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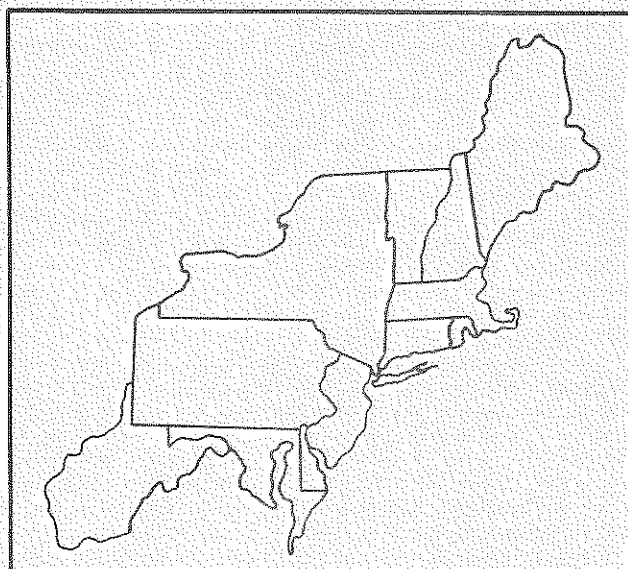
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THE NORTHEAST DAIRY INDUSTRY**



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ESTIMATES OF THE COSTS OF PROCESSING FLUID, SOFT, AND HARD MANUFACTURED MILK PRODUCTS

by

Blair J. Smith*

The NE-126 model of the Northeast dairy industry is structured to accommodate milk and dairy products in three groups on the consumption side of the market. These are the fluid products, the soft manufactured products (mostly ice cream, cottage cheese, sour cream, and yogurt), and a hard products grouping of butter, non-fat dry milk powder, and hard cheese. The costs of processing these product groups are in terms of dollars per hundredweight of raw milk going through each of the three types of plants, and pertain to the year 1980.

The fluid milk processing cost function was estimated from observations of processing costs reported in four different studies [1, 3, 6 and 7]. The report by Jones [4] was used to adjust those reported costs to a common time base (1980).

From the four reports, it was possible to identify 16 cost-quantity observations to which several functional forms were fitted using least-squares multiple regression techniques. The following function was determined to be the most appropriate for use in the NE-126 model:

$$ACF = 224.246623 + 427.536285 (1/\sqrt{V})$$

(t=48.9) (t=22.3)

Where:

ACF = Cost of processing raw milk into fluid milk products in cents per cwt.

V = Pounds of raw milk processed per month divided by 100,000

$\bar{R}^2 = 0.97$, $F = 497.8$. The F and all t-statistics are statistically different from zero at probabilities greater than 99.9 percent.

Using the estimating equation shown above, approximate costs for indicated quantities of raw milk processed per month are as follows:

Monthly Volume of Milk Processed (pounds)	Cost per cwt. (cents)	Monthly Volume of Milk Processed (pounds)	Cost per cwt. (cents)
250,000	495	20,000,000	254
500,000	415	25,000,000	251
1,000,000	359	30,000,000	249
2,500,000	310	35,000,000	247
5,000,000	285	40,000,000	246
10,000,000	267	45,000,000	244
15,000,000	259	50,000,000	243

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At monthly volumes greater than 50,000,000 pounds, the analysis suggests that processing costs remain constant at 243 cents per hundredweight of milk processed. Figure 1 is a plot of the relevant range of the fluid milk processing cost function.

The hard products manufacturing cost function was synthesized primarily from the reports by Boehm and Conner [2], and Lasley and Sleight [5]. One set of volume-cost estimates was developed from each report.

Lasley and Sleight showed the relationship between monthly volume as a percent of capacity and cost per hundredweight of milk processed for 60 plants in the United States. They arbitrarily set the base cost at \$1.00 per cwt for operation at 100 percent of capacity. From data later provided by Sleight, it was determined that the average capacity of the plants in the Lasley and Sleight report was about 25,000,000 pounds per month, and that they operated at about 75 percent of capacity in the years studied.

In 1980, the Commodity Credit Corporation make allowances (manufacturing margins) for butter-powder averaged \$1.22 and for cheese \$1.02 per cwt of milk processed. These are the assumed costs of converting 100 pounds of milk into those particular products, and were used in the price support program calculations at that time. The Minnesota-Wisconsin manufacturing grade milk price averaged \$12.23 at test, and the announced support price averaged \$12.33 at test in 1980. Thus, the make allowances appeared to be \$0.10 less than those necessary to generate the announced support price. It is concluded, therefore, that the actual costs of manufacturing butter-powder were \$1.32 and of cheese \$1.12 per cwt. of milk processed in 1980.

About 1.5 times as much milk is used for cheese as is used for butter and powder. Thus, the product-weighted cost of converting raw milk into butter, powder, and cheese was estimated to be \$1.20 per cwt. $(0.40 \times \$1.32) + (0.60 \times \$1.12)$. This \$1.20 is the cost used for the 75 percent level of plant operation, or 18,750,000 pounds of milk $(25,000,000 \times 0.75)$. This constituted one cost-volume estimate. The others were developed by scaling the costs associated with other levels of capacity (monthly volumes) shown in Lasley and Sleight.

