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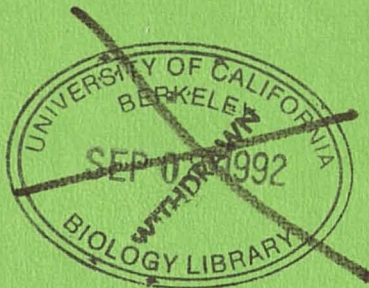
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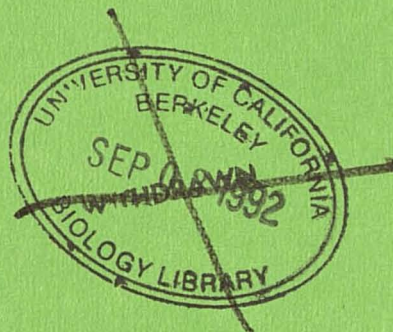
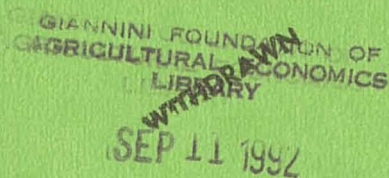
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Revised Procedures Used by the  
 Pennsylvania Agricultural Statistics Service  
 to Estimate the Cost of Producing Milk

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Revised Procedures Used by the  
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to Estimate the Cost of Producing Milk

Blair J. Smith, Stephen A. Ford, Bradley D. Parks, and Reid S. Miller\*

The Pennsylvania Agricultural Statistics Service has prepared and reported estimates of the cost of producing milk in Pennsylvania since 1961. The procedures and methodology followed in this undertaking have not been critically reviewed or modified since 1982.

The Pennsylvania Milk Marketing Board (PMMB) has been one of the principal users of these cost of production data. The PMMB requested that the College of Agricultural Sciences at Penn State, in cooperation with the Pennsylvania Agricultural Statistics Service, review the cost of production procedures and methodology currently in effect. The new procedures and methodology that have resulted from that review are the subject of this report.

#### CURRENT PROCEDURES AND METHODOLOGY

The procedures and methodology currently being used by the Pennsylvania Agricultural Statistics Service (PASS) to estimate the cost of producing milk (COP) are described in the publication by Smith and Sedlak [1]. The COP figures themselves, along with a good deal of related data, are published in the Special Dairy

