	Percent of total
1964			
January	64.8	17.8	17.4
February	63.7	18.0	18.3
March	64.7	17.1	18.2
April	65.9	16.1	18.0
May	63.4	17.2	19.4
June	61.5	16.7	21.8
July	57.9	15.9	26.2
August	58.0	14.5	27.5
September	52.2	17.6	30.2
October	53.6	22.0	24.4
November	57.8	19.3	22.9
December	59.4	19.0	21.6
Year	61.0	17.6	21.4
1965			
January	63.2	16.9	19.9
February	62.1	16.5	21.4
March	63.2	16.2	20.6
April	55.4	18.8	25.8
May	58.2	16.8	25.0
June	55.2	17.0	27.8
July	48.7	19.2	32.1
August	43.1	22.3	34.6
September	34.8	24.6	40.6
October	42.5	25.1	32.4
November	39.5	26.7	33.8
December	47.1	25.9	27.0
Year	53.4	19.6	27.0
1966			
January	50.8	24.8	24.4
February	41.6	32.6	25.8
March	46.6	26.9	26.5
April	51.1	23.8	25.1

* The Chicago order was terminated in 1966.

a. Some plants may overstate their reported pay price because of errors in butterfat testing and milk weighing.

b. Reported prices may not accurately reflect prices f.o.b. plant because of hauling subsidies. There is no practical way to include hauling subsidies.

c. Reported milk prices may or may not include various types of premiums.

d. Many dairy plants are organized as cooperatives. This may influence the firms' payment practices since cooperatives may distribute sizeable dividends or patronage refunds annually. These payments cannot be reflected in the price series on a month-by-month basis.

8. The competitive pay price series is more costly to calculate than product formula prices. However, since several series are already computed for uses other than federal order pricing, costs of computation for federal order use may not be overly important.

9. Competitive prices are based upon prices reported paid at a sample of plants and may not be accurate if the sample is not representative.

10. Because price for a given month is needed by the fifth of the following month, prices generally must be based upon estimates for the last half of the month.

Evaluation

As the preceding discussion indicates, there are good arguments for and against either product price formulas or competitive pay formulas for pricing surplus milk. However, in recent years federal milk orders have shifted emphasis from the use of product price formulas to competitive pay price formulas. Because surplus milk pricing issues are complex and because of the important advantages and disadvantages of both methods, the USDA should exercise great care when deciding the type of surplus milk pricing for any market. If product price formulas are used, special effort should be made to keep cost allowances and other factors up-to-date.

Chapter III

Does the Minnesota-Wisconsin Price Represent Average Prices Paid by All Manufacturing Plants?

Does the Minnesota-Wisconsin price represent the average of reported prices paid for manufacturing milk by all plants in the two states? The sample of plants which is used to determine the Minnesota-Wisconsin price is selected to include a representative group of plants in the two states. If the sample is in fact representative, then the announced Minnesota-Wisconsin price should closely approximate the average of prices reported paid at all plants in the two states. If it is not representative, and is unduly weighted by "high" paying or "low" paying plants, then the Minnesota-Wisconsin price would likely differ significantly from the all plant two-state average.

Separate and apart from the sample involved, is the procedure for estimating the current month's price. Is the method satisfactory? The main questions here relate to (a) the adequacy of the information obtained from plant managers concerning what they intend to pay for milk and (2) the accuracy of other techniques for estimating changes from the previous month.

If the Minnesota-Wisconsin price corresponds closely with more complete information based on reported prices paid at all plants in the two states, it is reasonable to presume that the procedure for estimating the current month's price is satisfactory.

Table 4 compares the Minnesota-Wisconsin price with the final average of prices reported paid at all manufacturing plants in the two states. For the 77 month period, August 1961 to December 1967, the two prices were the same in 12 months and they differed by only 1 cent in 35 months. Between August 1961 and September 1965, the largest difference was 3 cents and this only occurred during one month. Beginning with October 1965, the differences began to increase and reached a high of 7 cents in July 1966. These differences occurred when both butter and cheese prices were relatively volatile and out of normal relationship with each other. However, for the 77-month period the difference between the announced Minnesota-Wisconsin price and the average prices reported paid at all plants handling manufacturing grade milk in the two states was only 0.6 cents per hundredweight.

This close relationship indicates that over a period of time the Minnesota-Wisconsin series does accurately reflect the average of reported prices for the two states. However, in periods of highly volatile product price changes the Minnesota-Wisconsin price has not always accurately reflected the average of reported prices for the two states.

Another question is whether the prices finally reported by all plants represent the prices actually paid by the plants. This question will be considered in the next chapter.

Table 4. Comparison of Minnesota-Wisconsin manufacturing grade milk price with final two-state estimated price, for milk of 3.5 percent butterfat content, by months, August 1961 to December 1967*

Year and month	Minnesota-Wisconsin series price	Final two-state estimated price	Difference between final two-state and M-W series
	— dollars per hundredweight —		
1961			
August	3.27	3.27	0
September	3.29	3.30	+0.01
October	3.30	3.31	+0.01
November	3.31	3.32	+0.01
December	3.31	3.32	+0.01
1962			
January	3.30	3.31	+0.01
February	3.29	3.28	−0.01
March	3.21	3.20	−0.01
April	3.05	3.04	−0.01
May	3.01	3.02	+0.01
June	3.01	3.02	+0.01
July	3.03	3.03	0
August	3.04	3.03	−0.01
September	3.06	3.05	−0.01
October	3.07	3.08	+0.01
November	3.10	3.10	0
December	3.11	3.12	+0.01
1963			
January	3.10	3.12	+0.02
February	3.10	3.12	+0.02
March	3.09	3.11	+0.02
April	3.08	3.10	+0.02
May	3.07	3.10	+0.03
June	3.08	3.10	+0.02
July	3.09	3.11	+0.02
August	3.10	3.12	+0.02
September	3.12	3.13	+0.01
October	3.15	3.17	+0.02
November	3.16	3.18	+0.02
December	3.16	3.18	+0.02
1964			
January	3.17	3.18	+0.01
February	3.16	3.18	+0.02
March	3.15	3.14	−0.01
April	3.12	3.12	0
May	3.12	3.12	0
June	3.11	3.11	0
July	3.12	3.13	+0.01
August	3.15	3.16	+0.01
September	3.24	3.24	0
October	3.27	3.29	+0.02
November	3.29	3.31	+0.02
December	3.29	3.29	0

Table 4. (Continued)

Year and month	Minnesota-Wisconsin series price	Final two-state estimated price	Difference between final two-state and M-W series
	— dollars per hundredweight —		
1965			
January	3.25	3.24	−0.01
February	3.22	3.21	−0.01
March	3.22	3.20	−0.02
April	3.23	3.21	−0.02
May	3.22	3.20	−0.02
June	3.20	3.20	0
July	3.21	3.20	−0.01
August	3.25	2.26	+0.01
September	3.29	3.30	+0.01
October	3.34	3.37	+0.03
November	3.39	3.44	+0.05
December	3.47	3.51	+0.04
1966			
January	3.47	3.49	+0.02
February	3.58	3.61	+0.03
March	3.68	3.69	+0.01
April	3.64	3.65	+0.01
May	3.65	3.69	+0.04
June	3.82	3.82	0
July	4.05	4.12	+0.07
August	4.26	4.29	+0.03
September	4.34	4.34	0
October	4.26	4.25	−0.01
November	4.15	4.16	+0.01
December	4.14	4.12	−0.02
1967			
January	4.08	4.08	0
February	4.02	4.00	−0.02
March	4.01	3.98	−0.03
April	3.98	3.97	−0.01
May	3.96	3.95	−0.01
June	3.96	3.94	−0.02
July	3.95	3.96	+0.01
August	3.97	3.96	−0.01
September	3.97	3.97	0
October	3.98	3.99	+0.01
November	4.00	3.99	−0.01
December	4.04	4.02	−0.02
Simple average			
77 months	3.422	3.428	+0.006

* Prices have been converted from the average butterfat test to 3.5% using the butterfat differential specified in federal orders (Chicago Grade A butter x 0.120).

Chapter IV

Analysis of Factors Affecting Prices Paid for Manufacturing Grade Milk

Data from a sample consisting of 26 Minnesota and 26 Wisconsin manufacturing milk plants were used to analyze factors affecting prices paid for manufacturing grade milk.* These 52 plants are believed to be representative of manufacturing milk plants in the two states.**

The purpose of the analysis was to (1) find and measure differences between actual and reported milk prices of Minnesota and Wisconsin dairy plants; and (2) determine and evaluate the relationship between various plant factors and prices paid by plants for manufacturing grade milk.

The results provide a basis for appraising the accuracy and reliability of the Minnesota-Wisconsin and other price series, and for evaluating factors which affect the prices paid by Minnesota and Wisconsin manufacturing plants.

The 52 plants included in the sample were selected because: (a) they represent the kinds of manufacturing milk plants in the states in about the same proportions as the total population, (b) they represent the major types of dairy areas in the states, and (c) they are located within a cluster of plants which compete for milk supplies, and are, therefore, subject to similar competitive pressures within each area. It was felt this procedure assured a more representative sample than a random sampling technique.

In Minnesota, the plants were selected from the "dairy belt," a 30-county area which produced 71 percent of the state's milk in 1964. This area extends from southeastern to northwestern Minnesota and was divided, for this study into three regions on the basis of unique characteristics. (a) Area 1 — the northwestern part of the dairy belt is the most distant major milk producing region from markets for either fluid or manufactured dairy products. Ten plants were selected from this area. (b) Area 2 — the central part of the dairy belt is located within the fluid milkshed for the Twin Cities market. As such, pay prices of the manufacturing milk plants may be in influenced by the prices paid for milk for fluid use by competing plants. Ten plants were selected from this area. (c) Area 3 — the southeastern part of the dairy belt is within the corn-soybean area. It is not primarily a supply area for fluid milk although some significant local markets are supplied by it. It is, however, much nearer the large markets for manufactured dairy products than other milk producing areas in Minnesota. Six plants were selected from this area.

Distribution of the Minnesota and Wisconsin plants by type of product manufactured is indicated in tables 5 and 6. The plants were classified into four groups: butter, butter-powder, cheese, and receiving stations. Some of the plants produced other products; but they were classified in their major product classification.

Wisconsin plants selected for the sample were taken from all areas of the state, except the southeastern fluid milk area. Three major areas were designated: (a) south central Wisconsin, (b) northeastern Wisconsin, and (c) northwestern Wisconsin.

It is difficult to categorize dairy operations within each area because of the wide diversification of plants throughout Wisconsin. However, in general, Wisconsin is a major producer of American cheese with considerable quantities of brick, Italian, and Swiss cheese also made. Northeastern Wisconsin is also a major producing area for American cheese, with considerable quantities of Italian cheese also made. Northwestern Wisconsin is a major production area for butter and nonfat dry milk with some quantities of American cheese manufactured. All areas also have major supplies of Grade A milk.

Seven Wisconsin plants in the south central area, eight in the northeast area, and eleven in the northwest area were selected for study. The plants were also classified into the same four groups as the Minnesota plants — butter, butter-powder, cheese and receiving station. (table 6).

Table 5. Distribution of Minnesota dairy plants receiving milk from producers for manufacturing use, by-products, 1965

Product	Sample plants		All mfg. plants	
	Number	Percent	Number	Percent
Butter	16	61.5	240	59.0
Butter-powder	7	29.9	57	14.0
Cheese	1	3.9	19	4.7
Receiving station	2	7.7	91	22.3
Total	26	100.0	407	100.0

Table 6. Distribution of Wisconsin dairy plants receiving milk form producers for manufacturing use, by-products, 1965

Product	Sample plants		All mfg. plants	
	Number	Percent	Number	Percent
Butter	5	19.2	130	13.1
Butter-powder	3	11.5	66	6.7
Cheese	17	65.4	633	64.0
Receiving station	1	3.9	160	16.2
Total	26	100.0	989*	100.0

* Since some plants manufacture more than one product, the total number of Wisconsin plants in a physical sense is less than the total indicated here.

* The data were collected by the Minnesota and Wisconsin Departments of Agriculture and included raw product purchases, product sales, inventories, costs, and financial data on other aspects of the firms' operations.

** It is not known if any of the 52 plants surveyed are included in the 100 plant sample reporting to the Statistical Reporting Service. In accordance with general policy of SRS, the names of the 100 plant samples have not been disclosed. No effort was made, therefore, to select plants that are part of the SRS sample.

The sample represents Minnesota-Wisconsin dairy plants in terms of geographic distribution of plants, products manufactured, and various competitive situations which may influence milk processing in local areas.

The sample plants produce primarily manufactured dairy products from manufacturing grade whole milk. Fifteen of the Minnesota plants, however, received farm-separated cream. This represented 3.5 percent of all butterfat in whole milk and cream purchased by the 26 Minnesota plants. These purchases of butterfat in cream varied from zero to 18.7 percent of butterfat purchases. No farm-separated cream was purchased by the Wisconsin sample plants.

A few of the Minnesota manufacturing plants in the survey sample purchased some Grade A milk. Except for two plants, all Grade A milk was resold to other plants or utilized in manufactured dairy products. Two plants processed and distributed some of the Grade A milk products. However, as is true with respect to the Minnesota-Wisconsin price series, and other competitive pay price series, only manufacturing grade milk prices from these plants were used in the analysis. None of the Wisconsin plants in the survey distributed fluid products or purchased Grade A milk from farmers.

Total annual milk receipts for the 52 sample plants varied considerably — from a low of 5.7 million pounds to a high of 190.2 million pounds. The average total milk receipts for all plants was 31.2 million pounds. Receipts from producers averaged 26.7 million pounds annually.

Annual dairy product sales averaged $1,194,496 for the Minnesota plants and $1,191,136 for the Wisconsin plants. Considerable variation in dairy product sales existed, ranging from $349,938 to $4,957,363 for the Minnesota plants, and $32,870 to $7,524,734 for the Wisconsin plants.

Some plants had income from sources other than the sale of dairy products. For example, cooperatives (45 of the 52 sample plants) received cash refunds from their marketing agencies and from other local cooperatives. Various sidelines, such as feed, seed, and dairy farm supplies contributed to plant returns. In most Wisconsin sample plants other sources of income were small relative to income from dairy product sales. However, for about half of the Minnesota plants other income, particularly patronage refunds from other cooperatives, made the difference between a profit and a loss for the year.