A second set of cost-volume estimates was developed from the total cost function for cheese manufacture (TCC) reported by Boehm and Conner. This function, estimated for 1975, is as follows:

$$\text{TCC} = \$42,466 + \$0.52922 (\text{volume of milk processed})$$

Dividing TCC by varying levels of output yielded a complete set of cost-volume estimates. These were then adjusted to 1980 by assuming a general increase in costs of five percent per year (Jones [4]).

The estimates derived from Lasley and Sleight and Boehm and Conner were averaged, and a function was fitted to the resulting set of cost-volume estimates. The resulting following function will be used in the NE-126 model:

$$\text{ACH} = -43.83928583 - 3860.71598712 \left(\frac{1}{V} \right) + 2537.6834236 \left(\frac{1}{\sqrt{V}} \right)$$

Where:

ACH = Cost of processing raw milk into hard manufactured products in cents per cwt.

V = Pounds of milk processed per month divided by 100,000

$\bar{R}^2 = 0.99$, $F = 9430.0$. The F and all t-statistics are significantly different from zero at probabilities greater than 99.9 percent.

Using the estimating equations shown above, approximate costs for indicated quantities of milk processed per month are as follows:

Monthly Volume of Milk Processed (pounds)	Cost per cwt. (cents)	Monthly Volume of Milk Processed (pounds)	Cost per cwt. (cents)
2,500,000	309	17,500,000	126
5,000,000	238	20,000,000	116
7,500,000	198	22,500,000	108
10,000,000	171	25,000,000	101
12,500,000	152	27,500,000	95
15,000,000	137	30,000,000	90

At monthly volumes greater than 30,000,000 pounds, manufacturing costs were assumed to remain constant at 90 cents per hundredweight of milk processed. Figure 2 is a plot of the relevant range of the hard products manufacturing cost function.

The soft products processing cost function (ACS) will be a weighted combination of the fluid and the hard products functions. That is,

$$ACS = X(ACF) + Y(ACH)$$

The variables X and Y are the weights to be applied to the fluid and hard products functions, respectively, according to where the soft products cost function lies in the space bounded by the two functions, X and Y are each ≥ 0 , and $X + Y = 1.0$.

For the initial run of the NE-126 model, X will be set equal to 0.8 and Y will be set equal to 0.2. Subsequent runs of the model will use other values for X and Y if later information suggests a different combination of weights would be more appropriate.