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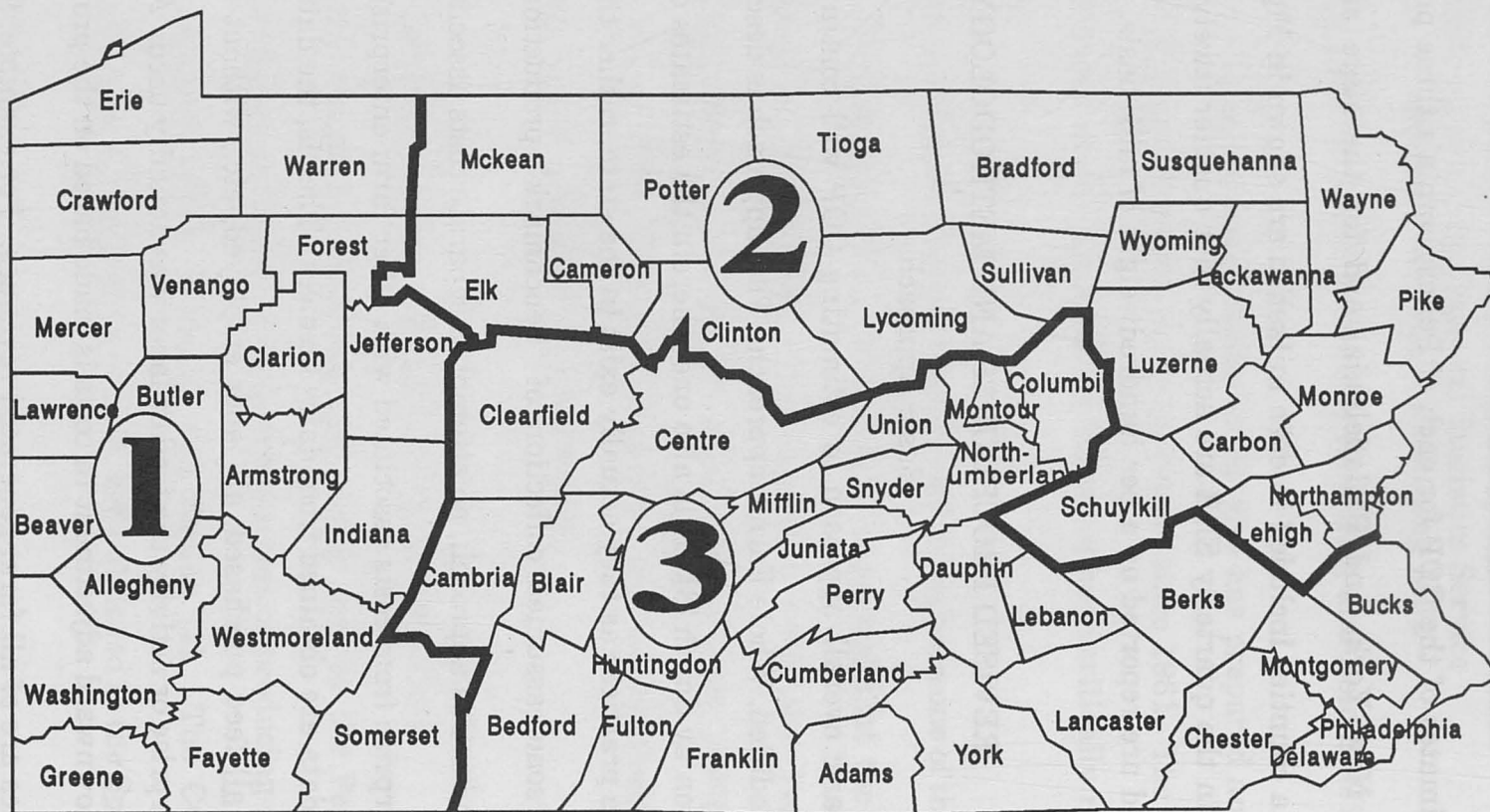
Report [2]. The Special Dairy Report (SDR) is published each calendar quarter and contains estimates of the COP for each of Pennsylvania's three primary milksheds (Pittsburgh, New York, and Philadelphia) and for the state as a whole. The Pennsylvania counties included in each milkshed are shown in Figure 1. The COP data shown in the quarterly SDR are actually four quarter (twelve month) moving averages, and are reported on a per hundredweight of milk basis.

## REVISED PROCEDURES AND METHODOLOGY

### Basic Approach

The basic overall approach to estimating COP will continue to be what is termed a "Modified, Whole Farm" approach. This approach is described in detail in the publication by Smith [3]. It is also one wherein the estimates of costs are based on production practices as they actually exist in the state, rather than on what costs might be if some assumed collection of "benchmark" production practices were followed. Under this approach, no attempt to separate costs associated with just the milking enterprise from costs associated with other farm enterprises or activities is made as the data are obtained from dairy farmers. That is, the dairy farmer reports the value of all feed purchased, all labor employed, etc., without regard for which farming enterprise or activity the feed or labor was actually used. After the data are collected, a downward adjustment in costs is made based on the proportion that non-dairy revenues are of all farm-generated revenues. For example, if farm-generated income other than from the dairy enterprise is 10 percent of all farm-generated

**Figure 1. The Three Milksheds as Delineated by the Pennsylvania Agricultural Statistics Service\***



\* More commonly referred to as the Pittsburgh, New York, and Philadelphia milksheds, respectively.

income, then only 90 percent of all farm costs (with a few exceptions to be noted later) are charged to the production of milk. The effect of this treatment of costs is that other farm enterprises are assumed to be no more nor any less profitable than is the production of milk.

PASS maintains a list of farm operators from which the sample for the monthly milk production and marketing inquiry is selected. Guidelines in selecting the sample are: number of milk cows on the farm, county of operation, the number of contacts for other surveys, and the estimated number of dairy farms in the state. Only farms that milked 10 or more cows are included in the sample of farms from which estimates of the cost of producing milk are developed.