Reported Pay Prices for Milk

In 1965 average annual prices paid patrons for manufacturing grade milk of 3.5 percent butterfat content by the 52 plants surveyed was $3.250 per hundredweight (weighted by the volume at individual plants) (Table 7). The average price paid by all plants handling manufacturing grade milk in Minnesota and Wisconsin for the same year was $3.280. Thus, from this evidence, the 52 plant sample appears reasonably representative of all manufacturing grade milk plants in the two states, and hence of plants in the Minnesota-Wisconsin series.

Prices in the 52 plants varied from a low of $3.076, to a high of $3.438 per hundredweight in 1965. Thus, price varied considerably among plants. The average-pay price in Minnesota was about 5 cents per hundredweight less than in Wisconsin.

For purposes of comparison and analysis in the remainder of this section, the 52 plants surveyed in the two states have been grouped according to prices paid patrons for milk of 3.5 percent butterfat. Group 1 is the third of the plants in each state with the highest pay prices, Group 2 is the third of the plants in each state with the medium pay prices, and Group 3 is the third of the plants in each state with the lowest pay prices. Group 1 includes 18 plants, groups 2 and 3, 17 plants each.

Table 7. Reported pay prices for 3.5 percent butterfat milk for 52 Minnesota and Wisconsin manufacturing milk plants, 1965

Plant grouping	Annual average pay price*		
	Both states	Minnesota	Wisconsin
	dollars per hundredweight		
Average price for all 52 plants	3.250	3.223	3.276
Group 1 (one-third of plants with highest pay prices)	3.313	3.291	3.345
Group 2 (one third of plants with medium pay prices)	3.253	3.208	3.280
Group 3 (one-third of plants with lowest pay prices)	3.166	3.144	3.192

* Weighted by volume of milk in individual plants.

Factors Resulting in Understatment or Overstatement of Actual Prices Paid Producers

Three plant factors are related to reported plant prices understatement or overstatement of actual prices paid to producers: (a) butterfat test error, (b) annual cash dividends paid in addition to regular prices paid for milk, and (c) plant gain or loss on hauling milk from farm to plant. The effect of each of these factors will be discussed in this section of the report.

Reported Butterfat Tests

Because butterfat represents such a high proportion of the value of milk, measurement errors can substantially affect the firms' quoted prices for milk. For example, suppose a plant has milk testing 3.5 percent butterfat, but lists its test as 3.4 percent butterfat, and quoted a price of $4.00 per hundredweight for milk of 3.5 test. With a 7-cent differential for each one-tenth of a percent of butterfat, this plant is actually paying only $3.93 for 3.5 percent milk rather than the $4.00 it quoted. It could, therefore, give the appearance of paying more than competing plants with accurate butterfat testing, who were quoting $3.93 per hundredweight for 3.5 milk, when in reality it is paying the same price.

Errors in sampling, weighing and testing, and down reading tests to the nearest tenth percent of butterfat could enable a plant to report a higher pay price than it is actually paying.

The purpose of this section is to determine if calculated butterfat tests do differ from reported butterfat tests, and if so, to measure the impact on reported producer pay prices.

In the 52 sample plants, pounds of butterfat reported in milk received from farmers and other plants was compared with pounds of butterfat in products made from the milk. Milk volumes, prices, and reported fat tests were obtained from plant records. Volumes of manufactured products sold by the plant were obtained from sales invoices, inventory reports, and lab reports. Calculated pounds of butterfat in manufactured products were determined on the basis of average product yields.

The following were used in calculating pounds of butterfat in manufactured products: (1) fat analyses furnished the

plant by the buyer of the product, and (2) theoretical cheese yield formula based on individual plant data with average casein content of milk applied to the formula. This procedure is used in Wisconsin law enforcement to determine gross deviations in product accounting.

The term "butterfat test error" used throughout this report is the combined errors of milk weights, errors in sampling and testing milk purchased, and all other errors. (See Appendix 3 for discussion of procedures used in calculating pounds of butterfat in manufactured products.) The difference between reported fat test and calculated fat test multiplied by the average butterfat differential paid provides an estimate of the effect of the butterfat testing error on prices paid for milk.

Butterfat Test Error

Based on the procedures used in calculating actual butterfat content of milk, 25 of the 26 plants in each state (50 of 52 in the two states), paid for less butterfat than they received from farmers and, therefore, quoted higher prices than actually paid. Nevertheless, there was a considerable range in the magnitude of these differences. Paying farmers for a lower butterfat test than the milk contains is referred to as understatement of the butterfat test.

The butterfat test error for sample plants resulted in an average understatement of butterfat tests of 1.76 percent in Minnesota,* 1.38 percent in Wisconsin and 1.56 in the two states combined (table 8). The understatement of tests amounted to 0.063 pounds of butterfat per hundredweight of milk in Minnesota, 0.051 pounds in Wisconsin, and an average of 0.057 for the two states combined.**

Low paying plants understated fat purchases to a larger extent than did the higher paying plants — 1.94 percent for low paying plants compared to 1.42 percent for the high paying plants, in the two states combined. The same situation existed in the two states separately. *Thus, high paying plants were not paying more than others because of the greater butterfat test error.*

Effect of Butterfat Test Error on Reported Pay Price

Because of understating fat purchases, milk prices were overstated by 4.4 cents per hundredweight in Minnesota plants, 3.8 cents per hundredweight in the Wisconsin plants, and an average of 4.1 cents per hundredweight for the 52 Minnesota and Wisconsin plants combined (table 8). As a result of larger understating of butterfat content, the low paying plants overstated their price more than did the high paying plants — 5 cents per hundredweight for low paying plants compared to 3.9 cents for high paying plants.

What causes the discrepancies between reported butterfat tests and calculated butterfat tests? One cause is errors in milk testing procedures — either intentional or unintentional. Another is simply rounding down all butterfat tests. Babcock fat tests are required by law to be reported to the nearest tenth of a percent; i.e., milk testing both 3.57 percent and 3.63 percent butterfat is to be reported as 3.6. But if all fractions are read down (i.e. 3.57 percent is read as 3.5 percent) an average understating of about 0.05 pound of fat per hundred pounds of milk occurs.

There are two additional reasons for the discrepancies between calculated and reported butterfat tests.

Using composite samples will result in different fat tests than if fresh samples are used. Fresh samples test about 0.02-0.04 percent more than composite, and farm milk tests could, therefore, be understated to the extent composite samples are used to determine fat purchases.

Testing procedure and equipment error can cause considerable variation if any laxity in the "official Babcock test" is allowed.

Thus, the number of errors possible in determining fat content can contribute to an overstatement of farm milk prices.

Patronage Refunds

Cooperative dairy plant earnings are allocated as patronage refunds to producer-members at the end of each fiscal period. These refunds can be considered as additional payments for milk; and therefore they represent an understatement of the reported price as compared to the actual price.

This section considers total refunds as well as cash refunds. Refunds include book credits, stock credits, certificates of equity, or any paper which is allocated to indicate participation in earnings, as well as cash refunds. Patronage refunds were calculated as an average for all plants, although private plants do not pay dividends to producers.

Even though refunds may be interpreted as additional payments for milk, they are not included in the reported price series for milk because there is no practical way to include them in the current data. For the 52 plants, cash refunds alone represent an additional 2.1 cents per hundred-

* None of the butter plants exceeded Minnesota's maximum legal overrun allowance of 24 percent. See Chapter VI for regulations on product accountability in Minnesota and Wisconsin.

** The hypothesis that fat gain or loss over all 52 plants differed from zero only because of chance variations, was rejected on the basis of the statistical test, which revealed that understating of tests of the magnitude indicated in this analysis, could have occurred by chance less than one time in a thousand.

Table 8. Butterfat test error and impact on reported pay price for 52 dairy plants in Minnesota and Wisconsin

Pay price group	Understatment of butterfat: Percentage			Understatment of butterfat: Volume			Amount by which reported price for milk testing 3.5% butterfat was overstated as a result of understatement of the butterfat test*		
	Minn.	Wis.	Both states	Minn.	Wis.	Both states	Minn.	Wis.	Both states
	percent			pounds/cwt			cents/cwt.		
Group 1 (high-pay)	1.74	1.02	1.42	0.062	0.037	0.051	4.4	3.0	3.9
Group 2 (middle-pay)	1.34	1.46	1.42	0.048	0.054	0.052	3.4	3.8	3.7
Group 3 (low-pay)	2.16	1.66	1.94	0.077	0.063	0.071	5.0	4.8	5.0
Average for all plants	1.76	1.38	1.56	0.063	0.051	0.057	4.4	3.8	4.1

* These figures were calculated by multiplying the understating of butterfat in pounds of butterfat per hundredweight of milk, times the average butterfat differentials paid by plants in each price grouping. (Weighted by the volume of milk in individual plants.) The average butterfat differential was 6.9 cents per point in Minnesota, 7.5 cents per point in Wisconsin and 7.2 cents per point for the two states combined.

weight not reported to state and federal agencies for construction of the Minnesota-Wisconsin manufacturing milk price series. In addition, paper credits totaled 4.8 cents. Some of these will be redeemed for cash at a later date. If patronage refunds are considered as additional payment for milk and not as a return for ownership, reported prices could be understated by a least 2.1 cents per hundredweight. This partly offsets the overstatement in price resulting from understating of butterfat tests discussed earlier.

Classified by milk pay price group the lowest group allocated the largest cash refund (3.7 cents) and the largest total refund (9.6 cents) per hundredweight. Refunds by the lowest pay price group were more than 1 cent per hundredweight above the high price group (table 9).

Gain or Loss on Hauling Producer Milk

Thirty-three of the 52 Minnesota and Wisconsin sample plants in this study contracted with private truckers to haul producer milk, while 13 owned trucks and hired drivers. Six plants had both contract and plant operated hauling. A few producers hauled their own milk. All plants deducted hauling charges from patrons' checks and paid the haulers. Producers are subsidized if contract hauling costs are larger than the amounts deducted from the checks, or if plant-owned trucks operate at a loss. On the other hand, if plants make a profit on hauling, producers receive a lower return than indicated by the reported price.

Hauling profits or losses were calculated for each of the 52 sample plants. Eleven Minnesota and 19 Wisconsin plants had hauling losses and 3 Minnesota and 6 Wisconsin plants had profits. The other 13 broke even. Individual plant results ranged from a loss of $20,577 to a gain of $17,076 for Minnesota, and a loss of $66,095 to a gain of $3,673 for Wisconsin.

Table 9. Patronage refunds per hundredweight of milk allocated to farmers, for 52 Minnesota and Wisconsin dairy plants, 1965*

Pay price group	Average cash refunds	Average total refunds**
	dollars per hundredweight	
Group 1 (high-pay)	0.025	0.086
Group 2 (middle-pay)	0.007	0.038
Group 3 (low-pay)	0.037	0.096
Average for all plants	0.021	0.069

* This includes both proprietary and cooperative plants. Inclusion of proprietary plants (which do not pay dividends to farmers) reduces the average below those paid by cooperatives alone.
** Cash plus paper.

Table 10. Effect of gain or loss from hauling producer milk on plant pay prices for 52 Minnesota and Wisconsin dairy plants, 1965*

Pay price group	Both states	Wisconsin	Minnesota
	dollars per hundredweight		
Group 1 (high-pay)	−0.003	−0.006	0
Group 2 (middle-pay)	+0.021	+0.034	+0.001
Group 3 (low-pay)	+0.023	+0.042	+0.009
Average for all plants	+0.014	+0.025	+0.003

* A profit on hauling reduced pay prices to producers, while a loss on hauling represented a subsidy to producers and increased pay prices .

The average gain or loss per hundredweight in each pay price group is presented in table 10. This table indicates that sample plants had average hauling losses of 1.4 cents per hundredweight and, in effect, were subsidizing producers by this amount. Thus, actual-pay prices for the plants surveyed were 1.4 cents per hundredweight higher than quoted prices. Wisconsin's average hauling subsidies were 2.5 cents per hundredweight while Minnesota's were 0.3 cents per hundredweight.

Hauling gains or losses are classified according to pay price categories in table 10. Data in this table indicate that highest paying sample plants in the two states combined, were making a small profit on hauling. Therefore, these plants were paying farmers 0.3 cents per hundredweight *lower* actual prices than those quoted. Plants with lower prices incurred hauling losses. They were, therefore, subsidizing hauling and hence paying an average of 2.3 cents per hundredweight *higher* actual prices than they quoted.

Net Overstatement in Reported Prices for Sample Plants

Butterfat test error, patronage refunds, and hauling subsidies cause differences in reported and actual prices. How each factor affects prices in the plants surveyed is listed in table 11. Butterfat test error resulted in a 4.1 cents per hundredweight overstatement; hauling subsidies resulted in a 1.4 cents per hundredweight understatement; and cash dividends resulted in a 2.1 cents per hundredweight understatement in reported prices. Thus, the net effect of the combined factors was a 0.6 cents per hundredweight overstatement in reported pay prices.

Table 11. Net effect of selected factors on reported pay prices for 52 Minnesota and Wisconsin dairy plants, 1965

Plant factor	Overstatement or understatment of actual prices as result of plant factor*
	cents per hundredweight
Butterfat test error	+4.1
Hauling subsidy	−1.4
Cash refund	−2.1
Net effect	+0.6

* (+) sign indicates overstatement of price; (−) sign indicates understatement of price.

Table 12. Percentage of total gross plant income from various dairy products for 52 Minnesota and Wisconsin dairy plants, 1965

Pay price group	Percent of income from butter-powder*	Percent of gross income from American cheese and whey cream	Percent of income from other dairy product
Group 1 (high-pay)	65.6	27.3	7.1
Group 2 (middle-pay)	48.2	42.2	9.6
Group 3 (low-pay)	79.1	7.1	13.8
Average for all plants	61.9	28.3	9.8

* All receiving stations in the sample shipped their milk to butter-powder plants.