FIGURE 1. COSTS OF PROCESSING FLUID MILK PRODUCTS, 1980

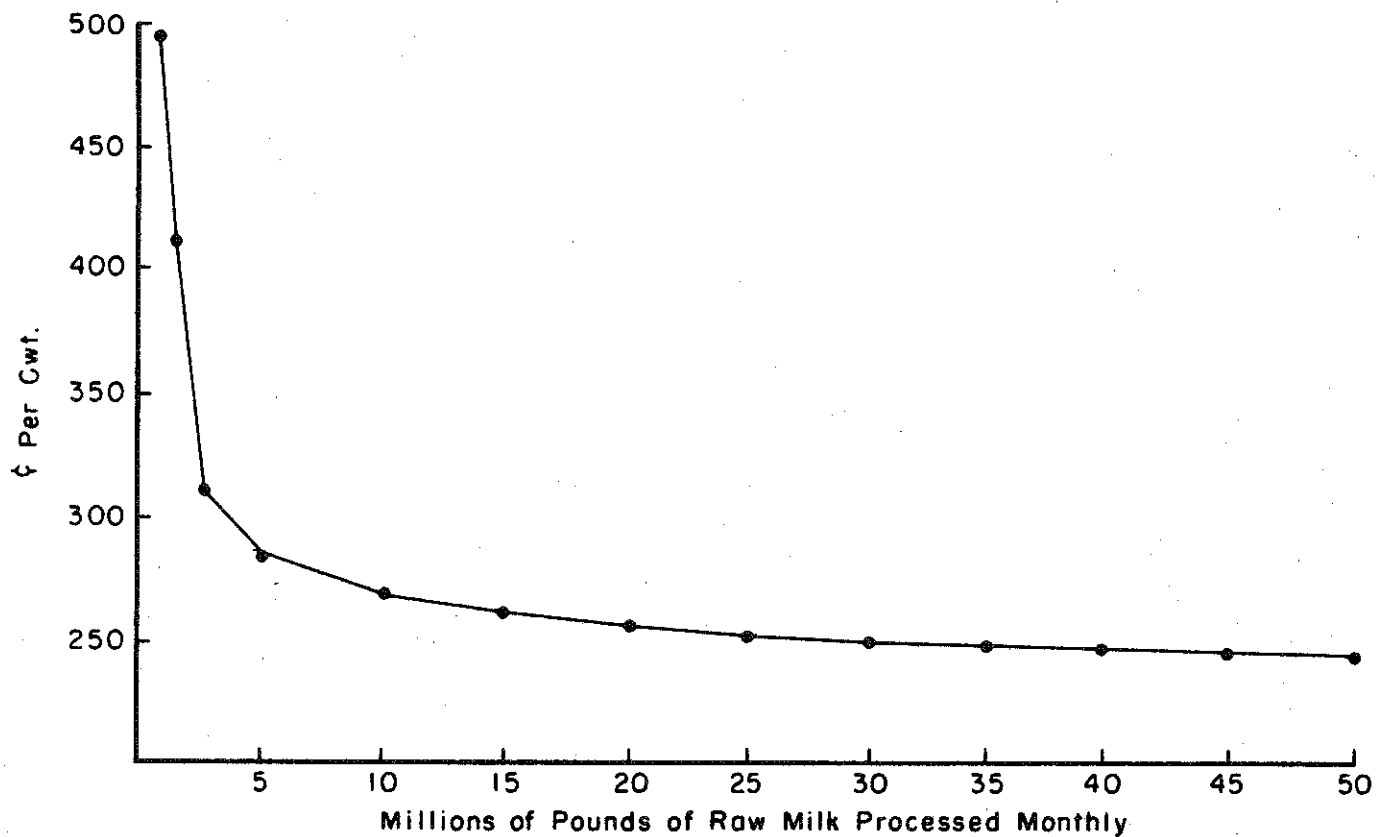
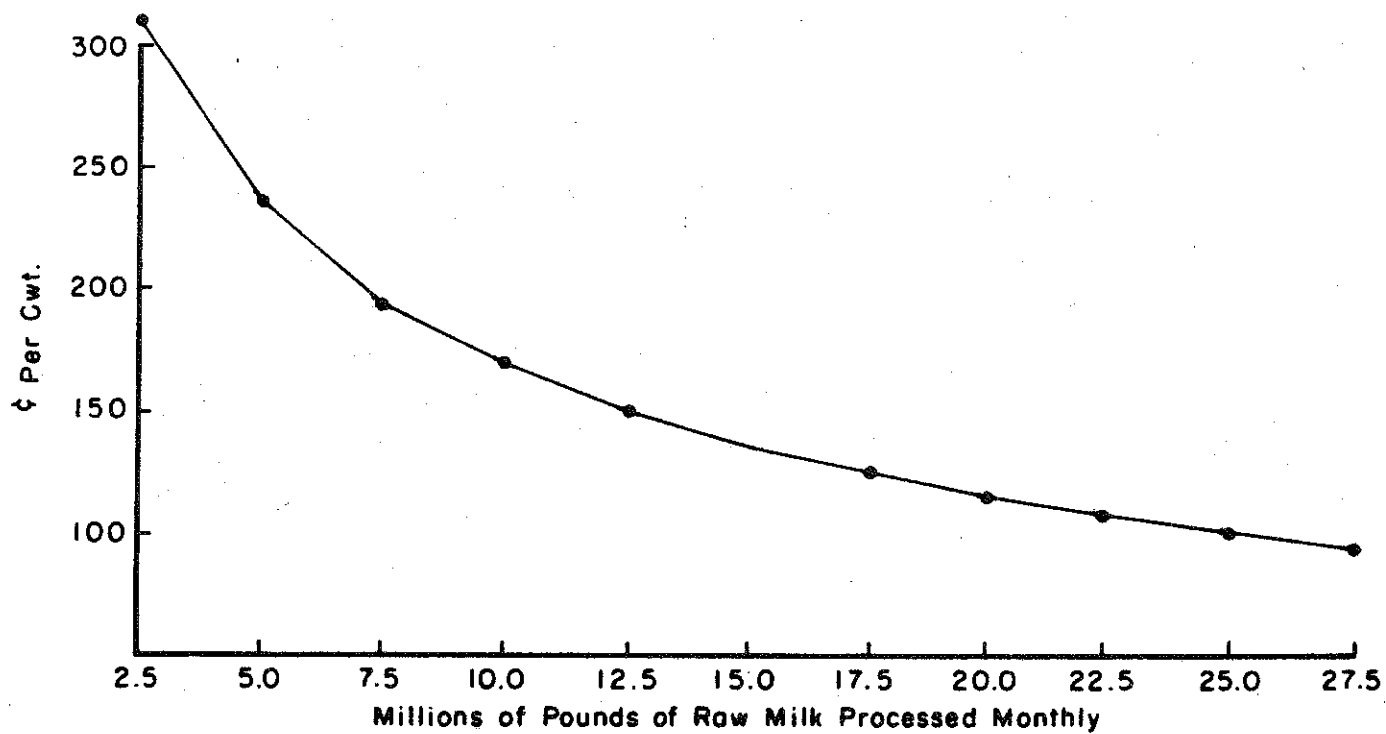


FIGURE 2. COSTS OF MANUFACTURING HARD DAIRY PRODUCTS, 1980



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