#### Costs to be Included in Cost of Production Estimates

Generally, the items shown in Table 1 are the costs that must be recovered in the proceeds from the sale of milk if a dairy farmer is to continue in production for an extended period of time. The figures in Table 1 are taken from the Pennsylvania Dairy Farm Business Analysis (PA DFBA)[4], and the four previous reports in that annual series, modified as appropriate as described in the text below. Costs (returns) of owner management and of equity capital are not included in Table 1. That is, although an allowance for the labor of the operator (and other unpaid family labor) is included, there is no allowance for his/her management. And, likewise, while the interest payments on indebtedness are included, there is no allowance or

Item	Total costs per farm <sup>1</sup> (dollars)	Specialization factor <sup>2</sup>	Dairy enterprise costs <sup>3</sup> (dollars)	Milk only costs	
				per cwt. <sup>4</sup> (dollars)	percent of total
<b>Cash costs</b>					
Milk hauling <sup>5</sup>	4760	1.000	4760	0.52	4.0 <sup>9</sup>
Purchases of dairy animals <sup>6</sup>	2470	1.000	2470	0.25	1.9 <sup>9</sup>
Purchased feed	30990	0.998	30928	3.08	23.6 <sup>9</sup>
Breeding, testing, registering	2874	0.998	2868	0.29	2.2
Veterinary and medicine	2392	0.998	2387	0.24	1.8
Livestock supplies	4053	0.998	4045	0.40	3.1
Hired labor	8058	0.903	7276	0.73	5.6 <sup>9</sup>
Crop, seed and supplies	4992	0.903	4508	0.45	3.4
Fertilizer and lime	5250	0.903	4741	0.47	3.6 <sup>9</sup>
Custom work hired	1974	0.903	1783	0.18	1.4
Machinery repair	6079	0.903	5489	0.55	4.2
Farm share truck and auto	1110	0.903	1002	0.10	0.8
Gas and oil	3412	0.903	3081	0.31	2.4 <sup>9</sup>
Building repair	1826	0.903	1649	0.16	1.2
Utilities	3968	0.903	3583	0.36	2.7
Rent	4157	0.903	3754	0.37	2.8
Taxes	1981	0.903	1789	0.18	1.4
Insurance	2223	0.903	2007	0.20	1.5
Interest paid on debt	8198	0.903	7403	0.74	5.7 <sup>9</sup>
Miscellaneous <sup>6</sup>	2702	0.903	2440	0.24	1.8
Purchases of non-dairy livestock <sup>7</sup>	328	0.000	0	0	0
<b>Non-cash costs</b>					
Depreciation	15810	0.903	14276	1.42	10.9 <sup>9</sup>
Value of unpaid labor <sup>8</sup>	20317	0.903	18346	1.83	14.0 <sup>9</sup>
<b>Total costs</b>	<b>139924</b>	<b>xxx</b>	<b>130585</b>	<b>13.07</b>	<b>100.0</b>



## Footnotes to Table 1.

<sup>1</sup> These are the averages of the annual averages shown in the five most recent PA DFBA reports, with the exceptions noted below. The 50-69 cow herd size group was used for all five years (1986-1990) because this range encompasses the average size of herd with 10 or more milk cows in Pennsylvania in each of those years.

<sup>2</sup> Specialization factors were developed to estimate the amounts that were properly chargeable to the dairy enterprise. These factors ranged from 0 (purchases of non-dairy livestock) to 1.0 (milk hauling and purchases of dairy livestock).

The other two factors were computed as follows, although neither will be permitted to exceed a value of 1.0:

$$0.903 = \frac{\text{Sales of milk} + \text{sales of dairy livestock} - \text{purchases of dairy livestock (Tables 1 and 2)}}{\text{Total farm income (from Table 2)}}$$

$$0.998 = \frac{\text{Sales of milk} + \text{sales of dairy livestock} - \text{purchases of dairy livestock}}{\text{Numerator (above)} + \text{sales of non-dairy livestock} - \text{purchases of non-dairy livestock}}$$

<sup>3</sup> The product of total costs per farm and the corresponding specialization factor.

<sup>4</sup> So that prices received for milk can be directly compared to estimates of costs of producing milk, it is necessary to subtract the costs that are associated with the production of cull cows and surplus calves from the costs of the entire dairy enterprise as shown in the third column. The factor used to do this was:

$$\frac{\text{Total cost of the dairy enterprise} - \text{milk hauling} - \text{sales of dairy livestock (Table 2)}}{\text{Total cost of the dairy enterprise} - \text{milk hauling}}$$

$$= \frac{130585 - 4760 - 11814}{130585 - 4760} = 0.90611$$

This factor was applied to all dairy enterprise costs except milk hauling. Then, the resulting values were divided by the 5 year average of milk sold per farm, 9091 hundredweights, to obtain the figures shown in the next to last column of this Table.