Effect of Plant Operating Factors on Overall Level of Pay Prices

Factors affecting the variation in prices among plants as contrasted to differences between actual and quoted prices were also analyzed. The purpose was to determine whether plant operating variables affect the level of plant-pay prices. If plant variables do affect ability to pay certain prices, the ability to meet the levels in the Minnesota-Wisconsin price series or any other average price would be affected. Of course, all plants are not influenced nor subjected to the same variables. On the other hand, if plant variables do not greatly affect plants abilities to pay certain prices, the ability to meet price levels in the Minnesota-Wisconsin series would not be affected. This part of the study examined the ability of individual plants to pay average prices in a price series.*

Percentage of Plant Income from Butter, Skim Milk Powder, and American Cheese

Table 12 indicates that farm milk pay prices are related to the type of product manufactured. For example, plants with the higher proportions of cheese had the highest pay prices for milk. Conversely, the higher the percentage of butter-powder, the lower the pay price. The lowest pay price group had the highest percentage of butter-powder sales, 79.1 percent, and the lowest percentage of cheese sales, 7.1 percent.

The figures in table 12 are consistent with pay price series for Minnesota and Wisconsin plants in 1965. Wholesale prices for cheese rose relative to butter and powder. Similarly cheese plant prices rose during the last half of the year relative to butter-powder prices. It must be emphasized, however, that results for other years might differ from those for 1965. Cheese has not always been the most favorably priced product.

Apparently the proportion of gross income derived by a plant from specific manufactured products influences the manufacturing milk prices paid to farmers. Therefore, in the short-run, a price series reflecting prices of only one manufactured product will not accurately reflect prices that plants manufacturing various products can profitably pay.

Utilization of Plant Capacity

Fixed costs comprise a large proportion of the processing costs in dairy plants. As a result, unit costs of the dairy plant and prices the plant can afford to pay are highly influenced by how completely the capacity of the plant is utilized.

The proportion of plant capacity utilized was calculated for the 52 sample plants and related to plant pay prices (table 13). Estimates of plant capacity were based on a 20-hour day. Although not all plants operate this length of time, nevertheless it is feasible to do so; hence this length of time was selected as a common denominater for all plants. The capacity estimates were calculated from dryer output rates for drying plants, vat capacity for cheese plants, churn capacity for butter plants, and receiving room capacity for receiving stations.

The sample plants had a great deal of excess capacity. An average of only 23 percent of total plant capacity was used in the 52 plants, with a variation for individual plants from 5 to 92 percent. This low capacity utilization would generally increase unit costs and reduce pay prices. For example, the lower pay group had the lowest percentage of capacity utilized — 17, compared to an average of 26 percent for the high and middle paying plants.

Thus, some relationship appeared to exist between plant pay prices and utilization of plant capacity. To the extent that individual plants have a different proportion of capacity utilized than Minnesota-Wisconsin price series plants as a whole, the individual plant's ability to pay the Minnesota-Wisconsin price will be affected.

Operating Gain or Loss

Some people contend that plants paying high prices for milk frequently do so at the expense of normal profits (also referred to as operating gain or loss for cooperatives). Therefore, other federal order plants will be at a disadvantage when they are obliged to pay similar prices (through use of a price series such as the Minnesota-Wisconsin series). Examination of profit-loss data for the 52 Minnesota-Wisconsin plants indicates high paying plants do have lower profits than low paying plants (table 14). Specifically, high paying plants had average plant profits of 3.5 cents per hundredweight and total profits (including outside income) of 9.6 cents per hundredweight. These profits were about 1 cent per hundredweight lower than those of low paying plants.

This analysis of 52 Minnesota-Wisconsin dairy plants indicates that profits for high paying plants are lower than for low paying plants, that profits generally decrease as pay prices increase, and that total profits or losses to milk firms (including outside income or loss) do affect the ability of a plant to pay prices based on the Minnesota-Wisconsin price series.

Depreciation

The size of the depreciation reserve set aside can also affect a firm's financial stability. A small depreciation reserve could mean that financially warranted plant improvements would be difficult to finance. This in turn could reduce the plants ultimate profit position and its ability to compete.

Data from the sample plants indicate that higher pay plants have lower relative depreciation reserves than either average or low paying plants. In 1965, for example, the de-

Table 13. Utilization of plant capacity by 52 Minnesota and Wisconsin dairy plants, 1965

Pay price group	Percentage of total plant capacity use*
	Percent
Group 1 (high-pay)	24.6
Group 2 (middle-pay)	27.7
Group 3 (low-pay)	17.3
Average for all plants	23.1

* Based on a 20-hour day operation.

Table 14. Operating gain or loss per hundredweight of milk for 52 Minnesota and Wisconsin dairy plants, 1965

Pay price group	Gain or loss on plant operation	Gain or loss on entire operation including outside income or loss
	dollars per hundredweight	
Group 1 (high-pay)	0.035	0.096
Group 2 (middle-pay)	0.022	0.040
Group 3 (low-pay)	0.047	0.109
Average for all plants	0.032	0.076

* A multiple regression was also applied to measure the relationship between the level of pay prices and various plant operating factors. See Appendix 4 for a discussion of these results.

Table 15. Depreciation per hundredweight, and as a percent of fixed assets, for 52 Minnesota and Wisconsin dairy plants, 1965

Pay price group	Depreciation	Depreciation as percentage of fixed assets
	dollars/cwt.	percent
Group 1 (high-pay)	0.036	5.92
Group 2 (middle-pay)	0.044	7.59
Group 3 (low-pay)	0.053	6.16
Average for all plants	0.043	6.60

preciation set aside by high-pay plants was 3.6 cents per hundredweight compared to 5.3 cents per hundredweight for low paying firms, and 4.3 cents per hundredweight for all firms. Depreciation set aside as a percent of fixed assets was 5.9 percent for high paying plants, and 6.6 percent for all plants (table 15).

On the basis of these data from 52 sample plants in Minnesota and Wisconsin it can be concluded that higher pay plants are taking less depreciation than lower pay plants. The maintenance of high depreciation reserves could influence a plant's ability to pay the Minnesota-Wisconsin price.

Financial Ratios

If plants pay more than they can afford to, based on their income and costs, financial stability can be impaired.* Examination of data from the 52 sample plants indicates that high-pay plants generally are less financially stable than lower pay plants. For example, the average equity ratio (total equities divided by total assets) was 63.1 for high paying plants, and 75.0 for low paying plants (table 16). Thus, high paying plants appear to have a weaker financial status than low paying plants.

Table. 16. Equity ratios for 52 Minnesota and Wisconsin dairy plants

Pay price group	Equity ratio*
Group 1 (high-pay)	63.1
Group 2 (middle-pay)	60.0
Group 3 (low-pay)	75.0
Average for all plants	65.4

* Total equities divided by total assets.

Table 17. Current ratio for 52 Minnesota and Wisconsin dairy plants

Pay price group	Current ratio*
	percent
Group 1 (high-pay)	1.09
Group 2 (middle-pay)	1.05
Group 3 (low-pay)	1.42
Average for all plants	1.15

* Current assets divided by current liabilities.

* The Wisconsin State Department of Agriculture licenses dairy plants on the basis of evidence that they are financially responsible. In order to show sufficient responsibility to assure reasonably prompt payment to producers for milk, plants will need to show at least $1.10 of current assets for every $1.00 of current liabilities until January 1, 1970, after which it will be raised to $1.15 to 1 for a year, and then to $1.20 to 1. Another test is the owner's equity in the business. The Department requires that dairy plants should have more total assets than total liabilities.

The current ratios (current assets divided by current liabilities) indicate the same problem for financial stability of plants. Data from the 52 sample plants indicate that high-pay plants generally have a lower current ratio than low-pay plants. The average current ratio was 1.09 for high paying plants and 1.42 for low-paying plants (table 17).

The current ratio, in part indicates the firm's ability to meet short term liabilities. A ratio very near one implies that any small business adversity could endanger the financial structure of the firm. It appears that high paying plants may be putting themselves in this dangerous financial position.

These relationships between financial stability and plant pay prices could affect a plant's long run ability to pay the Minnesota-Wisconsin price.

Geographic Location

Geographic location influences prices received for a commodity because of transportation cost differences in moving the product from production areas to consuming markets, production cost differences, and differing demands facing the various production areas. This section analyzes whether location of dairy plants within Minnesota and Wisconsin significantly affected their pay prices for milk.

In making this analysis, Minnesota and Wisconsin were each divided into three subareas. Average prices received by producers in each of the Minnesota and Wisconsin areas are presented in table 18.

In Minnesota, lowest prices were received by producers in the northwest area — the region most distant from the Twin Cities and from major consuming markets in the East. Highest average prices were paid in the central area, surrounding the Twin Cities where manufacturing milk plants compete for milk supplies with fluid milk plants. Higher priced fluid milk outlets exert upward pressures on prices paid by manufacturing milk plants in the common supply areas. Average pay prices in the southeastern Minnesota region were lower than in the central region, but higher than prices in the northwest region. The southwest area is nearer the consuming markets of the East, however, it is not so strongly influenced by the fluid milk markets as the central region.

In Wisconsin, prices for the northeastern region were highest of the three regions. This area is heavy in cheese production and has stiff competition from fluid milk plants supplying many urban markets. Average prices in the south central and northwest regions of Wisconsin were lower than in the northeast region. These south central and northwest regions do not produce as much cheese, nor is the fluid competition as keen as in the northeast region.

Table 18. Average producer pay prices for 3.5 percent manufacturing grade milk in six regions in Minnesota and Wisconsin, 1965 (52 sample plants)

Regions	Average price per cwt. of 3.5 percent butterfat
Minnesota	dollars per hundredweight
Central area	3.262
Southeast area	3.235
Northwest area	3.162
Wisconsin	
Northeast area	3.335
Northwest area	3.277
South central area	3.190

Analysis of variance was used to determine whether a significant difference existed between average pay prices by the sample plants for the six areas. The analysis indicates that the differences which existed in average prices between the areas could have occurred by chance less than 1 time in 100 and, therefore, are statistically significant.*

Average pay prices in various areas within the two states, therefore, did differ significantly from one another. A plant's ability to pay a certain price is related to its location which, therefore, affects a plant's ability to pay the Minnesota-Wisconsin price.

Operating Expenses

Plant manufacturing expenses per hundredweight of milk are normally inversely related to the prices plants can afford to pay producers. In other words, a low-cost plant can normally pay a higher price for milk than a high-cost plant manufacturing the same product. However, some in the dairy industry contend that high-cost plants artificially raise their prices to acquire milk and, thereby, stay in business.

To determine the extent that plant costs do affect milk prices to farmers and hence the level of manufacturing milk prices in Minnesota and Wisconsin, the 52 plants were classified according to three product groups — butter, butter-powder, and cheese. Plants in each product group were divided into high-, middle-, and low-pay price categories. Table 19 lists dairy plant costs by pay price categories for each of the three product groups.

An inverse relationship between pay price and processing costs is indicated for butter and butter-powder plants, but not for cheese plants. High-pay butter plants had a 6 cent per hundredweight lower total expense than low-pay butter plants. High-pay butter-powder plants had a 19 cent per hundredweight lower expense than low-pay butter-powder plants. However, high-pay cheese plants had a 7 cent per hundredweight *higher* cost than low-pay cheese plants.

The lack of a normal cost-price relationship in cheese plants may be explained by the diversity in types and styles of cheese, with resulting differences in costs and returns. Within American cheese plant, costs will differ depending on whether barrel cheese or block cheese and whether Cheddar or colby cheese is the final product. Thus, high-cost cheese plants can be receiving correspondingly higher prices for their cheese, and hence pay high prices to farmers for milk. Such diversity in type of operation is not nearly as characteristic within butter or butter-powder plants.

Regression analysis was used to measure the relationship between expenses and pay prices. Results are presented in table 20.

Except for plant operating expenses in cheese plants, all increases in expenses are associated with decreases in pay prices. Each 1 cent increase in total plant expense is associated with about a ⅓cent decrease in pay prices for both butter and butter-powder plants, and about 1/25-cent decrease in pay prices in cheese plants.

On the basis of data from the 52 sample plants, it cannot be argued that high-cost marginal plants are driving up pay prices. Instead, (with the exception of cheese plants making various types of products) high-cost plants generally have lower pay prices than do low-cost plants.

* The calculated F value for variance between areas was 8.93. This is significant at the 1 percent probability level.

Table 19. Costs of processing for selected dairy products in 52 Minnesota and Wisconsin dairy plants, 1965*

Pay price group	Plant operating expense	Administrative expense	Total expense
	dollars per hundredweight		
Butter plants			
Group 1 (high-pay)	0.193	0.003	0.226
Group 2 (middle-pay)	0.216	0.040	0.256
Group 3 (low-pay)	0.241	0.045	0.286
Average for all plants	0.218	0.040	0.258
Butter-powder plants			
Group 1 (high-pay)	0.416	0.044	0.460
Group 2 (middle-pay)	0.530	0.060	0.590
Group 3 (low-pay)	0.587	0.061	0.648
Average for all plants	0.491	0.052	0.543
Cheese plants			
Group 1 (high-pay)	0.441	0.032	0.473
Group 2 (middle-pay)	0.453	0.041	0.493
Group 3 (low-pay)	0.372	0.031	0.403
Average for all plants	0.441	0.037	0.478

* Costs were derived from plant records.

Table 20. Effect of dairy operating expenses on plant pay prices for milk in 52 Minnesota and Wisconsin dairy plants, 1965*

Type of plant	Impact of a 1 cent increase in expenses per hundredweight on plant-pay prices for milk		
	Plant operating expenses	Administrative expenses	Total expenses
	cents per hundredweight		
Butter plants	−0.383**	−1.521	−0.396**
Butter-powder plants	−0.351**	−2.387	−0.323**
Cheese plants	+0.018†	−0.283	0.035†

* Slope coefficients were calculated by simple regression analysis.
** Significant at the 5 percent probability level, i.e., a figure as large as this could have occurred by chance less than 5 times in 100.
† Not significant at the 5 percent probability level, i.e. could have occurred by chance more than 5 times in 100.

Volume of Milk Received

On the average, the largest volume plants were in the middle-pay group, while the plants with slightly smaller than average milk volume were in the high-pay group (table 21). These findings are somewhat surprising since many economies of size are known to exist in milk processing, and large plants normally are expected to be able to pay more for milk than smaller plants. However, in actual practice other factors such as type of product, dividend, depreciation, union versus non-union labor wage rates, trucking subsidy policy, and utilization of plant capacity appear to offset or overshadow the impact of plant volume in establishing pay price levels.

