AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

change would add considerably to the analysis of obstacles and would provide the key for overcoming them. It is doubtful whether this study will actually satisfy its economic obligation until it reaches this stage of development. But in taking the first step in resolving a popular and controversial issue it does open up avenues for future research.

Pricing Milk to Farmers at Butter-Nonfat Dry Milk Plants

By Scott A. Walker

A new method of pricing milk to farmers at butter-nonfat milk plants that will reflect accurately and equitably the true net farm values of milk of various fat contents is urgently needed. On completion of a regional research study on the costs and efficiencies of 12 specialized butter-powder plants in the Pacific Northwest it became apparent to the author of this paper that such an accurate, equitable, and feasible producer pricing system could be devised.[1] *The study was conducted in cooperation with the Bureau of Agricultural Economics and the Farm Credit Administration. This paper describes and analyzes the pricing plan that was developed from a detailed analysis of the physical and monetary input-output relationships in these plants. This plan is a simple and logical approach to the joint-cost problem that is so often a source of confusion in marketing studies. Essentially, it provides a formula for evaluating the differential in net farm value of milk, delivered to butter-powder plants, corresponding to differences in butterfat tests of milk. It does this in a way that gives a valid reflection of the differences in net returns from milk without involving allocations of overhead costs between the joint products. The paper is published with the approval of the Director of the Idaho Agricultural Experiment Station as Research Paper No. 368.*

BUTTER WAS ONCE the principal product of the dairy industry and milk fat was the only constituent of milk that had appreciable market value. Milk plants, therefore, usually paid farmers for milk on the basis of the quantity of fat it contained. This method of paying for milk is still used by many butter-powder plants [2] in spite of the pricing inaccuracies and inequities that result from it.

A straight butterfat basis of pricing milk implies that the gross market value of the products made from milk, processing costs, and the net farm value of milk are directly proportional to the fat content. This implication is false because (1) the nonfat solids content of milk increases (and decreases) less than proportionately with an increase (decrease) in the fat content; (2) prices of butter and powder do not remain in a fixed relationship; and (3) processing costs are influenced by outputs of both butter and powder.

A specialized butter-powder plant produces two joint products. The proportions of these two products are fixed, for practical purposes, once the solids content of the milk received at the plant has been ascertained. The production theory applicable to such plants is essentially the same as for a single-product plant. This single joint-product relationship, however, presents no serious problems in the develop-

[1] WALKER, SCOTT A., PRESTON, HOMER J., NELSON, GLEN T. AN ECONOMIC ANALYSIS OF BUTTER-NONFAT DRY MILK PLANTS. Idaho Agr. Expt. Sta. Bull. 20, 1953. This bulletin reports results of research conducted under the Western Regional Dairy Marketing Project WM–1.

[2] A butter-powder plant produces butter and nonfat dry milk solids (dried skim milk in nontechnical language).

ment of a pricing formula which accurately reflects the values of both joint products and processing cost to the farm value of milk of various fat tests.

All that is required is the gross revenue function for the two products combined and the total processing cost function per hundredweight of milk received (excluding the value of the unprocessed milk). The difference between the gross revenue and the total processing costs is the net farm value, f.o.b. the plant, of milk having a fat test equal to the average test of the milk received. At any given set of prices of products and inputs these functions are essentially linear, at least within the practical range of milk-fat tests.[3] This fact greatly simplifies the construction of a feasible pricing formula for determining the absolute and relative differences in prices of milk of various fat and nonfat solids contents.

A major advantage of this technique is that it avoids the necessity of allocating either costs or revenues to either of the joint products. Such allocations usually are arbitrary and, as a result, are likely to be inaccurate. The pricing method described below which establishes differentials for milk fat on the basis of the observed relationships between total revenues and total processing costs (excluding costs of unprocessed milk) in butter-powder plants is basically accurate and economically sound.

The average net farm value of 100 pounds of milk testing 4-percent fat is computed as follows: Multiply the price of butter, f.o.b. the plant, by 1.235 and again by 4; add the price of powder, f.o.b. plant, multiplied by 8.67 and again by 0.955; and subtract the average processing costs per hundredweight of milk received. These totaled 60 cents per hundredweight in the study by Walker, Preston, and Nelson, cited above. The figure 1.235 is the average yield of butter in pounds per pound of pure fat in milk received. It is usually referred to as a butter overrun of 23.5 percent. This is the average overrun found in the 12 Pacific Northwest plants. The figure 8.67 represents the number of pounds of nonfat solids in a hundredweight of 4-percent milk as reported by Jacobson[4] and 0.955 is the yield ratio for powder determined from studies of butter-powder plant operations (and comparable to the yield of 1.235 for butter).[5]

Average total processing costs per hundredweight of milk received increase slightly as the solids content of the milk increases. This is to be expected because milk with higher solids content yields more total products per 100 pounds of milk received. In the 12 butter-powder plants studied the average increase in cost per point (0.1 percent) increase in the fat test of milk received was only 0.124 cents.

Now all of the necessary information for a complete butter-powder differential formula is at hand. The differential per point equals 0.1235 times the price of butter (f.o.b. plant) plus 0.0382 times the price of powder (f.o.b. plant) minus $0.00124.[6] This differential is then added to or subtracted from the price of 4-percent milk, as computed above, to determine the price to farmers of milk of various other milk fat tests.

A detailed study indicates that the pricing system is not basically changed by the addition of products besides butter and powder, such as cream or nonfat milk. The additional products are simply included in the total gross

[3] For a thorough analysis of the functional relationships in butter-powder processing plants see Walker, Preston, and Nelson, *op. cit.*

[4] JACOBSON, M. S. BUTTERFAT AND TOTAL SOLIDS IN NEW ENGLAND FARMER'S MILK AS DELIVERED TO PROCESSING PLANTS. Jour. Dairy Sc., 19; 171-176, 1936.

[5] Several independent studies of butter-powder plant operations which confirm the above yield and cost data are reported in the following publications:

MARCH, R. W. THE PRICING OF SURPLUS MILK IN THE CHICAGO MARKET. U.S.D.A., PMA, Dairy Branch, November 1949.

FROKER, R. K., and HARDIN, C. M. PAYING PRODUCERS FOR FAT AND SOLIDS-NOT-FAT IN MILK. Wis. Agr. Expt. Sta. Research Bulletin 143, February 1942.

FRAZER, J. R., NIELSEN, V. A., and NORD, J. D. THE COST OF MANUFACTURING BUTTER. Iowa Agr. Expt. Sta. Research Bulletin 389. June 1952.

BENDIXEN, H. A. SIMPLIFIED BUTTER COMPOSITION CONTROL. American Butter & Cheese Rev., January 1949.

MINNESOTA, DEPARTMENT OF AGRICULTURE. DAIRY AND FOOD BULLETIN OF INFORMATION, 1948.

THOMSEN, L. C. SHALL WE PLAN TOWARD CONTINUED DIVERSIFICATION. American Butter & Cheese Rev., vol. 7, No. 3, p. 74.

[6] The figure 0.0382 equals the powder yield ratio of 0.955 times 0.04 which is the increase in the nonfat solids content of milk associated with a 0.1 percent increase in the milk fat test as reported by Jacobson, *op. cit.*