<sup>5</sup> Per hundredweight costs of hauling milk as shown in the Special Dairy Reports (average of 12 months, year by year) multiplied by hundredweights of milk sold as reported for the 50-69 cow herd-size group in the appropriate issue of PA DFBA.

<sup>6</sup> Not included are any possible cooperative membership dues or assessments, promotion check-offs, or assessments to reduce the federal budget deficit or to offset the costs of the milk price support program.

<sup>7</sup> The purchases of dairy livestock were estimated to be 88.75 percent of all livestock purchases using data reported in the SDR. This percentage was then applied to total purchases of livestock as shown in the PA DFBA reports to partition total livestock purchases into their dairy and non-dairy components.

<sup>8</sup> Average of 12 month values of unpaid family labor, year-by-year, as reported in the SDR.

<sup>9</sup> Items to be included in the monthly inquiries to be mailed by PASS to participating dairy farmers. Thus, cost data received directly from farmers each month will make up 71.7 percent of all costs included in the overall estimate of the cost of producing milk reported in the SDR. The remaining 28.3 percent of costs will be estimated as described in the text below.

provision for a return to the owner's equity or net worth in the farm business. For purposes of this publication, both equity capital and owner management are treated as residual factors of production whose rewards (if any) come from the excess of total returns over all other costs.

In summary, the estimates of the cost of producing milk generated by PASS will not include any returns (costs) for management or equity capital. Neither will they include changes in inventory values of such capital items as land, livestock, buildings, or machinery that are not accounted for by reported depreciation, nor will they incorporate the effect of changes in inventory values of noncapital items such as feed and supplies. Whether, and at what level, milk prices should exceed costs of production as computed by the procedures being proposed here will have to be determined by other parties or agencies. Then, whether the differences between prices received and computed costs of production are adequate compensation for their efforts and investments will continue to be a matter for each dairy farmer to decide.

#### Returns Relevant in Computing Cost of Production

The modified, whole farm approach to estimating the cost of producing milk requires that the proceeds from the sale of milk be separated from all other farm-generated income before costs per hundredweight are computed. A breakdown of the types of farm-generated income for which information should be obtained is provided in Table 2. Most of the data in Table 2 were obtained from the same sources as those of Table 1, and are believed to be appropriate for the average size Pennsylvania dairy

Table 2. Illustrative Returns Used in Estimating the Cost of Producing Milk in Pennsylvania		
Item	Returns per farm <sup>1</sup> (dollars)	Percent of Total
<b>Cash returns</b>		
Sales of farm products		
Milk and dairy products <sup>2</sup>	122,427	83.9 <sup>7</sup>
Dairy livestock	11,814	8.1 <sup>7</sup>
All other livestock and livestock products	618	0.4 <sup>7</sup>
All crops and crop products	2,068	1.4 <sup>7</sup>
Other cash returns		
Custom work and other services	498	0.3
Government payments	1,670	1.2
Miscellaneous <sup>3</sup>	3,610	2.5
<b>Non-cash returns<sup>4</sup></b>		
Value of farm products consumed in the farm home	518	0.4
Rental value of operator and other farm dwellings	2,635	1.8
Total farm income	145,858	100.0
Price received for milk (per hundredweight) <sup>5</sup>	\$13.47	
Hundredweights of milk sold per farm <sup>6</sup>	9,091	
<p><sup>1</sup> These are the averages of the annual averages shown in the five most recent PA DFBA reports, with the exceptions noted below. The 50-69 cow herd size group was used for all five years (1986-1990) because this range encompasses the average size of herd with 10 or more milk cows in Pennsylvania in each of those years.</p> <p><sup>2</sup> There is some uncertainty as to what is included in the PA DFBA reports with respect to the values of sales of milk and dairy products that were reported for 1986 through 1989, as compared to 1990. Generally, the 1986 through 1989 milk sales data seemed to exclude costs of hauling, whereas hauling is included in milk sales in the 1990 report. Furthermore, it is not clear how other marketing costs (coop dues and government assessments, for example) were handled in each instance. To interject as much uniformity as possible, therefore, the values shown for sales of milk and dairy products in this table are the products of the wholesale prices (before any deductions) reported to have been received by SDR farmer respondents, and the hundredweights of milk reported sold by the 50-69 cow herd size group in the PA DFBA reports.</p> <p><sup>3</sup> Not included are any possible payments or refunds from cooperatives, or refunds of assessments paid earlier to the federal government.</p> <p><sup>4</sup> Calculated from five-year data reported in Table 4, page 50, of <u>Economic Indicators of the Farm Sector</u> [5].</p> <p><sup>5</sup> From the respective SDR's as noted above.</p> <p><sup>6</sup> From the respective PA DFBA reports as noted above.</p> <p><sup>7</sup> Items to be included in the monthly inquiries to be mailed by PASS to participating dairy farmers. Thus, returns data received directly from farmers each month will account for 93.8 percent of all returns received by responding dairy farmers. The remaining 6.2 percent of returns will be estimated as described in the text below.</p>		