Patron Milk Volume as a Proportion of Total Milk Volume

Patron milk equaled 88 percent of all milk received by the 52 sample plants. Because higher receiving costs are likely to be associated with patron milk than with non-patron milk, an inverse relationship could be expected between pay prices and the proportion of patron milk. In other words, a high percentage of patron milk would be associated with low patron pay prices and vice versa.

Analysis of data from the 52 sample plants indicates such a relationship does not exist (table 22). Although the low paying group had the highest percentage of patron milk, nevertheless the high paying group had a higher percentage of patron milk than did the middle paying group.

Bulk Tank Milk and Bulk Tank Premiums

Premiums for bulk tank milk have been a common practice in milk procurement. These premiums are paid to encourage producers to shift from can to bulk handling of milk. Bulk handling reduces costs to plants for assembling and receiving milk.

Bulk premiums are included in the prices and values reported for the Minnesota-Wisconsin manufacturing milk price series. A discussion of the effect of bulk milk quantities and premiums on reported pay prices follows:

(a) Proportion of bulk tank milk: Bulk milk represented 30.1 precent of total manufacturing milk received by the 52 sample plants during 1965 (table 23). No great difference in these proportions existed between Minnesota and Wisconsin plants. Minnesota plants received 30.3 percent, and Wisconsin plants 29.9 percent of their milk as bulk tank milk.

Plants with high-pay prices did not receive a larger proportion of their milk in bulk than plants with lower prices. It is possible that a closer relationship between percentage of bulk milk and pay prices existed within product grouping, than for all plants together. Nevertheless, in the aggregate, little relationship existed between proportion of bulk tank milk and level of pay prices.

(b) Bulk tank milk premiums: The average premium paid on bulk tank milk by Minnesota and Wisconsin sample plants was 13.7 cents per hundredweight (table 23). A negative relationship existed between the amount of bulk premium paid by plants and the overall pay price level for milk. The low-pay price group paid a higher average bulk premium than the high-pay price group.

(c) Bulk tank premiums prorated to all producer milk: The effect of bulk premiums on reported pay prices of all producer milk is also presented in table 23. This was calculated by computing the total value of bulk premiums for the entire year and dividing this value by the total quantity of patron milk, both can and bulk.

Bulk tank premiums raised the price of all manufacturing grade milk of the 52 plants by 3.8 cents per hundredweight. The increase for Minnesota plants was 3.1 cents per hundredweight, and for Wisconsin 4.5 cents per hundredweight. Again, premiums were not the largest for the high paying plants. Middle-pay plants had larger premiums than high-pay plants.

Table 21. Average annual volume of milk received by each of 52 Minnesota and Wisconsin dairy plants, 1965

Pay price group	Average volume of manufacturing milk from producers	Average volume all milk received by plants
	pounds	
Group 1 (high-pay)	26,444,180	30,032,219
Group 2 (middle-pay)	31,282,503	39,540,808
Group 3 (low-pay)	22,251,733	24,239,605
Average for all 52 plants	26,655,332	31,247,057

Table 22. Patron milk deliveries as proportion of the total milk receipts for 52 Minnesota and Wisconsin dairy plants, 1965

Plant group	Patron milk deliveries as precent of total milk receipts
	percent
Group 1 (high-pay)	88.1
Group 2 (middle-pay)	82.5
Group 3 (low-pay)	97.3
Average for all 52 plants	88.0

Table 23. Percentage bulk milk receipts and bulk milk premiums for 52 Minnesota and Wisconsin dairy plants, 1965

Plant grouping	Bulk milk as percent of total plant milk	Bulk premium rate	Cents per cwt. impact of milk premium on average price of all milk
	percent	dollars per hundredweight	
Group 1 (high-pay)	32.9	12.4	+4.1
Group 2 (middle-pay)	35.2	14.4	+4.6
Group 3 (low-pay)	20.0	15.1	+2.2
Average for all plants	30.1	13.7	+3.8

Seasonal Variation

Since a substantial proportion of plant costs are fixed, seasonal variations in milk supplies can affect plant costs. A corollary question is whether seasonal variation in supplies also affects plant pay prices to farmers, and hence manufacturing milk values in Minnesota and Wisconsin and the Minnesota-Wisconsin price series.

Table 24 indicates that high-pay sample plants had the lowest seasonal variation in milk supplies, and low-pay plants had the largest seasonal swing. May milk receipts were 55 percent higher than November receipts in high-pay plants, and 84 percent higher in low-pay plants. On the basis of these data, it could be concluded that seasonal variation in milk receipts at plants substantially affects plant-pay prices.

Table 24. Seasonal variation in milk receipts for 52 Minnesota and Wisconsin dairy plants, 1965*

Pay price group	Seasonal variation
	percent
Group 1 (high-pay)	1.55
Group 2 (middle-pay)	1.63
Group 3 (low-pay)	1.84
Average for all plants	1.65

* May over November milk receipts.

Chapter V

Other Considerations in Pricing Milk for Manufacturing Use

A Single Surplus Class Price

Using a single price factor (or a method of establishing a single price), would require selecting one which is most representative of the value of milk for manufacturing use. This is one of the basic problems of surplus pricing, and the source of much current controversy. In effect, the agency establishing a surplus price must select on the basis of evidence at a hearing, a single price to represent some average value of milk for manufacture. This price must be set even though it will be higher than some plants pay for manufacturing milk and lower than others pay.

Table 25. Range in prices paid by manufacturing grade milk plants in Minnesota and Wisconsin, June and November 1965*

Prices paid per cwt.	June	November
dollars	percent of plants	
under-2.94	2.3	0
2.95-3.01	2.3	0.1
3.02-3.08	8.0	1.1
3.09-3.15	30.3	3.5
3.16-3.22	33.0	2.7
3.23-3.29	15.0	8.5
3.30-3.36	6.0	14.5
3.37-3.43	2.0	20.4
3.44-3.50	1.0	21.8
3.51-3.57	0.1	13.0
3.58-3.64	0**	5.7
3.65-over	0**	8.7
Total	100.0	100.0

* Based on data obtained from the Statistical Reporting Service representing all plants in both states as reported under state laws at year-end. All prices adjusted to 3.5 percent butterfat by applying the same butterfat differential used to adjust the Minnesota-Wisconsin price.

** Less than one-tenth of one percent.

To understand the problem of establishing a single measure of manufacturing milk values, it is helpful to find out why different prices are paid for manufacturing milk. Table 25 shows a frequency distribution of prices reported paid for manufacturing grade milk at over 1,000 unregulated manufacturing plants in Minnesota and Wisconsin. This table includes data for all plants handling manufacturing milk in the two states.

Prices on a 3.5 percent butterfat basis paid by 78 percent of the Minnesota and Wisconsin manufacturing plants had a range of 20 cents per hundredweight in June, and 34 cents in November. These differences are associated with plant efficiency, transportation costs, types of products manufactured, and the local competitive situation for milk supplies and other factors, as discussed in the previous chapter.

Price Differences Associated with Location

The prices paid in crop reporting districts in Minnesota and Wisconsin appear in table 26.

In 1965, Minnesota manufacturing grade milk prices in crop reporting districts varied from $3.01 to $3.29 per hundredweight — a range of 28 cents. In June, the range was 26 cents and in November it was 29 cents. In Wisconsin, the annual average price for manufacturing grade milk varied from $3.20 to $3.33 a range of 13 cents. In June, the range was 12 cents and in November it was 21 cents.

The price for manufacturing grade milk in Wisconsin has tended to be higher than in Minnesota when supplies are short and cheese demand is strong. The Minnesota pay price has generally been higher when milk supplies are heavy, particularly during the flush months. However, average pay

Table 26. Average prices paid to producers for milk delivered to Minnesota and Wisconsin dairy plants, per hundredweight of milk converted to 3.5 percent, by crop reporting districts, 1965, June and November 1965*

Milk Grade	Crop reporting district: N. West	N. Cen.	N. East	W. Cen.	Cen.	E. Cen.	S. West	S. Cen.	S. East	State
	dollars per hundredweight									
	Minnesota									
Mfg. grade milk										
1965	3.01	3.10	3.12	3.21	3.27	3.18	3.26	3.29	3.27	3.25
June	2.99	3.08	3.07	3.18	3.24	3.13	3.23	3.25	3.22	3.22
November	3.12	3.19	3.13	3.39	3.38	3.30	3.35	3.39	3.41	3.37
	Wisconsin									
Mfg. grade milk										
1965	3.20	3.30	3.28	3.23	3.27	3.32	3.29	3.33	3.32	3.28
June	3.15	3.19	3.18	3.17	3.17	3.20	3.20	3.27	3.22	3.19
November	3.35	3.53	3.49	3.38	3.47	3.56	3.51	3.56	3.49	3.49

* Converted by butterfat differentials specified in federal orders for adjusting Minnesota-Wisconsin price to 3.5 percent.

Table 27. Manufacturing grade milk prices

Year	Minnesota	Wisconsin
	dollars per cwt. of 3.5% milk*	
1961	3.28	3.25
1962	3.14	3.09
1963	3.11	3.12
1964	3.18	3.19
1965	3.26	3.29
1966	3.85	4.00
1967	4.01	3.98
7-year average	3.40	3.42

* Converted to 3.5 percent by using differential specified in federal orders for adjusting Minnesota-Wisconsin price.

prices for the two states are in close alignment. For the 7-year period 1961-1967, prices paid for manufacturing grade milk in Wisconsin averaged $3.42 per hundredweight and $3.40 in Minnesota (table 27).

Differences Associated with Products Manufactured

Over a period of time there is little difference in the average of prices paid for milk used in the major manufacturing milk products, i.e., butter-powder, Cheddar cheese, and evaporated milk. Plants making these products compete with each other for milk supplies, and generally must return about the same amount to producers over a period of time to obtain continued supplies of milk. This is particularly true in states such as Minnesota and Wisconsin where many dairy plants compete for milk supplies. Also, the existence of a number of diversified plants making several products allows plants to shift readily to the most profitable use at any particular time.

Table 28 shows the 7-year average of prices paid for milk used in butter-powder and American cheese. For this 7-year

Table 28. Minnesota-Wisconsin creamery and cheese plant pay prices for manufacturing grade milk

Year	Minnesota-Wisconsin creamery pay price*	Minnesota-Wisconsin cheese plant pay price**
	dollars per cwt of 3.5 percent milk†	
1961	3.28	3.23
1962	3.13	3.08
1963	3.12	3.15
1964	3.18	3.21
1965	3.26	3.30
1966	3.86	4.01
1967	3.99	3.96
7-year average	3.40	3.42

* State prices weighted by proporation or total volume of butter produced in the two states during preceding year.

** State prices weighted by proportion of total volume of cheese produced in the two states during preceding year.

† Converted to 3.5 percent by using differential specified in federal orders for adjusting Minnesota-Wisconsin price.

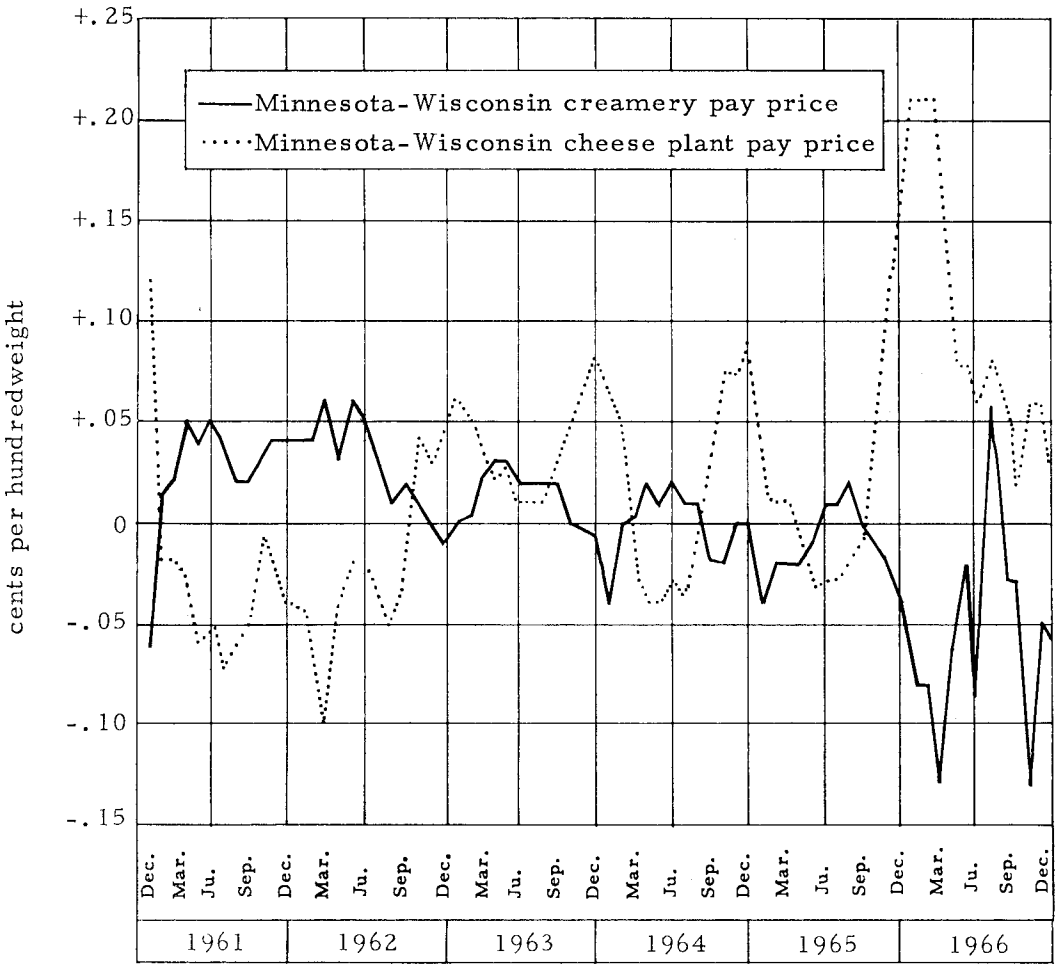

Figure 2. Deviation from Minnesota-Wisconsin manufacturing grade milk price in cents per hundredweight.

period, there was only slight difference in average prices paid. The weighted average of prices paid by cheese plants in Minnesota and Wisconsin exceeded the two-state creamery-pay price by 2 cents per hundredweight.

In the short-run, however, marked differences do exist between the average of prices paid for milk for butter-powder and the average of prices paid for milk for American cheese. For example, in 1966, the weighted average of prices paid by cheese plants in Minnesota and Wisconsin exceeded the two-state creamery-pay price by 15 cents per hundredweight. Table 28 shows that cheese plants have outpaid creameries, on an annual basis, during the 4 years, 1963-1966. In 1961, 1962, and 1967 creamery prices were higher. Monthly variations in creamery-pay prices and cheese-pay prices from the Minnesota-Wisconsin price are plotted in Figure 2.

Table 29 shows the amount by which Minnesota-Wisconsin cheese plant-pay prices were above or below creamery-pay prices, by months, during 1961-1962 and 1965-66. In January 1961, the cheese-pay price, exceeded the creamery-pay price by 18 cents. However, by May of that year the creamery-pay price was 10 cents over the cheese-pay price, and by March of 1962 it exceeded the cheese-pay price by 16 cents.

In August 1965, the creamery-pay price was 4 cents higher than the cheese-pay price, but by December the cheese-pay price was 21 cents higher. The spread increased to a peak of 34 cents in March 1966 and then dropped sharply to only a 9-cent spread in December 1966.

The relative level of prices paid for milk in the two states is partially explained by the relative importance of butter and powder to cheese in the manufacturing dairy industries in each state. Minnesota's industry is largely a butter-powder industry. Wisconsin has a very large cheese industry. As a result, when cheese prices are high relative to butter-powder the all manufacturing price for Wisconsin is high relative to Minnesota. This situation occurred during 1961-62 and 1965-66 (figure 3). When prices for butter and powder are high relative to cheese then the Minnesota all manufacturing milk price tends to be higher than the Wisconsin price.

In Minnesota and Wisconsin, competitive prices for milk for a particular product are influenced by prices paid at plants making other manufactured products. This causes the competitive prices for milk for one manufactured product to reflect considerably the general going value of milk rather than a particular use value. For example, in those months of 1965 and 1966 when manufacturing milk supplies were tight and cheese prices were high relative to butter-powder prices, creameries in Wisconsin had to pay substantially higher prices than creameries in Minnesota to compete for supplies. In 1962-64, when supplies were more abundant and product prices in closer relationship, cheese plants in Wisconsin did not have to pay as high prices as cheese plants in Minnesota to compete for supplies. However, over time, prices are in close relationship as indicated by the 7-year annual average prices paid by creameries and cheese plants in the two states (table 30).

There is some indication that plants making certain foreign type cheese and also those making ice cream, cottage cheese, and other specialty dairy products return somewhat more to producers. A study of the relative profitability of manufacturing alternative types of dairy products in the New York milkshed showed that the combination of ice cream mix and creamed cottage cheese offered manufacturers of dairy products the widest margins.* Calculated margins for ice cream mix combinations averaged about 60 cents per hundred pounds of milk higher than margins involving either butter or manufacturing cream. A difference in the level of margins from the manufacture of alternative dairy products has generally been recognized by the industry and has been demonstrated by similar studies made in other parts of the country.** Table 31 shows U. S. average prices paid by plants for manufacturing grade milk used in making American cheese and specialty cheese products.

With the short-run differences that sometimes exist in prices paid for milk for different manufacturing uses, it is easy to see why there is so much controversy about an appropriate single price level for manufacturing milk. This is true particularly at times when market prices of cheese are out of normal relationship with market prices for butter and powder.

An alternative might be to establish more than one surplus price. The alternative price could be used if the single price exceeds the butter-powder formula price values by more than a specified amount. Establishment of single or multiple surplus class prices requires consideration of several factors.

Table 29. Amount by which Minnesota-Wisconsin cheese plant-pay prices were above or below Minnesota-Wisconsin creamery-pay prices by months for 1961, 1962, 1965, and 1966

Month	1961	1962	1965	1966
	dollars per hundredweight of 3.5 percent milk			
January	+0.18	−0.08	+0.07	+0.29
February	−0.03	−0.10	+0.03	+0.29
March	−0.04	−0.16	+0.03	+0.34
April	−0.08	−0.07	+0.01	+0.14
May	−0.10	−0.08	−0.02	+0.10
June	−0.10	−0.07	−0.04	+0.15
July	−0.11	−0.07	−0.04	+0.02
August	−0.08	−0.06	−0.04	+0.09
September	−0.07	−0.04	−0.01	+0.05
October	−0.04	+0.03	+0.05	+0.19
November	−0.06	+0.03	+0.13	+0.11
December	−0.08	+0.05	+0.21	+0.09
Average	−0.05	−0.06	+0.03	+0.16

Table 30. Manufacturing grade milk prices

Year	Wisconsin		Minnesota	
	Cheese plants	Creameries	Cheese plants	Creameries
	dollars per cwt. of 3.5 percent milk*			
1961	3.23	3.29	3.20	3.28
1962	3.08	3.13	3.10	3.13
1963	3.14	3.14	3.19	3.11
1964	3.20	3.19	3.26	3.18
1965	3.29	3.28	3.34	3.25
1966	4.02	3.90	3.96	3.83
1967	3.94	3.99	4.05	4.00
7-year-average	3.41	3.42	3.44	3.40

* Converted to 3.5 percent by using differential specified in federal orders for adjusting Minnesota-Wisconsin price.

* McAllister, C. E. and D. A. Clarke, *Class III Milk in the New York Milkshed: IV Processing Margins for Manufactured Dairy Products*, Marketing Research Report No. 419, USDA, 1960.

** Clarke, D. A., O. D. Forker, and A. C. Johnson, *Pricing Milk for Manufacturing Purposes in California*, Bulletin 801, University of California, 1964.

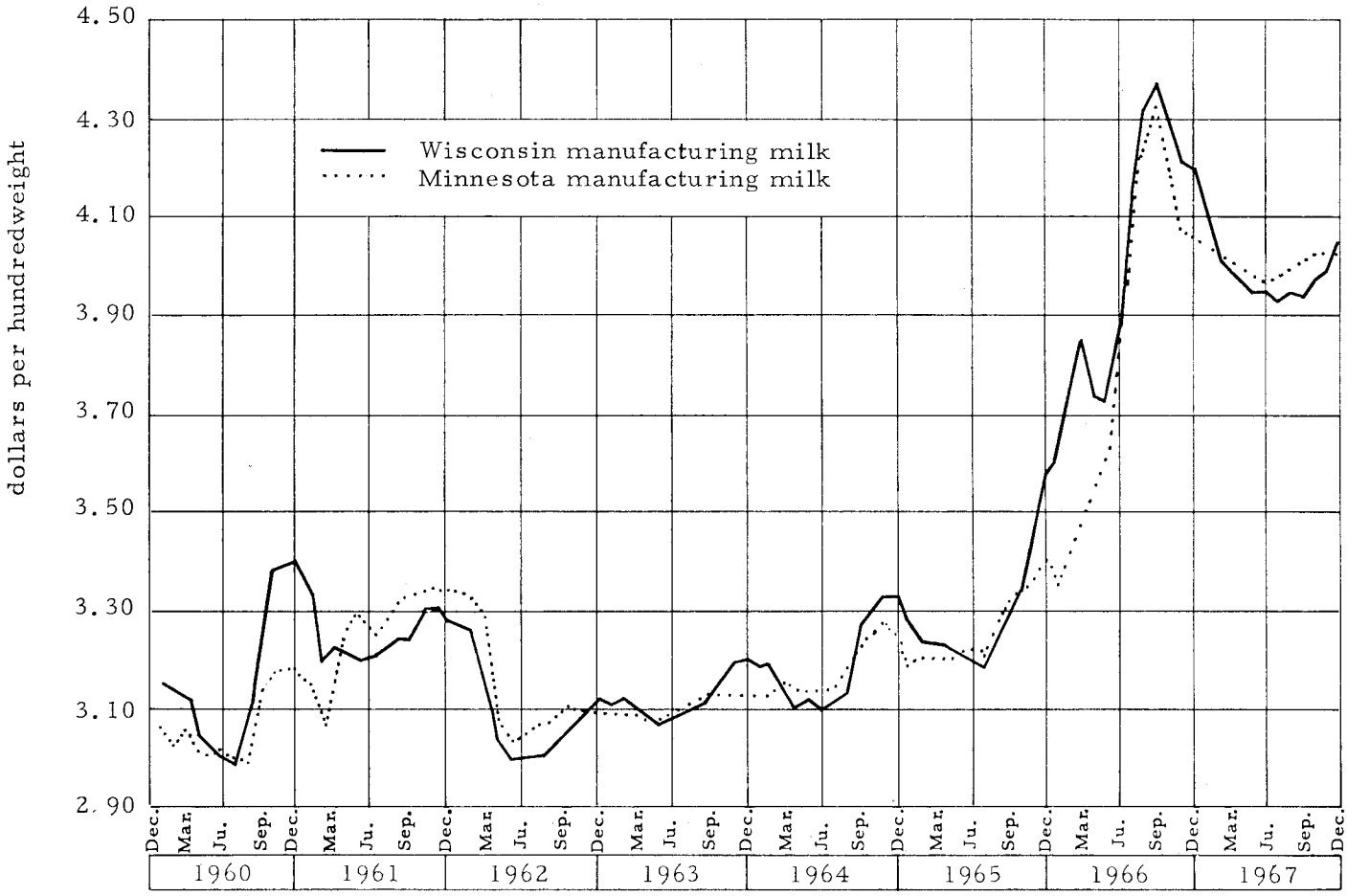

Figure 3. Prices paid for manufacturing milk, Minnesota and Wisconsin (3.5 percent butterfat basis). Source: Wisconsin Dairying, Agri.

Proposals have been made to establish one surplus class price for butter-powder and cheese, and another higher surplus class price for milk used in soft products. Some industry representatives have proposed that separate cheese and butter-powder class prices be based upon cheese and butter-powder formulas respectively. Others have suggested that Minnesota-Wisconsin butter-powder pay price series be developed and that a Minnesota-Wisconsin cheese plant pay price series be developed. Special soft products class prices in some markets provide a stated premium of 15 to 25 cents over the Minnesota-Wisconsin price.

Also, a number of federal orders adopted a butter-powder snubber to the Minnesota-Wisconsin price. The snubber price, a butter-powder formula, is the effective price whenever it is lower than the Minnesota-Wisconsin price.

Table 31. U. S average price paid by plants for manufacturing grade milk used in various types of cheese, average 1966

Product	Price at 3.5 percent*
	dollars
American cheese	3.84
Misc. cheese:	
Swiss	3.93
Brick and Munster	3.99
Italian	3.91
All other	3.74
Total misc.	3.89
Total cheese	3.86

* Converted to 3.5 percent by using differential specified in federal orders for adjusting Minnesota-Wisconsin price.

Single Surplus Class Price vs. Multiple Surplus Class Prices

Single Surplus Class Price

Single surplus class price proponents justify this approach on the basis of one or more of the following considerations:

A. It is difficult over time to develop evidence which indicates milk for different uses has substantially different values — or to quantify these differences in value. Often price differences among plants making the same product can be shown to be as great or greater than price differences associated with different products.

B. Even when (or if) differences between various uses exist, it is desirable to establish surplus prices which will encourage utilization in higher-valued products, rather than to

provide means by which milk can be utilized in lower use value products and thereby reduce blend to producers.

C. In the case of soft products, efforts under the federal milk order program to establish substantially higher prices for milk for cottage cheese and specialty cheese and ice cream have been generally unsuccessful because of availability of manufacturing milk supplies at close to the Minnesota-Wisconsin price.

D. Unregulated manufacturing plants must compete for supplies in the general market for manufacturing milk. Therefore, when butter-powder or cheese prices are out of line, plants making only one product, as a matter of course, have to pay more or less than they can afford to pay in order to compete for supplies of milk. Over time price disparities for various products either balance out due to interaction of supplies and demand, or plants shift to alternative higher priced products. Thus, it is argued that it is also reasonable to have only one order price for surplus milk.

Multiple Surplus Class Price

Proponents of more than one surplus class price justify their approach on the basis of one or more of the following considerations:

A. Differences clearly exist in the short-run in the value of milk for various uses. In the interest of orderly handling of the surplus it is desirable to provide separate class prices which reflect the value at any particular time in its major manufacturing uses. This is particularly true, it is argued, in the cases of markets where the facilities for manufacturing milk into some products (particularly cheese) do not exist. In such circumstances, it is contended, milk cannot always be shifted into higher valued uses but must be manufactured into products for which facilities exist.

B. If a single class price is used it must be low enough to assure handling of all surplus in a market, yet high enough to assure highest possible producer returns for surplus milk. With multiple surplus class prices, it may be possible to achieve a higher overall return for surplus milk. This is accomplished by establishing prices for various uses based on their market values, rather than having abnormally low prices because one use had depressed market prices.

C. Since the value of milk for soft products is not related to a national market, the opportunity exists for establishing somewhat higher prices for milk utilized in soft products. It also may be justified by the higher cost of transportation associated with milk used in such products.

The Minnesota-Wisconsin Price Limited by a Butter-Powder Snubber Formula in Surplus Pricing

Competitive pay prices offer advantages in order markets with both butter-powder and cheese facilities. Competitive prices, such as the Minnesota-Wisconsin price, provide incentive for shifts in the utilization of milk when finished product prices are out of normal relationship. In some markets, facilities for making cheese may not be available. In such situations the surplus may be used to make ice cream and cottage cheese; but substantial quantities may also be needed for butter and powder. Plants processing the market surplus into butter and powder could experience a financial strain if they paid the Minnesota-Wisconsin price during periods when such price significantly exceeded butter-powder product values.

To provide relief when this type of situation exists, 15 orders using the Minnesota-Wisconsin price for surplus pricing contain a provision that such price cannot be more than a butter-powder snubber formula value.