farm over the five year period 1986-1990. These returns data, along with appropriate cost data from Table 1, are used to compute the various specialization factors shown in Table 1. It is clear that there is a high degree of specialization in the production of milk among Pennsylvania dairy farms, and the higher the degree of specialization the more accurate the modified whole farm approach to estimating the cost of producing milk becomes.

#### Comparison of Cost of Production and Price Received for Milk

Table 1 shows total direct costs of producing milk to have averaged \$13.07 per hundredweight over the five year period 1986 through 1990. The average price received for that milk was \$13.47 per hundredweight (Table 2). The difference is a nominal profit of \$0.40 per hundredweight, or a total dollar value of  $\$0.40 \times 9091$  cwts. = \$3636.40. To this must be added the assumed profits on non-milk sales, which were 16.1 percent of total sales. Thus, if profits on milk sales (83.9 of all sales) were \$3636.40 then profits on all sales would be  $\$3636.40 \div 0.839 = \$4334.21$ . These are referred to as "nominal" profits because no returns to equity capital or unpaid owner management are included as costs, and no indirect returns in the form of appreciation in values of non-capital inventories, or of capital items (mostly land), are included in returns.

There are several other ways of computing income or profits, some of which could also be derived from the data provided in Tables 1 and 2. One would be the amount of money generated by the dairy farm that is available for family living,

savings, investment, or repayment of debts. In the present case this would be cash income (\$142,705, Table 2) minus cash expenses (\$103,797, Table 1) or \$38,908. If, however, an appropriate amount was set aside to cover depreciation (\$15,810) so that the value of farm assets was not impaired, then income during the five year period 1986 through 1990 would have averaged \$23,098 per year. Inasmuch as the value of farm products consumed in the farm home (\$518) and the rental value of the farm dwelling (\$2,685) are direct offsets to living expenses that farmers would otherwise have to face, income would then be measured at  $\$23,098 + \$518 + \$2,685 = \$26,301$ . In fact, the figures shown for value of farm products consumed in the farm home, and the rental value of the farm dwelling, seem quite low. To the extent they are low, of course, the effective income available to the dairy farmer is understated.

## OBTAINING THE NECESSARY DATA

### Costs Based on Direct Surveys of Dairy Farmers

The principal source of data for estimating the cost of producing milk in Pennsylvania will continue to be from monthly questionnaires mailed out by PASS and voluntarily completed by Pennsylvania dairy farmers. As shown earlier, these will comprise 71.7 of all costs that are used to estimate the cost of producing milk. Each month, questions will be asked that pertain to today, to yesterday, to last week, to this month, to last month, or to last year. These questions, and their approximate wording, are presented immediately below. (The numbering of these questions on the monthly questionnaires will not necessarily be the same as used in this publication.)