The following federal order markets use the Minnesota-Wisconsin price series limited by a butter-powder snubber formula in pricing milk in the lowest use class:

1. Cincinnati*	3-1-66
2. Clarksburgh*	2-1-66
3. Columbus*	5-1-64
4. Fort Wayne**	8-1-62
5. Indianapolis**	5-18-62
6. Kansas City†	4-16-66
7. Miami Valley**	9-1-67
8. Northeastern Ohio*	4-1-65
9. Northern Louisiana†	5-1-67
10. Northwestern Ohio*	1-1-65
11. Puget Sound†	7-1-66
12. Southern Michigan**	1-1-63
13. Wheeling*	9-1-66
14. Wichita†	9-1-66
15. Youngstown-Warren*	2-1-66

* (Chicago 92 score butter price — 3 cents x 4.2) — (Chicago area spray powder price — 5.5 cents x 8.2025) — 10 cents

** (Chicago 92 score butter price — 3 cents x 4.2) — (Chicago area spray powder price — 5.5 cents x 8.2) — 10 cents

† (Chicago 93 score butter price x 4.2) — (Chicago area spray powder price x 8.2) — 48 cents

In effect the butter-powder snubber means that a plant's order obligation for Class II surplus milk cannot be more than the butter-powder snubber formula price. Where the Minnesota-Wisconsin price is lower than the butter-powder snubber price, the plant's order obligation would be at the Minnesota-Wisconsin price level. The use of these so-called snubbers provides relief under certain circumstances and thus accommodates one objective of surplus pricing — to assure that the price for surplus milk is at levels at which handlers will be willing to accept it.

An equally important objective in surplus pricing is to provide the highest possible returns to all producers, and not to provide unreasonable profits for handling surplus milk. In an order market using the Minnesota-Wisconsin price for pricing surplus milk, a regulated plant making cheese does not pay the full competitive value for milk when cheese prices are high relative to butter-powder prices. The use of a butter-powder snubber, widens the disparity between the value of milk for cheese and the order price for milk used to make cheese, when cheese prices are high relative to butter-powder prices. In 1966, the average price paid by Wisconsin cheese plants for manufacturing grade milk was $4.02. The annual average surplus price in the order markets using the butter-powder snubber was $3.76. Any plants under these orders making cheese thus had a 26 cent competitive price advantage over prices paid by unregulated cheese factories in Wisconsin. This is a problem when the butter-powder snubber is used.

The Minnesota-Wisconsin price no longer functions in those markets with the snubber in their surplus pricing formula. The Indianapolis order was the first market to use the Minnesota-Wisconsin price limited by a butter-powder snubber formula in pricing surplus milk. During the first 31 months that this formula was used, June 1962 to December 1964, the butter-powder formula in the order exceeded the Minnesota-Wisconsin price in 18 months, and in those months the Minnesota-Wisconsin price was the Class II price. However, during the next 36 months, January 1965 to December 1967, the Minnesota-Wisconsin price was the

surplus price in only 3 months. Two of these months were in 1965. The last time the butter-powder snubber value exceeded the Minnesota-Wisconsin price was in July 1966.

In 1963, the annual average of creamery-pay prices in Minnesota and Wisconsin was 1 cent below the butter-powder snubber value. In 1964, the creamery-pay price was 1 cent above the snubber value, in 1965 it averaged four cents higher, and in 1966 and 1967 the differences were 10 and 8 cents respectively.

In summary, it is questionable if a snubber to the Minnesota-Wisconsin price carries out the surplus pricing objective of providing the highest possible returns to producers. It does, of course, provide relief for butter-powder plants during the periods when significant differences between the Minnesota-Wisconsin prices and butter-powder product values prevail. If used, care should be taken to see that the butter-powder snubber formula is realistic and up to date in terms of processing cost allowances.

Table 32. Indianapolis Class II price, Minnesota-Wisconsin manufacturing grade price, butter-powder snubber formula price, and average prices reported paid farmers for milk used in making butter and creamery by-products in Minnesota and Wisconsin, January 1963 to December 1967

Year and Month	Indpl. Class II price	Minn.-Wis. mfg. grade price	Butter powder formula	Minn.-Wis. exceeds BP snubber pr.	Minn.-Wis. cream pay price*
			dollars per hundredweight		
1963					
Jan.	3.10	3.10	3.12	−0.02	3.10
Feb.	3.10	3.10	3.12	−0.02	3.10
Mar.	3.09	3.09	3.12	−0.03	3.11
Apr.	3.08	3.08	3.12	−0.04	3.11
May	3.07	3.07	3.12	−0.05	3.10
June	3.08	3.08	3.12	−0.04	3.10
July	3.09	3.09	3.12	−0.03	3.11
Aug.	3.10	3.10	3.12	−0.02	3.12
Sept.	3.12	3.12	3.20	−0.08	3.14
Oct.	3.14	3.15	3.14	+0.01	3.15
Nov.	3.13	3.16	3.13	+0.03	3.16
Dec.	3.13	3.16	3.13	+0.03	3.16
Average	3.10	3.11	3.13	−0.02	3.12
1964					
Jan.	3.13	3.17	3.13	+0.04	3.13
Feb.	3.13	3.16	3.13	+0.03	3.16
Mar.	3.13	3.15	3.13	+0.02	3.15
Apr.	3.12	3.12	3.12	0	3.14
May	3.12	3.12	3.12	0	3.13
June	3.11	3.11	3.13	−0.02	3.13
July	3.12	3.12	3.13	−0.01	3.13
Aug.	3.15	3.15	3.20	−0.05	3.16
Sept.	3.24	3.24	3.27	−0.03	3.22
Oct.	3.23	3.27	3.23	+0.04	3.25
Nov.	3.29	3.29	3.30	−0.01	3.29
Dec.	3.18	3.29	3.18	+0.11	3.29
Average	3.16	3.18	3.17	+0.01	3.18
1965					
Jan.	3.13	3.25	3.13	+0.12	3.21
Feb.	3.13	3.22	3.13	+0.09	3.20
Mar.	3.13	3.22	3.13	+0.09	3.20
Apr.	3.17	3.23	3.17	+0.06	3.21
May	3.17	3.22	3.17	+0.05	3.21
June	3.16	3.20	3.16	+0.04	3.21
July	3.17	3.21	3.17	+0.04	3.22
Aug.	3.25	3.25	3.26	−0.01	3.27
Sept.	3.29	3.29	3.30	−0.01	3.29
Oct.	3.34	3.34	3.34	0	3.33
Nov.	3.36	3.39	3.36	+0.03	3.37
Dec.	3.36	3.47	3.36	+0.11	3.43
Average	3.32	3.27	3.22	+0.05	3.26

Table 32. (Continued)

Year and Month	Indpl. Class II price	Minn.-Wis. mfg. grade price	Butter powder formula	Minn.-Wis. exceeds BP snubber pr.	Minn.-Wis. cream pay price*
1966		dollars per hundredweight			
Jan.	3.21	3.47	3.21	+0.26	3.38
Feb.	3.31	3.58	3.31	+0.27	3.50
Mar.	3.40	3.68	3.40	+0.28	3.56
Apr.	3.47	3.64	3.47	+0.17	3.58
May	3.56	3.65	3.56	+0.09	3.63
June	3.67	3.82	3.67	+0.15	3.74
July	4.05	4.05	4.06	−0.01	4.10
Aug.	4.20	4.26	4.20	+0.06	4.23
Sept.	4.29	4.34	4.29	+0.05	4.31
Oct.	4.02	4.26	4.02	+0.24	4.13
Nov.	3.99	4.15	3.99	+0.16	4.11
Dec.	3.92	4.14	3.92	+0.22	4.07
Average	3.76	3.92	3.76	+0.16	3.86
1967					
Jan.	3.92	4.08	3.92	+0.16	4.03
Feb.	3.91	4.02	3.91	+0.11	4.01
Mar.	3.91	4.01	3.91	+0.10	4.00
Apr.	3.91	3.98	3.91	+0.07	3.97
May	3.91	3.96	3.91	+0.05	3.97
June	3.91	3.96	3.91	+0.05	3.95
July	3.91	3.95	3.91	+0.04	3.98
Aug.	3.94	3.97	3.94	+0.03	4.00
Sept.	3.97	3.97	3.93	+0.04	4.02
Oct.	3.91	3.98	3.91	+0.07	3.99
Nov.	3.91	4.00	3.91	+0.09	3.99
Dec.	3.96	4.04	3.96	+0.08	3.99
Average	3.92	3.99	3.92	+0.07	3.99

* Pay prices for the individual states weighted by the two-state production for the previous year.

Chapter VI

State Programs to Assure Accurate Payment for Milk

Wisconsin had 792 dairy plants buying milk from approximately 69,900 dairy farmers in late 1967. Minnesota had 501 dairy plants buying milk and cream from about 59,000 milk producers. The accuracy of milk weights and butterfat tests is vitally important to both producers and dairy plants. Each farmer desires and should receive accurate weights and tests on the milk he sells. Accuracy is also necessary to assure that milk price series used in other government programs is based on correct data. Accuracy of weights and tests is also necessary for equitable competitive relations among dairy plants.

Both Minnesota and Wisconsin have statutes, administrative codes, and agencies to regulate the equipment and procedures for weighing and testing milk and cream.* The statutes also authorize the State Departments of Agriculture to check plant records and to require plant operating records.**

In Wisconsin the Dairy, Food, and Trade Division of the Wisconsin State Department of Agriculture must administer these statutes and codes. In Minnesota, butterfat testing and reporting are regulated by the Food Inspection Division of the Minnesota Department of Agriculture. And, weighing and measuring equipment is regulated by the Weights and Measures Division of the Railroad and Warehouse Commission. The control programs are similar in both states.

Routine Control of Product Accountability

Wisconsin: A complete audit of plant records is a primary control method. All Wisconsin dairy plants receiving milk from producers are audited annually by a product accountability staff of the Wisconsin Department of Agriculture. This audit is accomplished by surveying eight geographic areas of the state at different times each year.

When requested, a plant must submit a detailed report of one month's operation listing all purchases of milk and dairy products which are manufactured by the plant. Federal milk market order plants (both Grade A and Grade B) are exempt from this audit requirement. The first product audit report is used as a screening operation. If the plant shows sales of butterfat exceeding reported receipts of butterfat by 3 percent or more it is placed on a list for further investigation. This additional investigation includes picking up composite samples of milk from all patrons for a retest at one of three district laboratories.

Normally plants test milk every 15 days, so both the first half and the second half of the month's composite samples are retested by the state. During the same month, the intake scale weigh tank will be sampled to determine if the agitation is sufficient to give the operator a truly representative daily sample of the patron's milk.

When the inspector picks up the composite samples, he also takes a physical inventory of equipment used by the dairy plant in sampling, storing, and testing of patrons' milk. If equipment or technique irregularities have occurred, the district testing technician will make an immediate follow-up to obtain compliance with Wisconsin sampling and testing requirements.

If the results of the two consecutive comparative retest results do not compare with the plant test within accepted tolerances, a 3-month product audit is conducted at the plant by department accountants. This audit covers the month before, the month after, and the month that the composite is retested by the state. If the audit shows a continued imbalance of purchases versus production, all evidence is studied to determine the causative factors.

Minnesota: As part of the screening process in Minnesota's butterfat control program, all plants are required to complete and submit to the department of agriculture monthly and annual dairy reports. These reports include all milk and cream purchases, milk and cream inventories with butterfat content and production of all manufactured dairy products. These reports are checked for irregularities in product accountability. Errors in reporting or discrepancies within the reports or among monthly reports call for additional investigation.

Minnesota has a 24 percent maximum overrun law for butter plants. This declares as illegal, an overrun figure in butter plants in excess of this amount. If plant records show a larger overrun, additional investigation is required. The additional investigation is similar to that in Wisconsin. A complete input-outgo audit is required. All records on weights, butterfat tests, payrolls, and operations are thoroughly audited. Sampling and testing equipment is checked. Techniques of sampling and testing are observed. Composite samples must be retested by the state testing laboratories to determine if plant tests are within accepted tolerances. During these retests sample identities are coded.

Another phase of Minnesota's program is a routine audit of plant records. A dairy product inspector is assigned to each of four state areas to audit plant records and check equipment in each plant at least once every two years. Also, the regular food inspector of the Department of Agriculture periodically checks dairy plants. They report any irregularities to the dairy inspection division.

Many cheese buyers now run moisture and dry matter tests on every vat of cheese they buy, and report this information on the cheese invoices. Similarly butter buyers test and report the fat test on each churning of butter. This information is extremely helpful in the product audit program, and in corrective action by the state, both educational and in court. It helps regulatory departments determine and prove whether more fat was actually sold then purchased during a given period.

Both States: The procedures followed, once improper techniques or equipment or illegal practices are found, are similar in both states. Four courses of action may be under-

* Weighing of milk: Wisconsin Statutes, Chapter 98, Minnesota Statutes Chapter 239.23. Testing for butterfat: Wisconsin Administrative Code 107, Minnesota Statutes, Chapter 32.

** Wisconsin Statutes, Chapter 93; Minnesota Statutes, Chapter 32, Section 18-19.

taken. (1) an educational visit to the plant by departmental personnel may be undertaken. If the problem is a minor one of improper equipment or technique, this visit usually resolves the problem. (2) An informal hearing may be held with the plant manager, testers, and board of directors. Here personnel are instructed on procedures which are to be followed to assure proper testing and accounting for butterfat. The plant may be closely observed and supervised until proper testing and accounting procedures are assured. (3) A formal heearing can be called by the state Department of Agriculture to permit plant representatives to show cause why the plant licenses should not be revoked. (4) The offenders may be charged in a court of law. For example, violation of the 24 percent overrun law in Minnesota is a misdemeanor. A person found guilty of violating this law is subject to fine and imprisonment.

Composite Retesting

In all cases where there are questions regarding a dairy plant's accountability for milk and butterfat, retesting of the plant's composite samples is undertaken by the states. Both states routinely check random samples from the plants as a part of the regular screening process.

Split-Sample Testing and Plant Retest Programs

Both Departments of Agriculture conduct year-round programs to help assure accuracy in butterfat testing. In the Wisconsin program, each district state testing laboratory prepares a number of samples of known butterfat content for distribution to laboratories doing official testing for plants. The licensed testers are requested to test the samples and return the results to the district laboratories. All samples are coded, so that neighboring laboratory personnel are unable to "get together" on their results. At the time these sets of samples are distributed, district dairy inspectors make a complete check of the equipment and facilities.

This program has shown that plant laboratories report both higher and lower tests on the control sample. When incorrect results are reported, techniques and equipment are corrected, to minimize deviations.

Minnesota does not use the split-sample method, but selects composite samples from randomly selected plants. These samples are coded so they cannot be identified by the plants. They are then sent back to the plant laboratories to see if the original test can be duplicated. Here, also, the technique and testing equipment are checked for irregularities which could cause testing error. Both methods provide information on the accuracy of the testing laboratories used by the plants.