I. QUESTIONS TO BE ASKED EVERY MONTH:

1. ALL MILK COWS on this farm yesterday, both dry and in milk (Exclude heifers not yet freshened)
2. COWS MILKED on this farm yesterday
3. MILK PRODUCED on this farm yesterday. Report in either pounds or gallons. Report one day's production
4. ALFALFA HAY - Average farm price per ton, baled
5. ALL OTHER HAY - Average farm price per ton, baled
6. Total Hours Worked on this farm Last Week in All farm activities, not just with the dairy herd by:
  - a. Unpaid family workers
    - (1) Operator
    - (2) Unpaid family workers no longer attending school for whom you regularly provide room and/or board
    - (3) Other unpaid family workers
  - b. Paid workers for whom you regularly provide room and/or board
    - (1) Total hours worked last week
    - (2) Total pay for last week
  - c. Other paid workers
    - (1) Total hours worked last week
    - (2) Total pay for last week
7. TOTAL AMOUNT of milk shipped during (month)
8. GROSS VALUE of milk shipped during (month) before any deductions
9. Deduction for Hauling during (month), if any (include stop charge)

10. Fat Test of Milk Shipped during (month)
11. TOTAL COST of all Feed and feed supplements of all kinds purchased during the (month) for all purposes including grinding, mixing and hauling costs, if any.
12. TOTAL VALUE of all crop Fertilizer and Lime purchased during (month) including costs of custom application
13. TOTAL COST of all Gasoline, Oil, and Other Farm Fuels and Lubricants purchased during (month)
14. TOTAL VALUE of Livestock Purchased during (month)
  - a. Animals for dairy purposes
  - b. All other livestock
15. VALUE of Farm Products, other than milk, sold during (month)
  - a. Dairy animals
  - b. Livestock other than dairy
  - c. Poultry and eggs
  - d. Crops and crop products
  - e. All other farm products

II. TO BE INCLUDED ONLY ON THE JAN, APR, JULY, AND OCT INQUIRIES:

16. TOTAL QUANTITY of Grain and other concentrates Fed Yesterday to all milk cows on this farm (both dry and in milk)
17. VALUE of Grain and other concentrates currently being Fed to Milk Cows on this farm
18. Average price per head of Milk Cows used for dairy herd replacement

III. TO BE INCLUDED ONLY ON THE APR AND OCT INQUIRIES:

19. Of the Milk Produced on this farm yesterday (item 3) how much was:

- a. Used for Food, Drink, or farm churned Butter by All people on this Farm
- b. Fed as whole milk (unskimmed) to Calves or other livestock on this farm (Do not include milk sucked by calves)

IV. TO BE INCLUDED ONLY ON THE JAN INQUIRY:

20. Average Price per head for heifers for dairy herd replacement weighing 500 pounds and over

V. TO BE INCLUDED ONLY ON THE MAY INQUIRY:

21. Interest Paid Last Year on farm real estate debt and operating loans
22. Total Depreciation Last Year of farm machinery, equipment, structures, livestock, etc.

Among the entire set of 22 questions to be included in the monthly inquiries, perhaps in a different order, only numbers 6, 7, 8, 9, 11, 12, 13, 14, 15, 21 and 22 will actually be used in estimating the cost of producing milk. The remaining questions are used by PASS and the U.S. Department of Agriculture to prepare other national statistical reports pertinent to the dairy industry.

As already noted, the cost items included on the monthly inquiries, after the application of appropriate specialization factors, will provide the information needed for 71.7 percent of the total cost of producing milk (in accordance with Table 1). All the costs reported monthly will be used directly in the computations, and a value will be assigned to operator and unpaid family labor. The operator labor will be valued at the average hourly rate paid, without room and board, to hired workers in the milkshed in which the farm is located. The labor of unpaid family no longer attending public school will be valued at the rate assumed for the operator. The labor



of unpaid family still in public school will be valued at 75 percent of the operator rate. These rates will be developed monthly from information received on the monthly PASS inquiries.

Interest paid on farm indebtedness and depreciation reported for the previous calendar year, to be obtained on the May Inquiry, will be estimated and updated for each intervening calendar quarter by use of the index of prices paid by farmers for production items, interest, taxes, and wage rates, published monthly by the U.S. Department of Agriculture in Agricultural Prices [6].

#### Determination of Non-Surveyed Costs

Item	1986	1987	1988	1989	1990
Surveyed (milk only) Costs	\$8.69	\$8.79	\$9.11	\$9.77	\$10.37
Non-Surveyed (milk only) Costs	3.64	3.47	3.45	3.69	4.11
Total (milk only) Costs	12.33	12.26	12.56	13.46	14.48
Non-Surveyed Costs as a % of Total Costs	29.5	28.3	27.5	27.4	28.4

The determination of the non-surveyed costs (28.3 percent of all costs) has previously been based on an historic estimate of the proportion of non-surveyed costs to surveyed costs. The data presented in Table 3 provide empirical support for the continued use of such an approach. The proportion of total costs that were comprised of non-surveyed costs ranged from 27.4 to 29.5 percent during the 1986-90 period, only a 2.1 percent spread. The stability of these percentages, and the relatively inconsequential effect their maximum variation has on the estimate of cost of

production, encourages the use of the approach being proposed here. Thus, non-surveyed costs for the SDR will be 28.3 percent of reported costs, initially. This factor will be updated as a five-year rolling average as new PA DFBA reports are published.

#### Source of Returns Information

Questions 8 and 15, as numbered in this publication, will provide information for 93.8 percent of all farm returns thought to be relevant in estimating the cost of producing milk. The remaining 6.2 percent, consisting of other cash income, the value of farm products consumed in the farm home, and the rental value of the farm dwelling, will be added to reported income by multiplying reported income by the factor 1.066 to bring total income up to 100 percent ( $100 \div 93.8 = 1.066$ ).

How closely "other income" remains at 6.2 percent will be monitored by carrying the five year averages for the two components of returns forward as the new PA DFBA report becomes available each year. Each new five-year factor will then be applied to reported returns in place of the one then being used.

#### MAKING THE TRANSITION FROM THE PRESENT TO THE PROPOSED PROCEDURES

The transition to the new methods and procedures will take place completely at the time they are considered adequately tested and ready for use. That is, one month the present methods and procedures will be employed, and the next month they will be completely replaced by the new ones.

The estimates of costs actually published, however, will be phased in over a period of four quarters. After three months on the new system, the cost of producing milk will be estimated according to the procedures proposed in this report. The estimate of costs reported for the year ending at the end of that first quarter will be the average of the costs reported for the three prior quarters as computed under the present procedures, and the cost computed for the quarter just ended using the new computational procedures. The transition will continue in this manner, quarter by quarter, until four quarters under the new procedures have been completed.

One reason for phasing in the new procedures in this manner is to avoid the necessity of maintaining a dual system of computational procedures for two full years. A second reason is that if the estimates of costs under the two sets of procedures were in fact to differ much from each other, a sharp discontinuity in the published level of costs would be avoided.

### SUMMARY

This report is the result of a critical review of the methods presently being used by the Pennsylvania Agricultural Statistics Service to estimate the cost of producing milk in Pennsylvania. It contains a number of proposed changes in procedures and methodology to make the estimates more accurate and up to date.

Under both the current and proposed procedures a "modified, whole farm" approach is used. Under this approach, the dairy farmer reports all feed purchased, all labor employed on the farm, etc., without regard to how much of each expense is

attributable to the milking herd. The farmer also reports the value of sales of all farm-generated income (milk, grain, hay, etc.) by way of the same monthly inquiries used to report expenses. About 71.7 percent of all costs will be reported directly by volunteer dairy farmers. The remaining 28.3 percent will be based on other sources, primarily the farm records program of the Pennsylvania Farmers' Association as shown in the Pennsylvania Dairy Farm Business Analysis reports published by the Pennsylvania State University.

The cost of producing milk will be computed and reported quarterly as the moving average of four calendar quarters for the entire state, and for the same three Pennsylvania milksheds as is currently being done. The costs that go into the numerator of the fraction (costs ÷ cwts. of milk sold) are the proportion of total costs that the revenues from the sale of milk are of total revenues. Thus, the "profitability" of the non-milk enterprises is presumed to be no higher nor any lower than the "profitability" of the milk producing enterprise.

As Pennsylvania dairy farms become increasingly specialized in the production and sale of milk, the whole farm and enterprise approaches to estimating the cost of producing milk converge toward the same figure. Although most Pennsylvania dairy farms also have a number of field enterprises, by and large these exist primarily to provide feed for the dairy herd. The goal of the estimating procedure being proposed here is to determine, as accurately as time and funds allow, how the cost of producing milk changes over time as it is produced, not how it would change if it were all produced on farms on which the sole enterprise is the milking herd. To try to extract

the costs of the milking operation from the costs of all the other supporting enterprises and activities that take place on the typical Pennsylvania dairy farm would not only be extremely difficult, but also inappropriate and unnecessary for the purposes at hand. That is, to provide price setting guidance for the Pennsylvania Milk Marketing Board.

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