Weighing and Measuring Milk

The intake scale of any Wisconsin dairy plant showing excessive product gain is checked immediately by the weights and measures inspector of the Food Division. If the plant was using the bulk tank method of handling milk, the Department of Agriculture's farm milk tank specialist checks the tanks and makes a quantity control check with plant management.

In Minnesota, weights and measures are the responsibility of the Weights and Measures Division of the Railroad and Warehouse Commission. The division is responsible for checking scales used by dairy plants about once every 2 years, or upon request of the Food Inspection Division of the Department of Agriculture. If a violation of the laws regarding scales and weighing of milk is found, violators can be prosecuted.

In both states, the dairy plants are responsible for the accuracy of their plant intake scales. The Wisconsin Department of Agriculture suggests that every plant intake scale be tested at least 4 times a year by a competent scale agency. Privately operated scale services have substantially improved the accuracy of plant intake scales in the past few years.

Wisconsin has worked with farm milk tank installers to check their installation method and calibration procedures. Wisconsin's Department of Agriculture recommends that every newly installed tank be calibrated by a private agency immediately after installation at a farm, and again after 1 year.

Periodically, Wisconsin's weights and measures inspectors will select and weigh a number of bulk tank farm pick-up trucks. The weight of the milk on the truck will be compared with the total weight indicated on the pick-up tickets. Periodically, specific geographic areas of the state are selected and all farm milk tanks are tested in that area. Questions on installation are immediately reported to area tank installers.

Minnesota has no formal program for checking the measuring devices for farm bulk tanks. However, the Weights and Measures Division will investigate if complaints are registered with it on farm bulk tanks.

Complaints of High-Pay Prices

Complaints from individual plant operators, groups of operators, and associations, questioning the ability of particular plants or groups of plants to pay higher than normal prices without having altered butterfat tests, are frequently received by departments of agriculture in Minnesota and Wisconsin.

Operations in question are personally audited by departmental personnel, composite samples are retested, and the regular investigational routine for problem plants is carried out. In addition, cost analysis of the plants' operating records is made, to determine whether the prices paid can be justified.

Evaluation of State Programs Dealing with Accurate Payment for Milk

In general, personnel of the regulatory agencies in each state have the authority to effectively regulate dairy plant product accountability for products. However, both states have only small budgets and departments to perform this function. As a result irregularities in product accountability do exist.

It is obvious that many factors affect the prices which are reported and paid by dairy plants. The butterfat content of milk and milk products is also affected by many factors. Continuing surveillance of the industry is a large job. Considering the importance of the program both to the farmer and dairy industry, and the value of the products involved, a greater commitment of resources in operating the programs is justified.

Regulation of Data Reporting for Price Series

The Federal Government does not require manufacturing grade milk plants to report value, quantity, or price data for use in computing various price series, nor does it have authority to do so. Instead the Federal-State Crop Reporting Service relies on the reporting requirements of the state departments of agriculture.

Both Minnesota and Wisconsin have state laws which require reporting of values, prices, and quantities by dairy plants, and prescribe penalties for false reporting. Section 32.18 of the Minnesota Statute states that, "Every person engaged in the purchase, manufacture, or sale of dairy products, and all dairy plants, owners, or operators shall keep in proper books true and full records of all milk, cream or butterfat, and other dairy products, manufactured, purchased, received, shipped, stored, or handled by them each day." Section 32.19 states that, ". . . Within 90 days following the close of each fiscal year and at such other times as the Commissioner (of Agriculture) may fix or require, by rules and regulation adopted as required by law, make and file with the commissioner on blank form prepared by him, itemized and verified reports on all business transacted by him, as set out in Section 32.18, during the preceding fiscal year." Section 32.201 provides that, "Any person violating any of the provisions of Section 32.18 to 32.20 shall be guilty of a misdemeanor." These sections make it mandatory for all dairy plants to report the data necessary in constructing milk price series.

Wisconsin also has statutes requiring reports from dairy plants for use in constructing price series. Since only annual reports are mandatory in Wisconsin, data for the current and preceding month used in price estimates are obtained from voluntary reports of plants. Current-month data are also obtained from voluntary reporting in Minnesota but data for the preceding month are obtained from mandatory reports. These data are part of those used in constructing the Minnesota-Wisconsin Price series and other milk price series. Since some of the voluntary reports can be verified from the mandatory reports which are filed, false price reporting is less of a problem, than is accurate product accountability.

Appendix 1

Prices Received by Farmers for Manufacturing Grade Milk in Minnesota and Wisconsin, 1961-66

Prepared by the Statistical Reporting Service
U.S. Department of Agriculture*

The Statistical Reporting Service of the U. S. Department of Agriculture publishes on or about the 5th of each month an estimate of the average price received by farmers and of the average milkfat test for milk of manufacturing grade for the preceding month for the two-state, Minnesota-Wisconsin area. For example, the price for August was reported on September 5.

These two states produce about half of the manufacturing grade milk marketed in the United States, and the estimates relate to prices paid to farmers for this milk. The estimates relate only to manufacturing grade milk purchased from farmers and do not include Grade A milk diverted to manufacturing uses. The price concept used is that represented by dividing total dollars paid to producers, before hauling costs are deducted, by the number of hundredweight of manufacturing grade milk purchased from farmers. This is an estimate of the average price for all milk of manufacturing grade delivered in bulk tanks and in cans, f.o.b. plant or receiving station, before hauling costs are deducted. It includes bulk tank, quantity, or other premiums paid to producers, but excludes hauling subsidies.

Most of the basic and preliminary data needed for the preparation of the two-state average price and fat test of manufacturing grade milk are collected by the offices of the Federal-State Agricultural Statisticians in Minnesota and Wisconsin. These data come from regularly scheduled monthly reports submitted by plants manufacturing dairy products.

After these data are summarized and analyzed by the Federal-State Statisticians, they are forwarded to Washington, D. C. for final U. S. Crop Reporting Board review and consolidation into the two-state average price and test.

The price and test estimates for a given month are derived from two factors: (1) the estimated average price and test for the base month, which is the month preceding that to which the estimate relates, and (2) an estimate of change from the base month to the month to which the estimate relates.

Estimated Price and Test for Base Month

The level for the base month, which is used as the benchmark, is based on reports from about 260 plants in Wisconsin that purchase approximately 40 percent of all manufacturing grade milk sold by farmers in the state, and on reports from about 300 plants in Minnesota that purchase approximately 70 percent of all manufacturing grade milk sold by Minnesota farmers. These reports include information as to total dollars paid producers, total pounds of milk received

* Based on SRS-11, November 1967.

from producers, and total pounds of milkfat received from producers.

The estimated monthly price and fat test for each state are weighted by the quantity of manufacturing grade milk purchased from farmers in that state. During the first half of any year these weights are based on data for the same month two years earlier. During the latter half of the year, weights are based on purchases for the corresponding month in the preceding year, since later data are available than during the first 6 months. The quantity weights for weighting data for each state in computing the two-state average price change each month and vary seasonally. In 1965, the average of the monthly volume weights for Wisconsin was 57 percent of the two-state total, and for Minnesota, 43 percent.

The 560 plants are well distributed geographically over both states, and represent all the major types of manufacturing grade milk processing plants. At the end of the year, reports from all manufacturing grade milk plants in each state indicate close agreement with the monthly prices derived from the 560 plants.

Estimate of Change from Base Month

The estimate of change from the base month to the month to which the estimate relates is based primarily on reports from a sample of 100 plants distributed in the two states. These plant reports are evaluated in terms of changes from the base month in wholesale prices of manufactured dairy products and historic price and fat test relationships. Estimated changes in price and fat test are applied to the state averages for the base month to estimate price and fat test for each state for the month to which the estimates relate.

The sample design for estimating change from the previous month allocated 36 of the 100 plants to Minnesota and 64 to Wisconsin. Each state was divided into three broad geographic areas — northern, central, and southern, and plants in each area were classified according to type of products manufactured. Sample plants were drawn from each product class and geographic area in each state. Plants that consolidate or go out of business are replaced by the same kind of plant of approximately the same size in the same area.

In Minnesota, plants were classified originally into those making (1) butter and by-products and (2) other dairy products. Because of changing conditions, a new classification of Minnesota plants was made in 1963. Plants were classified into (1) butter and by-products plants; (2) cheese factories; and (3) varied-products plants. Based on this method of classification, in 1966 the butter category accounted for 84 percent of all manufacturing grade milk in the state; cheese, 13 percent; and the varied-product group, 3 percent.

In Wisconsin, the plants were divided into four major product groups. In 1966, the proportion of manufacturing grade milk purchased in the state by these groups was: (1) cheese, 63 percent; (2) butter and by-products, 9 percent; (3) condenseries, 2 percent; and (4) varied-products plant, 26 percent.

In both Minnesota and Wisconsin, the varied product groups consist mostly of those plants which make butter, cheese, or other products in such proportions that they cannot be clearly classified in any one specific group such as primarily butter-making plants, primarily cheese-making plants, or condenseries.

These percentages are used as weights for combining reported price and milkfat test data by product groups for monthly manufacturing grade average price and milkfat estimates in each state. The percentages are based on final plant enumerations for the previous year and are changed once each year, or approximately 7 months after the close of the calendar year, when enumerated data become available.

Data are collected from the 100 plant sample by a special questionnaire mailed near the close of each month. This inquiry is designed to obtain from these plants for the base month and for the first half of the month to which the estimate relates (1) quantity of milk purchased, (2) quantity of fat included, (3) dollars paid, if available, (4) average price at average test, (5) related information such as quantities purchased in bulk and in cans, and the base price for 3.5 percent milk and point differential for fat. Space also is provided on the inquiry for the plant manager's best estimate of the average fat test and milk price for the last half of the month to which the estimate relates. For condenseries, this procedure is modified to utilize quantity and price data for the base month furnished to the Statistical Reporting Service in Washington by the central offices of the condenseries and basic prices for 3.5 percent milk for the first half of the month to which the estimate relates as reported by Wisconsin condenseries to the Dairy Division of the Consumer and Marketing Service.

Publication

The report on price per hundredweight at the average test for a given month is issued about the 5th of the following month from the Chicago office of the Statistical Reporting Service, Room 1300-A, Main Post Office Building, 433 W. Van Buren Street, Chicago, Illinois 60797. This report is available on request. The price series is also published in the Dairy and Poultry Market News reports issued by several offices of the Dairy and Poultry Market News Service. In addition, the Market News Service reports show the price per hundredweight converted to a 3.5 percent basis.

Appendix Table 1 — Comparison of Minnesota-Wisconsin manufacturing grade milk price and milkfat test with the two-state average of final estimates, beginning of series through 1966, average price per cwt. at test

Year and month	Minnesota-Wisconsin series		Final two-state estimate		Difference between final two-state price & Minn-Wis series	
	Price per cwt.	Milkfat test	Price per cwt.	Milkfat test	Price per cwt.	Milkfat test
	dols.	percent	dols.	percent	dols.	percent
1961						
August	3.36	3.63	3.35	3.61	—.01	—.02
September	3.44	3.71	3.45	3.71	+.01	—
October	3.50	3.77	3.51	3.77	+.01	—
November	3.49	3.74	3.50	3.74	+.01	—
December	3.44	3.68	3.45	3.68	+.01	—
1962						
January	3.39	3.63	3.40	3.63	+.01	—
February	3.34	3.57	3.35	3.59	+.01	+.02
March	3.28	3.59	3.26	3.58	—.02	—.01
April	3.09	3.56	3.10	3.58	+.01	+.02
May	3.06	3.57	3.08	3.59	+.02	+.02
June	3.07	3.58	3.06	3.56	—.01	—.02
July	3.10	3.60	3.09	3.59	—.01	—.01
August	3.14	3.64	3.11	3.61	—.03	—.03
September	3.21	3.72	3.21	3.73	—	+.01
October	3.27	3.78	3.28	3.78	+.01	—
November	3.27	3.74	3.28	3.75	+.01	+.01
December	3.24	3.68	3.25	3.69	+.01	+.01
1963						
January	3.18	3.61	3.21	3.63	+.03	+.02
February	3.16	3.59	3.18	3.59	+.02	—
March	3.13	3.56	3.15	3.56	+.02	—
April	3.12	3.55	3.12	3.53	—	—.02
May	3.10	3.54	3.13	3.55	+.03	+.01
June	3.11	3.54	3.11	3.54	—	—.02
July	3.14	3.57	3.14	3.54	—	—.03
August	3.17	3.60	3.18	3.59	+.01	—.01
September	3.25	3.68	3.27	3.69	+.02	+.01
October	3.33	3.76	3.32	3.72	—.01	—.04
November	3.30	3.70	3.33	3.71	+.03	+.01
December	3.28	3.67	3.31	3.68	+.03	+.01
1964						
January	3.25	3.62	3.26	3.61	+.01	—.01
February	3.20	3.56	3.21	3.55	+.01	—.01
March	3.17	3.53	3.18	3.55	+.01	+.02
April	3.15	3.54	3.16	3.55	+.01	+.01
May	3.16	3.55	3.16	3.56	—	+.01
June	3.14	3.54	3.12	3.52	—.02	—.02
July	3.15	3.55	3.14	3.52	—.01	—.03
August	3.20	3.57	3.21	3.57	+.01	—
September	3.37	3.68	3.39	3.70	+.02	+.02
October	3.45	3.75	3.46	3.73	+.01	—.02
November	3.44	3.70	3.47	3.71	+.03	+.01
December	3.40	3.66	3.41	3.67	+.01	+.01

Appendix Table 1. (Continued)

Year and month	Minnesota-Wisconsin series		Final two-state estimate		Difference between final two-state price & Minn-Wis series	
	Price per cwt.	Milkfat test	Price per cwt.	Milkfat test	Price per cwt.	Milkfat test
	dols.	percent	dols.	percent	dols.	
1965						
January	3.33	3.62	3.31	3.60	−.02	−.02
February	3.26	3.56	3.27	3.58	+.01	+.02
March	3.26	3.55	3.26	3.58	—	+.03
April	3.27	3.56	3.26	3.57	−.01	+.01
May	3.26	3.56	3.26	3.58	—	+.02
June	3.24	3.55	3.24	3.55	—	—
July	3.25	3.56	3.25	3.57	—	+.01
August	3.32	3.60	3.33	3.60	+.01	—
September	3.43	3.69	3.50	3.76	+.07	+.07
October	3.55	3.78	3.58	3.78	+.03	—
November	3.57	3.74	3.61	3.72	+.04	−.02
December	3.61	3.68	3.64	3.67	+.03	−.01
1966						
January	3.56	3.62	3.58	3.63	+.02	+.01
February	3.65	3.59	3.68	3.59	+.03	—
March	3.73	3.57	3.74	3.57	+.01	—
April	3.68	3.56	3.70	3.57	+.02	+.01
May	3.70	3.57	3.74	3.56	+.04	−.01
June	3.86	3.55	3.84	3.52	−.02	−.03
July	4.09	3.55	4.15	3.54	+.06	−.01
August	4.35	3.60	4.38	3.60	+.03	—
September	4.51	3.69	4.51	3.69	—	—
October	4.48	3.76	4.48	3.78	—	+.02
November	4.35	3.75	4.38	3.77	+.03	+.02
December	4.32	3.73	4.30	3.72	−.02	−.01
1967						
January	4.21	3.66	4.20	3.65	−.01	−.01
February	4.11	3.61	4.10	3.62	−.01	+.01
March	4.09	3.60	4.07	3.61	−.02	+.01
April	4.05	3.59	4.04	3.59	−.01	—
May	4.04	3.60	4.01	3.57	−.03	−.03
June	4.00	3.55	3.99	3.56	−.01	+.01
July	4.01	3.57	4.00	3.55	−.01	−.02
August	4.04	3.59	4.02	3.58	−.02	−.01
September	4.10	3.66	4.10	3.66	—	—
October	4.16	3.73	4.18	3.74	+.02	+.01
November	4.18	3.73	4.19	3.75	+.01	+.02
December	4.19	3.69	4.19	3.71	—	+.02
Simple ave. 77 months	3.5175	3.6283	3.5251	3.6290	.0076	.0007

Appendix 2

Converting Manufacturing Milk Prices at Average Price to Price at 3.5 Percent

The Minnesota-Wisconsin price and the U. S. 3-Product price are reported at the average butterfat test. For use in federal orders, the price at average test is converted to a 3.5 percent basis using a butterfat differential. For example, the differential used in converting the Minnesota-Wisconsin price is calculated by multiplying the average price of Grade A (92 score) butter at Chicago by 0.120.

Butterfat differentials are used by most of the manufacturing plants in Minnesota and Wisconsin in adjusting prices to reflect differences in butterfat tests. Some plants, however, still use the direct ratio method. Of the 52 plants surveyed, only 10 adjusted prices on the direct ratio method. The differential used in federal orders to convert the Minnesota-Wisconsin price to 3.5 percent averaged 7.2 cents per point in 1965, the same as the average butterfat differential of the 52 plants surveyed.

Converting the Minnesota-Wisconsin price to 3.5 percent using the specified butterfat differential method results in a higher price than that obtained by direct ratio method.* It was 2 cents in 1963, 1964, and 1965 and 4 cents in 1966 and 1967. Monthly differences appear in appendix table 2. Since most plants adjust prices by butterfat differentials which are comparable to that used in adjusting the Minnesota-Wisconsin price, the amount that this method causes the announced 3.5 percent price to differ from the 3.5 percent price paid farmers is minimal.

* In direct ratio method, the price at average test is divided by the average test and the resulting price per pound of butterfat is multiplied by 3.5 to obtain a 3.5 percent price.

Appendix Table 2. Average of prices received by farmers for manufacturing grade milk in Minnesota-Wisconsin converted to 3.5% butterfat test by using Chicago 92-score butter price times .120 and converted by direct ratio

Year.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Simple average
						dollars per 100 pounds							
						(Chicago 92-score butter x .120)							
1961								3.27	3.29	3.30	3.31	3.31	3.26
1962	3.30	3.29	3.21	3.05	3.01	3.01	3.03	3.04	3.06	3.07	3.10	3.11	3.11
1963	3.10	3.10	3.09	3.08	3.07	3.08	3.09	3.10	3.12	3.15	3.16	3.16	3.11
1964	3.17	3.16	3.15	3.12	3.12	3.11	3.12	3.15	3.24	3.27	3.29	3.29	3.18
1965	3.25	3.22	3.22	3.23	3.22	3.20	3.21	3.25	3.29	3.34	3.39	3.47	3.27
1966	3.47	3.58	3.68	3.64	3.65	3.82	4.05	4.26	4.34	4.26	4.15	4.14	3.92
1967	4.08	4.02	4.01	3.98	3.96	3.96	3.95	3.97	3.97	3.98	4.00	4.04	3.99
						(Direct ratio)							
1961								3.24	3.24	3.25	3.27	3.27	3.23
1962	3.27	3.28	3.20	3.04	3.00	3.00	3.01	3.02	3.02	3.03	3.06	3.08	3.08
1963	3.08	3.08	3.08	3.08	3.07	3.08	3.08	3.08	3.09	3.10	3.12	3.13	3.09
1964	3.14	3.15	3.14	3.12	3.12	3.10	3.10	3.14	3.21	3.22	3.26	3.25	3.16
1965	3.22	3.21	3.21	3.22	3.21	3.20	3.20	3.23	3.26	3.29	3.34	3.43	3.25
1966	3.44	3.56	3.66	3.62	3.63	3.80	4.03	4.23	4.28	4.17	4.06	4.05	3.88
1967	4.02	3.99	3.98	3.95	3.93	3.94	3.93	3.94	3.92	3.90	3.92	3.98	3.95
						(Ch. 92° — butter x .120 over direct ratio)							
1961								+.03	+.05	+.05	+.04	+.04	+.03
1962	+.03	+.01	+.01	+.01	+.01	+.01	+.02	+.02	+.04	+.04	+.04	+.03	+.03
1963	+.02	+.02	+.01	0	0	0	+.01	+.02	+.03	+.05	+.04	+.03	+.02
1964	+.03	+.01	+.01	0	0	+.01	+.02	+.01	+.03	+.05	+.03	+.04	+.02
1965	+.03	+.01	+.01	+.01	+.01	0	+.01	+.02	+.03	+.05	+.05	+.04	+.02
1966	+.03	+.02	+.02	+.02	+.02	+.02	+.02	+.03	+.06	+.09	+.09	+.09	+.04
1967	+.06	+.03	+.03	+.03	+.03	+.02	+.02	+.03	+.05	+.08	+.08	+.06	+.04

Appendix 3

Procedures Used in Calculating Pounds of Butterfat in Manufactured Products

Butter

Overrun figures for butter manufacturing plants were used to calculate the quantity of butterfat required to produce the reported sales volume of butter of a given fat content. (See appendix table 3.) The overrun figures are based on the work of Professor L. C. Thompsen of the Department of Dairy Industries at the University of Wisconsin. They represent carefully observed yields of butter manufacturing plants over a period of several years. They show, for example, that a whole milk creamery which produces butter of 80 percent fat has an actual overrun of 23.4131 percent.

Theoretically, if all fat in milk could be retained and made into butter with 80 percent butterfat the overrun would be 25 percent. The difference between actual overrun and 25 percent arises because of mechanical losses of butterfat and milk during the processing operation, butterfat loss in the skim milk in the separating operation, and butterfat loss in the buttermilk during the churning operation.

The following illustrates the calculation of required butterfat to produce a given quantity of butter. A whole milk plant has a butter production of 100,000 pounds as determined from sales invoices, less beginning inventory, plus ending inventory. The fat content of the butter, based on buyer laboratory reports, is 80.3. Appendix table 3 lists overrun for a whole milk creamery with butter of 80.3 percent butterfat at 21.0518. The volume of butter 100,000 pounds, is divided by 1.210518 (1 + .210518) which results in a figure of 82,609, the pounds of butterfat in whole milk required to produce the 100,000 pounds of butter. The plant had reported purchases of milk of 2,288,338 pounds of milk testing 3.63 percent butterfat (a total of 83,066.7 pounds of butterfat). Recalculating the actual fat results in a fat test of 3.61 (82,609 ÷ 2,288,338). Butterfat test error amounts to an overstatement of .02. This plant would be paying a higher price for milk than it is reporting.

Cheese

Butterfat gain or loss for cheese plants was calculated by the use of a cheese yield formula. This formula, based on operating results and research of Van Slyke and Price,* is used for trade practice regulation by the Wisconsin State Department of Agriculture. The formula is as follows:

$$\frac{(\%\text{ fat retention} \times \text{fat test}) + (\%\text{ casein in content} - .1)}{1.00 - \text{proportion of moisture in cheese}} \times 1.10 = \text{Yield of cheese per hundredweight of milk}$$

Fat lost in whey usually averages about 7 percent. The casein content of 3.5 percent butterfat milk is close to 2.30 percent and changes directly by .04 percent for each 1/10 of one percent change in the fat test. If the cheese has a 37 percent moisture content the above formula can be written as follows: (x is the butterfat content of the milk)

$$\frac{(.93)\ (x) + 2.30 + (x - 3.5)\ (.4) - .1}{1.00 - .37} \times 1.10 = \text{cheese yield per hundredweight of milk}$$

For each plant, pounds of milk purchased and volume of cheese production were available. Given this information, the actual cheese yield per hundredweight of milk could be calculated from the above formula, and this figure in turn, made possible solving the above equation for the butterfat test of milk necessary to obtain the actual cheese yield.

Receiving Stations

Butterfat gain or loss for receiving stations was obtained by comparing butterfat purchases in milk from producers with butterfat in milk sales. The latter was adjusted for inventory.

Minor Products

Many plants had sales of minor products which contained fat. In some cases, the fat content was reported; therefore, it presented no problem. In other cases, the fat content was estimated on the basis of yield formulas.

Appendix Table 3. Overrun chart

% Fat in butter	% Overrun gathered cream factory	% Overrun whole milk factory	% Overrun continuous whole milk system
80.0	23.4131	21.5057	21.9644
80.1	23.2590	21.3540	21.8122
80.2	23.1055	21.2027	21.6603
80.3	22.9520	21.0518	21.5088
80.4	22.7991	20.9012	21.3577
80.5	22.6465	20.7510	21.2069
80.6	22.4944	20.6011	21.0565
80.7	22.3426	20.4517	20.9065
80.8	22.1912	20.3027	20.7569
80.9	22.0401	20.1539	20.6076
81.0	21.8894	20.0056	20.4587
81.1	21.7391	19.8577	20.3101
81.2	21.5892	19.7100	20.1620
81.3	21.4397	19.5628	20.0142
81.4	21.2905	19.4159	19.8667
81.5	21.1417	19.2694	19.7197
81.6	20.9932	19.1232	19.5729
81.7	20.8451	18.9774	19.4266
81.8	20.6974	18.8320	19.2806
81.9	20.5500	18.6869	19.1450
82.0	20.4030	18.5421	18.9897

* Van Slyke, L. L. and W. V. Price, *Cheese*, Orange Judd Publishing Co., Inc., New York, 1941, pp. 70-73.

Appendix 4

Multiple Regression Analysis Measuring Relationship Between Level of Pay Prices and Various Plant Operating Factors

Analysis of the relationship between the plant pay price for milk and various plant operating factors discussed in Chapter 4 was undertaken with a statistical procedure. For most of the plant factors considered in the text, a step-wise multiple regression program was used to determine and measure relationships that may exist. Equity ratios were not available for all plants, therefore, it was eliminated from the multiple regression program.

The step-wise multiple regression procedure was as follows: first, to eliminate the problem of intercorrelation, simple correlations among all the variables were calculated. For those with high correlation coefficients, one of the variables was climinated from the multiple regression program. As a result, total pounds of whole milk received at the plant, butterfat test error as a percent of total butterfat, amount of butterfat test error on price, percent of total plant income from cheese sales, plant operating expense per hundredweight of milk, and total expense per hundredweight of milk were climinated.

The step-wise multiple regression was then used to analyze the remaining data. This program begins by selecting that variable which accounted for the largest proportion of variance in milk pay prices and then calculates a simple regression equation. Then in order of importance in reducing the variance, it adds the other variables until all are included in the multiple-regression equation. In the program, no additional variables were included when inclusion of another failed to reduce total variance in pay price by more than 1 percent. The results of this program are presented in appendix table 4.

Only three factors entered the regression with a significant regression coefficient. They are, in order of importance in accounting for variance in pay price, (1) the distance from Chicago, (2) gain or loss on milk hauling, and (3) the percent of plant income from butter, powder and their by-products.

Although the other plant factors did not enter the regression equation, this does not mean that they are not a component of milk price. Instead, the result of the regression implies that they are not significantly different for high paying plants than for low paying plants.

Appendix Table 4. Responsiveness of prices paid farmers for manufacturing grade milk to various operating factors for 52 Minnesota and Wisconsin dairy plants, 1965*

Plant factor	Effect of plant factor on plant milk price**	Standard error of regression coefficient
1. Distance from Chicago (miles)	—0.00029†	0.00012
2. Seasonal variation in milk supply (May receipts a percent of November receipts)	—0.00043	—0.00026
3. Gain or loss on hauling producers' milk (dollar per hundredweight)	0.68633†	0.27008
4. Percent of income from butter and powder	—0.00052†	0.00025
5. Percent utilization of plant capacity	0.00040	0.00057
6. Net gain or loss on entire operation (dollars per hundredweight)	—0.43741	0.20531
7. Total dividends per hundredweight of milk (dollars per hundredweight)	0.33143	0.26528
8. Depreciation per hundredweight of milk (dollars per hundredweight)	—0.43883	0.37508
Intercept = 3.44966		
$R^2 = 0.464$		

* The earlier publication of this research at the University of Wisconsin presented somewhat different results. Subsequent to that report this analysis was done with distance from Chicago (the basing point for pricing many manufactured dairy products) included in the regression program. Though this factor was the most important in explaining pay price variation, the other coefficients do not differ greatly from our original regression results.

** The regression coefficients indicate the effect of unit changes in the various factors on reported farm milk prices paid by plants at 3.5 butterfat test. Some unit changes in plant factors are on a percentage basis, some on a dollar basis and some on a volume basis. A plus sign indicates a price response in the same direction as the change in the plant variable, a minus sign indicates a price response in the opposite direction of a change in the plant variable. For example, the figure —0.00029 for distance from Chicago indicates that a 1 mile increase in distance from Chicago would result in a $0.00029 decrease in the plants' price for milk.

† Significant at the 5-percent probability level.

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